



# DIPLOMA IN ENGINEERING AND TECHNOLOGY

**1047 / 1049 & 2047**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) /  
MECHATRONICS ENGINEERING**

SEMESTER PATTERN

**N – SCHEME**

IMPLEMENTED FROM 2020 - 2021

CURRICULUM DEVELOPMENT CENTRE

**DIRECTORATE OF TECHNICAL EDUCATION  
CHENNAI-600 025, TAMIL NADU**

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU  
DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS (II / III YEAR)**

**N SCHEME**

(Implemented from the Academic year 2020 - 2021 onwards)

**Chairperson**

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Director, Directorate of Technical Education, Guindy, Chennai.

**Co-ordinator**

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<b>Diploma in Electronics (Robotics) Engineering (1049) / Mechatronics (1047 / 2047)</b>	
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# GOVERNMENT OF TAMILNADU

## DIPLOMA COURSES IN ENGINEERING / TECHNOLOGY (SEMESTER SYSTEM)

(Implemented from 2020 - 2021)

N – SCHEME

### REGULATIONS\*

*\*Applicable to the Diploma Courses other than Diploma in Hotel Management & Catering Technology.*

#### 1. Description of the Course:

##### a. Full Time (3 years)

The Course for the Full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters\* and the First Year is common to all Engineering Branches.

##### b. Sandwich (3½ years)

The Course for the Sandwich Diploma in Engineering shall extend over a period of three and half academic years, consisting of 7 semesters\* and the First Year is common to all Engineering Branches. The subjects of three years full time diploma course being regrouped for academic convenience.

During 4<sup>th</sup> and/or during 7<sup>th</sup> semester the students undergo industrial training for six months / one year. Industrial training examination will be conducted after completion of every 6 months of industrial training.

##### c. Part Time (4 years)

The course for the Part Time Diploma in Engineering shall extend over a period of 4 academic years containing of 8 semesters\*, the subjects of 3 year full time diploma courses being regrouped for academic convenience.

**\* Each Semester will have 16 weeks duration of study with 35 hrs. / Week for Regular Diploma Courses and 18 hrs. / Week for Part-Time Diploma Courses.**

The Curriculum for all the 6 Semesters of Diploma courses (Engineering & Special Diploma Courses viz. Textile Technology, Leather Technology, Printing Technology,

Chemical Technology etc.) have been revised and revised curriculum is applicable for the candidates admitted from 2020 – 2021 academic year onwards.

## **2. Condition for Admission:**

Condition for admission to the Diploma courses shall be required to have passed in The S.S.L.C Examination of the Board of Secondary Education, Tamil Nadu.

(Or)

The Anglo Indian High School Examination with eligibility for Higher Secondary Course in Tamil Nadu.

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examinations recognized as equivalent to the above by the Board of Secondary Education, Tamil Nadu.

Note: In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

## **3. Admission to Second year (Lateral Entry):**

A pass in HSC (academic) or (vocational) courses mentioned in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board with eligibility for University Courses of study or equivalent examination & Should have studied the following subjects.

A pass in 2 Years ITI with appropriate Trade or Equivalent examination.

Sl. No	Courses	H.Sc Academic	H.Sc Vocational		Industrial Training Institutes Courses
		Subjects Studied	Subjects Studied		
			Related subjects	Vocational subjects	
1.	All the Regular and Sandwich Diploma Courses	Physics and Chemistry as compulsory along with Mathematics / Biology	Maths / Physics / Chemistry	Related Vocational Subjects Theory & Practical	2 years course to be passed with appropriate Trade
2.	Diploma Course in Commercial Practice	English & Accountancy  English & Elements of Economics  English & Elements of Commerce	English & Accountancy,  English & Elements of Economics,  English & Management Principles & Techniques,  English & Typewriting	Accountancy & Auditing,  Banking,  Business Management,  Co-operative Management,  International Trade,  Marketing & Salesmanship,  Insurance & Material Management,  Office Secretaryship.	-

- For the Diploma Courses related with Engineering/Technology, the related / equivalent subjects prescribed along with Practicals may also be taken for arriving the eligibility.
- Branch will be allotted according to merit through counseling by the respective Principal as per communal reservation.
- For admission to the Textile Technology, Leather Technology, Printing Technology, Chemical Technology and Commercial Practice Diploma courses the candidates studied the related subjects will be given first preference.
- *Candidates who have studied Commerce Subjects are not eligible for Engineering Diploma Courses.*

**4. Age Limit: No Age limit.**

**5. Medium of Instruction: English**

**6. Eligibility for the Award of Diploma:**

No candidate shall be eligible for the Diploma unless he/she has undergone the prescribed course of study for a period of not less than 3 academic years in any institution affiliated to the State Board of Technical Education and Training, Tamil Nadu, when joined in First Year and two years if joined under Lateral Entry scheme in the second year and passed the prescribed examination.

The minimum and maximum period for completion of Diploma Courses are as given below:

<b>Diploma Course</b>	<b>Minimum Period</b>	<b>Maximum Period</b>
Full Time	3 Years	6 Years
Full Time (Lateral Entry)	2 Years	5 Years
Sandwich	3½ Years	6½ Years
Part Time	4 Years	7 Years

This will come into effect from N Scheme onwards i.e. from the academic year 2020-2021.

**7. Subjects of Study and Curriculum outline:**

The subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical subjects.

The curriculum outline is given in Annexure – I.

**8. Examinations:**

Board Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester.

The internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment. Board Examinations are conducted for 100 marks and reduced to 75.

The total marks for result are  $75 + 25 = 100$  Marks.

## 9. Continuous Internal Assessment:

### A. For Theory Subjects:

The Internal Assessment marks for a total of 25 marks, which are to be distributed as follows:

#### i) Subject Attendance

**5 Marks**

(Award of marks for subject attendance to each subject Theory/Practical will be as per the range given below)

80%	-	83%	1 Mark
84%	-	87%	2 Marks
88%	-	91%	3 Marks
92%	-	95%	4 Marks
96%	-	100%	5 Marks

#### ii) Test #

**10 Marks**

2 Tests each of 2 hours duration for a total of 50 marks are to be conducted. Average of the these two test marks will be taken and the marks to be reduced to: 05 Marks

The Test – III is to be the Model Examination covering all the five units and the marks obtained will be reduced to : 05 Marks

TEST	UNITS	WHEN TO CONDUCT	MARKS	DURATION
Test I	Unit – I & II	End of 6 <sup>th</sup> week	50	2 Hrs
Test II	Unit – III & IV	End of 12 <sup>th</sup> week	50	2 Hrs
Test III	<b>Model Examination:</b> Covering all the 5 Units. (Board Examinations-question paper-pattern).	End of 16 <sup>th</sup> week	100	3 Hrs

# From the Academic Year 2020 – 2021 onwards.

Question Paper Pattern for the Test - I and Test – II is as follows. The tests should be conducted by proper schedule. Retest marks should not be considered for internal assessment.

**Without Choice:**

Part A Type questions:	6 Questions × 1 mark	06 marks
Part B Type questions:	7 Questions × 2 marks	14 marks
Part C Type questions:	2 Questions × 15 marks	30 marks
	<b>Total</b>	<b>50 marks</b>

**iii) Assignment**

**5 Marks**

For each subject Three Assignments are to be given each for 20 marks and the average marks scored should be reduced for 5 marks.

**iv) Seminar Presentation**

**5 Marks**

The students have to select the topics either from their subjects or general subjects which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present seminar (For First and Second Year, the students will be permitted to present the seminar as a group not exceeding six members and each member of the group should participate in the presentation. For the Third Year, the students should present the seminar individually.) The seminar presentation is mandatory for all theory subjects and carries 5 marks for each theory subject. The respective subject faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (2 ½ marks for the material submitted in writing and 2 ½ marks for the seminar presentation). For each subject minimum of two seminars are to be given and the average marks scored should be reduced to 5 marks.

All Test Papers, Assignment Papers / Notebooks and the seminar presentation written material after getting the signature with date from the students must be kept in safe custody in the department for verification and audit. It should be preserved for one semester after publication of Board Exam results and produced to the flying squad and the inspection team at the time of inspection/verification.



## **B. For Practical Subjects:**

The Internal Assessment mark for a total of 25 marks which are to be distributed as follows:-

a) Attendance	<b>: 5 Marks</b>
(Award of marks same as theory subjects)	
b) Procedure/ observation and tabulation/ Other Practical related Work	<b>: 10 Marks</b>
c) Record writing	<b>: 10 Marks</b>
<b>TOTAL</b>	<b>: 25 Marks</b>

- *All the Experiments/Exercises indicated in the syllabus should be completed and the same to be given for final Board examinations.*
- The observation note book / manual should be maintained for 10 marks. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical subject during practical classes should be evaluated properly during the practical class hours with date.
- The Record work for every completed exercise should be submitted in the subsequent practical classes and marks should be awarded for 10 marks for each exercise as per the above allocation.
- At the end of the Semester, the average marks of all the exercises should be calculated for 20 marks (including Observation and Record writing) and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.

*All the marks awarded for Assignments, Tests, Seminar presentation and Attendance should be entered periodically in the Personal Theory Log Book of the staff, who is handling the theory subject.*

*The marks awarded for Observation, Record work and Attendance should be entered periodically in the Personal Practical Log Book of the staff, who is handling the practical subject.*

**10. Communication Skill Practical, Computer Application Practical and Physical Education:**

The Communication Skill Practical and Computer Application Practical with more emphasis are being introduced in First Year. Much Stress is given to increase the Communication skill and ICT skill of students.

As per the recommendation of MHRD and under Fit India scheme, the Physical education is introduced to encourage students to remain healthy and fit by including physical activities and sports.

**11. Project Work and Internship:**

The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. **The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.**

**a) Internal assessment mark for Project Work & Internship:**

Project Review I	...	<b>10 marks</b>
Project Review II	...	<b>10 marks</b>
Attendance	...	<b>05 marks</b> (Award of marks same as theory subject pattern)
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Total	...	<b>25 marks</b>

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Board Exams results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

**b) Allocation of Marks for Project Work & Internship in Board Examinations:**

Demonstration/Presentation	25 marks
Report	25 marks
Viva Voce	30 marks
Internship Report	20 marks
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<b>Total</b>	<b>100* marks</b>

\*Examination will be conducted for 100 marks and will be converted to 75 marks.

**c) Internship Report:**

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV / V semester during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year “Project Work & Internship” for 20 marks. The internship shall be undertaken in any industry / Government or Private certified agencies which are in social sector / Govt. Skill Centres / Institutions / Schemes.

**A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work & Internship Board examination.**

**12. Scheme of Examinations:**

The Scheme of examinations for subjects is given in Annexure - II.

**13. Criteria for Pass:**

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.
2. A candidate shall be declared to have passed the examination in a subject if he/she secures not less than *40% in theory subjects* and *50% in practical subjects* out of the total prescribed maximum marks including both the Internal Assessment and the Board Examinations marks put together, subject to the condition that he/she secures at least a minimum of *40 marks out of 100 marks in the Board Theory Examinations* and a minimum of *50 marks out of 100 marks in the Board Practical Examinations*.

**14. Classification of successful candidates:**

Classification of candidates who will pass out the final examinations from April 2023 onwards (Joined first year in 2020 -2021) will be done as specified below.

**First Class with Superlative Distinction:**

A candidate will be declared to have passed in **First Class with Superlative Distinction** if he/she secures not less than 75% of the marks in all the subjects and passes all the semesters in the first appearance itself and passes all subjects within

the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

**First Class with Distinction:**

A candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters except the I and II semester in the first appearance itself and passes all subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

**First Class:**

A candidate will be declared to have passed in **First Class** if he/she secures not less than 60% of the aggregate marks in all the semesters put together and passes all the subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

**Second Class:**

All other successful candidates will be declared to have passed in **Second Class**.

The above classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021)

**15. Duration of a period in the Class Time Table:**

The duration of each period of instruction is 1 hour and the total period of instruction hours excluding interval and lunch break in a day should be uniformly maintained as 7 hours corresponding to 7 periods of instruction (Theory & Practical).

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## Board Examination-Question Paper Pattern

Time: 3 Hrs.

Max.Marks:100

- PART - A Five questions will be asked covering all units. All questions are to be answered. Each question carries 1 mark.
- PART- B Fifteen questions will be asked covering all the units. Three questions from each unit. Answer any ten questions. Each question carries 2 marks.
- PART-C Five questions will be asked Either or type. One question from every unit. Answer either A or B. Each question carries 15 marks. A and B have subdivisions. (7 + 8)

**The questions are to be numbered from 1 to 25. All the units are to be covered with equal weightage.**

<b>PART A</b> Definitions and Statements. Question Number 1 to 5	5 X 1 = 5 Marks
<b>PART B</b> Short answer type questions Question Number 6 to 20	10 X 2 = 20 Marks
<b>PART C</b> Descriptive answer type questions (Either A or B) Question number 21 to 25	5 X 15 = 75 Marks
<b>TOTAL</b>	100 Marks

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

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**ANNEXURE- I**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**BRANCH CODE: DIPLOMA IN ELECTRONICS (ROBOTICS) / MECHACTRONICS**  
**ENGINEERING (FULL TIME) SYLLABUS**  
**N-SCHEME**  
**(To be implemented for the students admitted from the year 2020-21 onwards)**  
**CURRICULUM OUTLINE**

**III Semester**

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
4040310	Electronic Devices and Circuits\$	5	-	-	5
4047320	Electrical circuit, Machines and Drives	5	-	-	5
4047330	Manufacturing Technology	5	-	-	5
4040340	Electronic Devices and Circuits Practical \$	-	-	4	4
4047350	Electrical Circuits and Machines and Drives Practical	-	-	4	4
4047360	Manufacturing Technology Practical	-	-	5	5
4047370	CAD Practical	-	-	4	4
<b>Sub Total</b>		<b>15</b>	<b>-</b>	<b>17</b>	<b>32</b>
Library		-	-	-	1
Physical Education		-	-	-	2
<b>TOTAL</b>					<b>35</b>

\$ - Common with Electronics and Communication Engineering

#### IV Semester

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
<b>4040430</b>	Analog and Digital Electronics \$	4	-	-	4
4047420	Mechanics of Materials	5	-	-	5
4047430	Industrial Instrumentation and Sensors	5	-	-	5
<b>4040520</b>	Microcontroller and its applications \$	5	-	-	5
<b>4040460</b>	Analog and Digital Electronics Practical \$	-	-	5	5
4047460	Industrial Instrumentation and Sensors Practical	-	-	4	4
<b>4040550</b>	Microcontroller Practical \$	-	-	4	4
<b>Sub Total</b>		<b>19</b>		<b>13</b>	<b>32</b>
Library		-	-	-	1
Physical Education		-	-	-	2
<b>TOTAL</b>					<b>35</b>

\$ - Common with Electronics and Communication Engineering



## V Semester

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
4047510	Industrial Automation	5	-	-	5
4047520	Robotics	5	-	-	5
<b>Elective I Theory</b>					
4047531	C Programming Language	5	-	-	5
<b>4030621</b>	Power Electronics #				
<b>4020532</b>	Green Energy and Energy Conservation*				
4047540	Industrial Automation Practical	-	-	5	5
4047550	Robotics Practical	-	-	4	4
<b>Elective I Practical</b>					
4047564	C Programming Language Practical	-	-	4	4
4047565	Power Electronics and Drives Practical				
<b>4020562</b>	Green Energy and Energy Conservation Practical *				
<b>4040570</b>	Entrepreneurship and start up#	-	-	4	4
<b>Sub total</b>		<b>15</b>	<b>-</b>	<b>17</b>	<b>32</b>
Library		-	-	-	1
Physical Education		-	-	-	2
<b>TOTAL</b>					<b>35</b>

@ - Common with all branches

# - Common with Electrical and Electronics Engineering

\* Common with Mechanical Engineering

## VI Semester

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
4020610	Industrial Engineering and Management*	5	-	-	5
4047620	Computer Intergrated Manufacturing	6	-	-	6
<b>Elective II Theory</b>					5
4047631	Process Control	5	-	-	
4047632	Auto Electronics				
4040633	Embedded System \$				
4047640	CNC Practical	-	-	5	
<b>Elective II Practical</b>					5
4047654	Process Control Practical	-	-	5	
4047655	Auto Electronics Practical	-	-		
4040636	Embedded System Practical \$	-	-		
4047660	Project Work and Internship	-	-	6	6
<b>Sub Total</b>		<b>16</b>	<b>-</b>	<b>16</b>	<b>32</b>
Library		-	-	-	1
Physical Education		-	-	-	2
<b>TOTAL</b>					<b>35</b>

\* Common with Mechanical Engineering

\$ - Common with Electronics and Communication Engineering

**ANNEXURE- II**

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**BRANCH CODE: DIPLOMA IN ELECTRONICS (ROBOTICS) / MECHACTRONICS**  
**ENGINEERING (FULL TIME)**

**N-SCHEME**

**(To be implemented for the students admitted from the year 2020-21 onwards)**  
**SCHEME OF EXAMINATION**

**III Semester**

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
<b>4040310</b>	Electronic Devices and Circuits\$	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4047320	Electrical circuit, Machines and Drives	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4047330	Manufacturing Technology	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
<b>4040340</b>	Electronic Devices and Circuits Practical \$	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047350	Electrical Circuits and Machines and Drives Practical	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047360	Manufacturing Technology Practical	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047370	CAD Practical	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
Total		<b>175</b>	<b>700</b>	<b>700</b>		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

#### IV Semester

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
4040430	Analog and Digital Electronics \$	25	100*	100	40	3
4047420	Mechanics of Materials	25	100*	100	40	3
4047430	Industrial Instrumentation and Sensors	25	100*	100	40	3
4040520	Microcontroller and its applications \$	25	100*	100	40	3
4040460	Analog and Digital Electronics Practical \$	25	100*	100	50	3
4047460	Industrial Instrumentation and Sensors Practical	25	100*	100	50	3
4040550	Microcontroller Practical \$	25	100*	100	50	3
Total		175	700	700		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

#### V Semester

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
4047510	Industrial Automation	25	100*	100	40	3
4047520	Robotics	25	100*	100	40	3
	Elective Theory – I	25	100*	100	40	3
4047540	Industrial Automation Practical	25	100*	100	50	3
4047550	Robotics Practical	25	100*	100	50	3
	Elective Practical – I	25	100*	100	50	3
4040570	Entrepreneurship and start up @	25	100*	100	50	3
Total		175	700	700		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

## VI Semester

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
4020610	Industrial Engineering and Management*	25	100*	100	40	3
4047620	Computer Intergrated Manufacturing	25	100*	100	40	3
	Elective Theory – II	25	100*	100	40	3
4047640	CNC Practical	25	100*	100	50	3
	Elective Practical – II	25	100*	100	50	3
4047660	Project Work and Internship	25	100*	100	50	3
Total		150	600	600		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**List Of Equivalent Subjects for M - Scheme to N – Scheme**

**III Semester With Effect from Oct '21**

<b>M Scheme</b>		<b>N Scheme</b>	
34031	Electronic Devices and Circuits	4040310	Electronic Devices and Circuits
34232	Electrical Circuits and Machines	4047320	Electrical circuit, Machines and Drives
34733	Manufacturing Technology	4047330	Manufacturing Technology
34034	Electronic devices and Circuits Practical	4040340	Electronic Devices and Circuits Practical
34735	Electrical Circuits and Machines Practical	4047350	Electrical Circuits and Machines and Drives Practical
34736	Manufacturing Technology Practical	4047360	Manufacturing Technology Practical
30001	Computer Application Practical	<b>40002</b>	<b>Computer Application Practical</b>

**IV Semester With Effect from Apr '22**

<b>M Scheme</b>		<b>N Scheme</b>	
34241	Analog and Digital Electronics	4040430	Analog and Digital Electronics
34742	Mechanics of Materials	4047420	Mechanics of Materials
34743	Hydraulics and Pneumatics Systems	<b>No Equivalent</b>	
34744	Measuring Instruments and Sensors	4047430	Industrial Instrumentation and Sensors
34245	Analog and Digital Electronics Practical	4040460	Analog and Digital Electronics Practical
34746	Hydraulics, Pneumatics and PLC Practical	4047540	Industrial Automation Practical (with effect from Oct '22)
30002	Life and Employability skill Practical	<b>40001</b>	<b>Communication Skill Practical</b>

**V Semester With Effect from Oct '22**

<b>M Scheme</b>		<b>N Scheme</b>	
34751	Industrial Instrumentation and Automation	<b>No Equivalent</b>	
34752	Microcontroller and PIC	4040520	Microcontroller and its applications
34753	Auto Electronics	4047632	Auto Electronics (with effect from Apr '23)
34754	CAD/CAM	4047620	Computer Intergrated Manufacturing (with effect from Apr '23)
34755	Microcontroller Practical	4040550	Microcontroller Practical
34756	Programming in C Practical	4047564	C Programming Language Practical
34757	CNC Practical	4047640	CNC Practical (with effect from Apr '23)

**VI SEMESTER – With Effect from Apr '23**

<b>M Scheme</b>		<b>N Scheme</b>	
32061	Industrial Engineering and Management	4020610	Industrial Engineering and Management*
34762	Process Control	4047631	Process Control
34763	Robotics	4047520	Robotics
34764	Process Control Practical	4047654	Process Control Practical
34765	Robotics Practical	4047550	Robotics Practical
34766	CAD Practical	4047370	CAD Practical
34767	Project Work	<b>No Equivalent</b>	



**DIPLOMA IN ELECTRONICS (ROBOTICS) ENGINEERING /  
MECHATRONICS (SANDWICH)**

**CODE NO: 2047**

**N - SCHEME**

**2020- 2021**

**DIRECTORATE OF TECHNICAL EDUCATION**

**GOVERNMENT OF TAMILNADU**



**ANNEXURE- I**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**BRANCH CODE: DIPLOMA IN ELECTRONICS (ROBOTICS) / MECHACTRONICS**  
**ENGINEERING (FULL TIME) SYLLABUS**  
**N-SCHEME**

(To be implemented for the students admitted from the year 2020-21 onwards)

**III Semester**

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
<b>4040310</b>	Electronic Devices and Circuits\$	4	-	-	4
4047320	Electrical circuit, Machines and Drives	4	-	-	4
4047330	Manufacturing Technology	4	-	-	4
4040430	Analog and Digital Electronics \$	4			4
<b>4040340</b>	Electronic Devices and Circuits Practical \$	-	-	4	4
4047350	Electrical Circuits and Machines and Drives Practical	-	-	4	4
4047360	Manufacturing Technology Practical	-	-	4	4
4040460	Analog and Digital Electronics Practical \$	-	-	4	4
<b>Sub Total</b>		<b>16</b>	<b>-</b>	<b>16</b>	<b>32</b>
Library		-	-	-	1
Physical Education		-	-	-	2
<b>TOTAL</b>					<b>35</b>

\$ - Common with Electronic and Communication Engineering

**IV Semester**

<b>Subject Code</b>	<b>SUBJECT</b>	<b>HOURS PER WEEK</b>			
		<b>Theory hours</b>	<b>Drawing hours</b>	<b>Practical hours</b>	<b>Total hours</b>
4047430	Industrial Instrumentation and Sensors	4	-	-	4
4047460	Industrial Instrumentation and Sensors Practical	-	-	3	3
4047480	Industrial Training – I	-	-	28	28
<b><i>Sub Total</i></b>		<b>4</b>	<b>-</b>	<b>31</b>	<b>35</b>
<b>TOTAL</b>					<b>35</b>

\$ - Common with Electronic and Communication Engineering

## V Semester

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
4047510	Industrial Automation	4	-	-	4
4047420	Mechanics of Materials	5			5
<b>4040520</b>	Microcontroller and its applications \$	4	-	-	4
<b>Elective I Theory</b>					
4047531	C Programming Language	5	-	-	5
<b>4030621</b>	Power Electronics#				
<b>4020532</b>	Green Energy and Energy Conservation*				
4047370	CAD Practical	-	-	3	3
<b>4040550</b>	Microcontroller Practical \$	-	-	3	3
4047540	Industrial Automation Practical	-	-	4	4
<b>Elective I Practical</b>					
4047564	C Programming Language Practical	-	-	4	4
4047565	Power Electronics and Drives Practical				
<b>4020562</b>	Green Energy and Energy Conservation Practical *				
<b>Sub total</b>		<b>18</b>	<b>-</b>	<b>14</b>	<b>32</b>
Library		-	-	-	1
Physical Education		-	-	-	2
<b>TOTAL</b>					<b>35</b>

@ - Common with all branches

# - Common with Electrical and Electronics Engineering

\$ - Common with Electronic and Communication Engineering

\* Common with Mechanical Engineering

## VI Semester

Subject Code	SUBJECT	HOURS PER WEEK				
		Theory hours	Drawing hours	Practical hours	Total hours	
4020610	Industrial Engineering and Management*	4	-	-	4	
4047620	Computer Intergrated Manufacturing	5	-	-	5	
4047520	Robotics	4	-	-	4	
<b>Elective II Theory</b>					5	
4047631	Process Control	5	-	-		
4047632	Auto Electronics					
4040633	Embedded System \$					
4047640	CNC Practical	-	-	5		5
4047550	Robotics Practical	-	-	4		4
<b>Elective II Practical</b>					5	
4047654	Process Control Practical	-	-	5		
4047655	Auto Electronics Practical	-	-			
4040636	Embedded System Practical \$	-	-			
<b>Sub Total</b>		<b>18</b>	<b>-</b>	<b>14</b>	<b>32</b>	
Library		-	-	-	1	
Physical Education		-	-	-	2	
<b>TOTAL</b>					<b>35</b>	

\* Common with Mechanical Engineering

\$ - Common with Electronic and Communication Engineering

## VII Semester

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
4040570	Entrepreneurship and start ups \$	-	-	3	3
4047710	Project Work	-	-	4	4
4047720	Industrial Training – II	-	-	28	28
<b>Sub Total</b>		-	-	<b>35</b>	<b>35</b>
<b>TOTAL</b>					<b>35</b>

\$ - Common with Electronic and Communication Engineering

**ANNEXURE- II**

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**BRANCH CODE: DIPLOMA IN ELECTRONICS (ROBOTICS) / MECHACTRONICS**  
**ENGINEERING (FULL TIME)**

**N-SCHEME**

**(To be implemented for the students admitted from the year 2020-21 onwards)**

**SCHEME OF EXAMINATION****III Semester**

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
<b>4040310</b>	Electronic Devices and Circuits\$	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4047320	Electrical circuit, Machines and Drives	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4047330	Manufacturing Technology	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4040430	Analog and Digital Electronics \$	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
<b>4040340</b>	Electronic Devices and Circuits Practical \$	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047350	Electrical Circuits and Machines and Drives Practical	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047360	Manufacturing Technology Practical	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4040460	Analog and Digital Electronics Practical \$	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
Total		<b>200</b>	<b>800</b>	<b>800</b>		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

#### IV Semester

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
4047430	Industrial Instrumentation and Sensors	25	100*	100	40	3
4047460	Industrial Instrumentation and Sensors Practical	25	100*	100	50	3
4047480	Industrial Training – I	25	100*	100	50	3
Total		175	300	300		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

#### V Semester

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
4047510	Industrial Automation	25	100*	100	40	3
4047420	Mechanics of Materials	25	100*	100	40	3
<b>4040520</b>	Microcontroller and its applications \$	25	100*	100	40	3
	Electrive Theory – I	25	100*	100	40	3
4047370	CAD Practical	25	100*	100	50	3
<b>4040550</b>	Microcontroller Practical \$	25	100*	100	50	3
4047540	Industrial Automation Practical	25	100*	100	50	3
	Elective Practical – I	25	100*	100	50	3
Total		200	800	800		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**VI Semester**

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
<b>4020610</b>	Industrial Engineering and Management*	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4047620	Computer Intergrated Manufacturing	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4047520	Robotics	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
	Elective Theory – II	<b>25</b>	<b>100*</b>	<b>100</b>	<b>40</b>	<b>3</b>
4047640	CNC Practical	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047550	Robotics Practical	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
	Elective Practical – II	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
Total		<b>175</b>	<b>700</b>	<b>700</b>		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**VII Semester**

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment marks	Board Exam Marks	Total Marks		
<b>4040570</b>	Entrepreneurship and start ups @	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047710	Project Work	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
4047720	Industrial Training – II	<b>25</b>	<b>100*</b>	<b>100</b>	<b>50</b>	<b>3</b>
Total		<b>50</b>	<b>200</b>	<b>200</b>		

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.



**List Of Equivalent Subjects for M - Scheme to N – Scheme**

**III Semester With Effect from Oct '21**

<b>M Scheme</b>		<b>N Scheme</b>	
34031	Electronic Devices and Circuits	4040310	Electronic Devices and Circuits
34232	Electrical Circuits and Machines	4047320	Electrical circuit, Machines and Drives
34733	Manufacturing Technology	4047330	Manufacturing Technology
34744	Measuring Instruments and Sensors	4047430	Industrial Instrumentation and Sensors
34034	Electronic devices and Circuits Practical	4040340	Electronic Devices and Circuits Practical
34735	Electrical Circuits and Machines Practical	4047350	Electrical Circuits and Machines and Drives Practical
34736	Manufacturing Technology Practical	4047360	Manufacturing Technology Practical
30001	Computer Application Practical	<b>40002</b>	<b>Computer Application Practical</b>

**IV Semester With Effect from Apr '22**

<b>M Scheme</b>		<b>N Scheme</b>	
34756	Programming in C Practical	4047564	C Programming Language Practical
34791	Industrial Training – I	4047480	Industrial Training – I
30002	Life and Employability skill Practical	<b>40001</b>	<b>Communication Skill Practical</b>

**V Semester With Effect from Oct '22**

<b>M Scheme</b>		<b>N Scheme</b>	
34241	Analog and Digital Electronics	4040430	Analog and Digital Electronics
34742	Mechanics of Materials	4047420	Mechanics of Materials
34743	Hydraulics and Pneumatics Systems	<b>No Equivalent</b>	
34752	Microcontroller and PIC	4040520	Microcontroller and its applications
34754	CAD/CAM	4047620	Computer Intergrated Manufacturing (with effect from Apr '23)
34766	CAD Practical	4047370	CAD Practical
34755	Microcontroller Practical	4040550	Microcontroller Practical
34245	Analog and Digital Electronics Practical	4040460	Analog and Digital Electronics Practical

**VI SEMESTER – With Effect from Apr '23**

<b>M Scheme</b>		<b>N Scheme</b>	
34751	Industrial Instrumentation and Automation	<b>No Equivalent</b>	
32061	Industrial Engineering and Management	4020610	Industrial Engineering and Management*
34753	Auto Electronics	4047632	Auto Electronics
34762	Process Control	4047631	Process Control
34763	Robotics	4047520	Robotics
34757	CNC Practical	4047640	CNC Practical (with effect from Apr '23)
34764	Process Control Practical	4047654	Process Control Practical
34765	Robotics Practical	4047550	Robotics Practical
34746	Hydraulics, Pneumatics and PLC Practical	4047540	Industrial Automation Practical (with effect from Oct '22)

**VII SEMESTER – With Effect from Oct '24**

<b>M Scheme</b>		<b>N Scheme</b>	
34767	Project Work	4047710	Project Work
34792	Industrial Training – II	4047720	Industrial Training – II



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **III SEMESTER**

**2020-21 onwards**

# **ELECTRONIC DEVICES AND CIRCUITS** **(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING/TECHNOLOGY SYLLABUS**  
**N SCHEME**

(To be Implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1040:Electronics and Communication Engineering

Subject Code : 4040310

Semester : III Semester

Subject title : ELECTRONIC DEVICES AND CIRCUITS

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks/ semester:

16weeks

Subject	Instruction		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
<b>Electronic Devices and Circuits</b>	<b>5</b>	<b>80</b>	<b>25</b>	<b>100*</b>	<b>100</b>	<b>3 Hrs</b>

\* Examination will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and allocation of hours**

UNIT	TOPIC	Hrs
I	Filters, Zener diode and Opto-electronic devices	14
II	Bipolar Junction Transistor, Field Effect Transistor and UJT	16
III	Feedback, Amplifiers and Oscillators	16
IV	Special Semiconducting Devices( SCR, DIAC AND TRIAC)	14
V	Wave shaping Circuits	13
	Tests and Model Exam	7
	Total	80

**RATIONALE:**

Every Electronics Engineer should have sound knowledge about the components used in Electronics Industry. This is vital in R&D Department for chip level troubleshooting. To meet the industrial needs, diploma holders must be taught about the most fundamental subject, Electronic devices and Circuits . By studying this subject, they will be skilled in handling all types of electronic devices and able to apply the skill in electronics system.

**OBJECTIVES:**

On completion of the following units of syllabus contents, the students must be able to:

- Know the importance of Filters
- Know the construction, working principle and applications of Zener diode
- Know the construction, working principle and applications of Optoelectronic devices
- Know the biasing methods of Transistors and their applications
- Study the performance of special devices like UJT, FET
- Study the Concept of Feedback, different types of Negative feedback connections
- Know the Types of Transistor amplifiers , Transistor oscillators and their applications
- Study the performance of Special semiconducting devices like SCR, DIAC, and TRIAC
- Explain the concept of wave shaping circuits, Bistable Multivibrator and Schmitt trigger
- Study the working principle of clippers , clampers , Voltage Multipliers and their applications

## 4040310 ELECTRONIC DEVICES AND CIRCUITS

### DETAILED SYLLABUS

Contents: Theory

Unit	Name of the topics	Hours
I	<b>FILTERS, ZENER DIODES AND OPTO-ELECTRONIC DEVICES</b>	
	<b>1.1: FILTERS</b> Definition - Types - Capacitor filter - Inductor filter - L section filter - Pi section and RC filter - Comparison and Applications of Filters	5
	<b>1.2: ZENER DIODE</b> Construction, Working principle and Characteristics of Zener Diodes- Zener breakdown-Avalanche breakdown- Zener diode as a Voltage regulator.	5
	<b>1.3: OPTO-ELECTRONIC DEVICES</b> Definition - Types - Symbol, Working , Characteristics and Applications of LED, 7 Segment LED - Photo diode, Photo	4
II	<b>BIPOLAR JUNCTION TRANSISTOR (BJT), FIELD EFFECT TRANSISTOR (FET) AND UNI JUNCTION TRANSISTOR (UJT)</b>	
	<b>2.1: BIPOLAR JUNCTION TRANSISTOR</b> Transistor biasing: Need for biasing - Types- Fixed bias, Collector to base bias and Self bias (Operation only ,No derivation of circuit elements and parameters)– Define: Stability factor - Operation of Common Emitter Transistor as an Amplifier and as a switch.	7
	<b>2.2: FIELD EFFECT TRANSISTOR (FET)</b> Construction – Working principle–Classification - Drain and Transfer Characteristics -Applications–Comparison between FET and BJT - FET amplifier (common source amplifier).	5
	<b>2.3: UNIUNCTION TRANSISTOR (UJT)</b> Construction-Equivalent circuit-Operation-Characteristics-UJT as a relaxation oscillator	4

III	<p><b>FEEDBACK , AMPLIFIERS AND OSCILLATORS</b></p> <p><b>3.1: FEEDBACK</b>  Concept - effects of negative feedback-Types of negative feedback connections - Applications</p> <p><b>3.2: AMPLIFIERS</b>  Transistor amplifiers - Types - RC coupled amplifier - Working and Frequency response characteristics –Working of Common Collector Amplifier( Emitter follower)</p> <p><b>3.3 : OSCILLATORS</b>  <b>Transistor oscillators</b>–Conditions for oscillation (Barkhausen criterion)- Classifications– Hartley Oscillator– Colpitts Oscillator – RC Phase shift oscillator</p>	<p><b>6</b></p> <p><b>6</b></p> <p><b>4</b></p>
IV	<p><b>SPECIAL SEMICONDUCTING DEVICES (SCR, DIAC AND TRIAC)</b></p> <p><b>4.1:SCR (SILICON CONTROLLED RECTIFIER)</b>  Symbol – Layered Structure – Transistor analogy - Working–VI characteristics–Applications - Comparison between SCR and Transistor</p> <p><b>4.2: DIAC ( Diode for Alternating Current)</b>  Symbol – Layered structure - Working – VI characteristics- Applications</p> <p><b>4.3: TRIAC ( Triode for Alternating Current )</b>  Symbol – Layered structure - Working – VI characteristics- Applications</p>	<p><b>5</b></p> <p><b>5</b></p> <p><b>4</b></p>

V	<b>WAVE SHAPING CIRCUITS</b>	
	<b>5.1: CLIPPERS AND CLAMPERS</b> Construction and working of Positive, Negative and biased Clippers - Construction and working of Positive and Negative Clamper	<b>5</b>
	<b>5.2: Voltage Multipliers</b> Construction and working of Voltage Doubler and Tripler.	<b>3</b>
	<b>5.3 :Multivibrator and Schmitt Trigger</b> Construction – Working – Waveform of Astable and Monostable Multivibrator using Transistors and Schmitt Trigger using Transistors	<b>5</b>

**Reference Books:**

1. Electronics Devices & Circuits by Salivahanan S,N.Suresh Kumar, A.Vallavaraj  
Tata McGraw Publication 3<sup>rd</sup>Edition 2016
2. Electronics Devices and circuit theory by Boyestad& Nashelsky, PHI , New Delhi  
2009
3. Electronic Principles by Malvino,-Tata McGraw Hill Publication 2010.
4. Electronics Devices & Circuits by Jacob Millman and Halkias 3<sup>rd</sup> Edition  
2010, Tata McGraw– Hill publication
5. Optical Fiber Communication by Gerd Keiser 5<sup>th</sup> Edition, Tata McGraw– Hill .





# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **III SEMESTER**

**2020-21 onwards**

# **ELECTRICAL CIRCUITS, MACHINES AND DRIVES**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics)

Engineering

Subject Code : 4047320

Semester : III Semester

Subject Title : **Electrical Circuits, Machines and Drives**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Electrical Circuits, Machines and Drives	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	ELECTRICAL SAFETY & DC CIRCUITS	15
II	AC CIRCUITS AND DC MACHINES	15
III	THREE PHASE SUPPLY AND TRANSFORMER	15
IV	AC MACHINES	14
V	SPECIAL MACHINES & DRIVES	14
Test & Model Exam		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

The fundamental knowledge about Electrical circuits both AC and DC is essential for all diploma holders. The working principle of DC & AC machines, transformer and special machines is a prerequisite for technicians in their workplace. This subject helps in this way.

**OBJECTIVES:**

- Appreciate the safety practices followed in Electrical system.
- Define voltage, current, resistance, resistivity, power, energy and their units.
- State and explain ohm's law and Kirchoff's law and solve simple problems
- Derive equivalent resistance of series and parallel circuits
- State and explain super position theorem, and maximum power transfer theorem and solve problems in theorems
- Explain constructional details of dc machines
- Define the various parameters of single phase supply system
- Derive the impedance, current and voltage of RL, RC & RLC series circuits and also solve the simple problem
- Explain the Explain three phase power measurement by two wattmeter method
- Explain the construction, working and starting methods of single phase, three phase induction motor and Alternator
- Explain the principle and working of different types of induction motor
- Explain the principle and working of transformer
- Compare the use of servo motors and stepper motors in electrical driving system

## 4047320 ELECTRICAL CIRCUITS, MACHINES & DRIVES

### DETAILED SYLLABUS

#### Contents: Theory

Unit	Name of the Topics	Hours
I	<p><b>ELECTRICAL SAFETY AND DC CIRCUITS</b></p> <p><b><u>Chapter: 1.1: Electrical Safety</u></b> Importance of earthing - Electric shock - First aid - Precautions - Causes of accident and their preventive measures</p> <p><b><u>Chapter: 1.2: DC Circuits</u></b> Concept of electrical quantities – Voltage – current – resistance – power – energy – ohm’s law – Resistances in series – Resistances in parallel – series parallel circuits – Kirchoff’s laws - Super position and maximum power transfer theorems – Statement and explanations – Simple problems (Using Series, Parallel, Ohms Law, KCL&amp; KVL for maximum three loops, Super position and maximum power transfer theorem)</p>	3  12
II	<p><b>AC CIRCUITS &amp; DC MACHINES</b></p> <p><b><u>Chapter: 2.1: Single phase AC Circuits</u></b> AC fundamentals – AC waveform – sinusoidal and non-sinusoidal – period – frequency – cycle – amplitude – phase – peak value – average value – RMS value (effective value) – form factor – AC Through pure resistor, inductor and Capacitor – Concept of impedance – Capacitors in series and parallel – simple problems. Power in AC circuits – power factor– RL, RC and RLC series – Simple problems (RL,RC (Maximum two branch circuit), RLC Series)</p> <p><b><u>Chapter: 2.2: DC Machines</u></b> DC generators – construction, principle of operation, types and application - DC motors: - construction, principle of operation, types and application - speed control of DC motor-applications - Necessity of starters: Three point, four point starters</p>	8  7
III	<p><b>THREE PHASE AC CIRCUITS &amp; TRANSFORMER</b></p> <p><b><u>Chapter: 3.1: Three Phase AC Circuits</u></b></p>	

	<p>Concept of 3 phase supply – line and phase voltage and current in star and delta connected circuits – three phase power – Measurement of three phase power by two watt meter method – advantages of three phase over single phase system</p> <p><b><u>Chapter: 3.2: Transformers</u></b></p> <p>Transformer – Ideal transformer – principle of working – constructional details – emf equation – turns ratio – core loss – copper loss – efficiency – SC and OC tests – Transformer on No load – Transformer on load – All-day efficiency - Auto transformer – construction and working – applications</p>	8
IV	<p><b>AC MACHINES</b></p> <p><b><u>Chapter: 4.1: Alternator</u></b></p> <p>3 phase alternator – construction and working – relation between speed and frequency</p> <p><b><u>Chapter: 4.2: Three phase Induction motor</u></b></p> <p>Three phase induction motors – Squirrel cage and slip ring Induction motors (construction and working principle only) – methods of starting of 3 phase induction motor - DOL and star/delta starter – slip – speed control of 3<math>\Phi</math> Induction motor</p> <p><b><u>Chapter: 4.3: Single phase Induction motor</u></b></p> <p>Single phase induction motor – principle of operation – Types – capacitor start motors – Applications</p>	4  6  4
V	<p><b>SPECIAL MACHINES &amp; DRIVES</b></p> <p><b><u>Chapter: 5.1: Special Machines</u></b></p> <p>PMDC, Stepper motor- construction and working principle and applications - Servo motor – types: brushless servo motor, permanent magnet servo motor construction and applications</p> <p><b><u>Chapter: 5.2: Industrial drives</u></b></p> <p>Types of drives - Group drive, Individual drive, Multi motor drive - Block diagram of Variable frequency drive - Stepper motor drive - Single stepping and half stepping - Servo drives</p>	7  7

## Reference Books

1. Electric Circuit Theory Dr.M.Arumugam & Dr.N.Premkumaran, Khanna Publishers, New Delhi
2. A text book of Electrical Technology, Vol. I & II, Theraja. B.L., S.Chand & Co
3. Electrical Technology, Edward Hughes Addison – Wesley International Student Edition
4. Elements of Electrical Engineering, Louis M.M. , Khanna Publishers
5. Elementary of Electrical Engineering, Gupta M.L. ,S.K.Kataria & Sons,
6. Control of Machines - S.K Bhattacharya, Brijinder Singh – New Age Publishers, Second Edition- Reprint 2010



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **III SEMESTER**

**2020-21 onwards**

# **MANUFACTURING TECHNOLOGY**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047330

Semester : III Semester

Subject Title : **MANUFACTURING TECHNOLOGY**

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Manufacturing Technology	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Lathe	16
II	Drilling machines, Milling machines	16
III	Grinding machine, Shaper	14
IV	Unconventional Machining Processes	14
V	Fundamentals of measurement	13
Test & Model Exam		7
<b>Total</b>		<b>80</b>



**RATIONALE:**

The Working principle of various machines like Planer, Shaper, Lathe, Drilling machine, Milling Machine is necessary for supervisors and Head's of Manufacturing industries. Usage of machines & Maintenance of Machines are important for plant Engineers.

Knowledge of Unconventional machining processes & measurement methods are necessary for a Mechanical Engineer.

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- Explain the working of machine tool Lathe
- Compare various work holding devices
- Explain the working of machine tools drilling machine, Milling machine
- Distinguish various types of milling cutter
- Classify different types of grinders and grinding wheels
- Explain the working of shaper and work holding devices
- Explain the working of various unconventional machines
- Explain the various types of Measuring instruments

## 4047330 - MANUFACTURING TECHNOLOGY

### DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	<b>Lathe:</b> Introduction - specifications – simple sketch – principal parts – head stock – back geared type – all geared type – feed mechanism - tumbler gear mechanism – quick change gear box – apron mechanism – work holding device – three jaw chuck – four jaw chuck – centres - faceplate – mandrel – steady rest – follower rest – machining operations done on lathe – straight turning – step turning - taper turning methods: form tool – tailstock set over method – compound rest method – taper turning	16

	attachment – knurling - Thread cutting – Facing – Boring – chamfering – grooving – parting-off – eccentric turning – cutting speed – feed - depth of cut - metal removal rate.	
II	<p><b><u>Chapter 2.1 Drilling machines:</u></b></p> <p>Drills-flat drills-twist drills-types of drilling machines-bench type-floor type-radial type-gang drill –multi spindle type-principle of operation in drilling-speeds and feeds for various materials-drilling holes- methods of holding drill bit-drill chucks-socket and sleeve-drilling-reaming-counte sinking- counter boring-spot facing-tapping-deep hole drill.</p> <p><b><u>Chapter 2.2 Milling machines:</u></b></p> <p>Types-column and knee type-plain-universal milling machine- vertical milling machine-specification of milling machines- principles of operation-work and tool holding devices-arbor-stub arbor-spring collets-adaptors-milling cutters-plain milling cutter- slab milling cutter-slitting saw-side milling cutter-angle milling cutter-T-slot milling cutter woodruff milling cutter-fly cutter- nomenclature of milling cutter-milling process-conventional milling-climb milling-milling operations-straddle milling-gang milling-vertical milling attachment-types of milling fixtures</p>	7                    9
III	<p><b><u>Chapter 3.1 Grinding machines</u></b></p> <p>Types and classification-specifications-rough grinders-floor mounted hand grinders-portable grinders-belt grinders-precision grinders-cylindrical, surface, centre less grinders-internal grinders- planetary grinders-principles of operations-grinding wheels- abrasives-natural and artificial-dressing and truing of wheels- balancing of grinding wheels-diamond wheels-types of bonds-grit, grade and structure of wheels-wheels shapes and sizes-standard marking systems of grinding wheels-selection of grinding wheel- mounting of grinding wheels.</p> <p><b><u>Chapter 3.2 Shaper:</u></b></p> <p>Types of shaper-specifications-standard-plain-universal- principles of operations-drives-quick return mechanism –crank and slotted link-feed mechanism-work holding devices-tools and fixtures.</p>	9                    5
IV	<p><b><u>Unconventional Machining Processes</u></b></p> <p>Unconventional machining process-need – classification-Abrasive jet machining (AJM) working principle -applications – water jet machining</p>	14

	(WJM) – working principle –applications- Abrasive water jet machining (AWJM) – working principle –applications- Electric discharge machining (EDM) - wire cut EDM- working principle -applications –Chemical machining and Electro chemical machining – working principle - applications -Laser beam machining and drilling- working principle - applications Plasma arc machining- working principle -applications - Electron beam machining –working principle –applications	
V	<p><b><u>Chapter 5.1 Fundamentals of Measurement :</u></b> Introduction –Metrology – Inspection – Definition of terms- Accuracy – Precision – Tolerance – Surface finish – Quality – Reliability – Interchangeability – optical fundamentals – optical instruments – principles of operation- interference band - Measurement of Length –</p> <p><b><u>Chapter 5.2 Classification of measuring instruments</u></b> – Radius measurement – Measurement of Angles – Sine bar and slip gauges, Sine bar and spirit level , Angle gauges- Measurement of Tapers –vernier bevel protractor, Tool room microscope, Autocollimator, External taper – Ring gauge measurement by balls and slip gauges –ring gauge measurement by unequal balls – Screw threads Inspection –Elements of a thread-gauging of screw threads – thread gauges – Measurement of individual elements of a screw thread – Measurement of External threads</p>	<p>6</p> <p>7</p>

### Reference Books

1. HajraChoudhry “work shop technology” Vol.II Media Promoters and Publishers Pvt Ltd.,
2. Jain R.K “Production Technology” Khanna Publishers
3. M I khan ,ErajulHaque “Manufacturing Science” PHI Learning Pvt Ltd.
4. Vijay K Jain –“Advanced machining processes” Allied publishers pvt Ltd., New delhi 2007
5. Pandey p.c and shan H.S “Modern machining processes” Tata Mcgraw hill, New delhi 2007



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **III SEMESTER**

**2020-21 onwards**

# **ELECTRONIC DEVICES AND CIRCUITS PRACTICAL**

**(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**

(To be Implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1040 Electronics and Communication Engineering  
 Subject code : 4040340  
 Semester : III  
 Subject title : ELECTRONIC DEVICES AND CIRCUITS PRACTICAL

**TEACHING AND SCHEME OF EXAMINATION:**

No. of weeks/ Semester: 16 weeks

Subject	Instruction		Examination			
	Hours /week	Hours /semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
<b>Electronic Devices and Circuits Practical</b>	<b>4</b>	<b>64</b>	<b>25</b>	<b>100*</b>	<b>100</b>	<b>3 Hours</b>

\*Examination will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE:**

Every Electronics Engineer should have sound knowledge about the components used in Electronics Industry. This is vital in R&D Department for chip level troubleshooting. To meet the industrial needs, diploma holders must be taught about the most fundamental subject, Electronic devices and Circuits Practical. By doing practical experience in this, they will be skilled in handling all types of electronic circuits and able to apply the skill in electronic systems.

**OBJECTIVES:**

On completion of the following experiments, the students must be able to

- Know the Color Checking of Active and Passive Component
- Find out the Unknown Resistance value of a Resistor using Colour Coding
- Find out the Unknown Capacitance value of a Capacitor using Colour Coding

- Find out the Unknown Inductance value of an Inductor using Colour Coding
- Understand the concept, working principle and applications of PN Junction diode
- Understand the concept, working principle and applications of Zener diode
- Understand the concept, working principle and applications of BJT and FET
- Understand the concept, working principle and applications of UJT
- Understand the concept, working principle and applications of SCR
- Understand the concept, working principle and applications of DIAC and TRIAC
- Understand the concept, working principle and applications of Clippers and Clampers
- Understand the concept, working principle and applications of various types of Negative feedback amplifiers
- Understand the concept, working principle and applications of Astable Multivibrator

## **4040340 ELECTRONIC DEVICES AND CIRCUITS PRACTICAL**

### **DETAILED SYLLABUS**

Contents: Practical

#### **Exercises**

**Note: At least 5 experiments should be done using Soldering board / Bread board**

1. Construct a circuit to test the forward and reverse bias characteristics of a PN Junction Silicon diode. Find the value of its cut-in voltage
2. Construct a circuit to test the forward and reverse bias characteristics of a Zener diode. Find the value of its reverse breakdown voltage
3. Construct a Full wave (center tapped) rectifier and test its input and output waveforms with and without Capacitor filter. Find its maximum voltage.
4. Construct a Full wave (Bridge) rectifier and test its input and output waveforms with and without Capacitor filter. Find its maximum voltage.
5. Construct a Common Emitter Transistor circuit and test its input and output characteristic curves.
6. Construct a Common Source Field Effect Transistor circuit and test its drain and transfer characteristic curves.
7. Construct a circuit to test the Turning on and Turning off characteristics of SCR and find out the forward break over voltage, the value of Latching and Holding currents.
8. Construct a circuit to test the bidirectional characteristics of DIAC and plot its switching characteristics.
9. Construct a circuit to test the bidirectional characteristics of TRIAC and plot its switching characteristics.
10. Construct a Common emitter amplifier circuit and test its frequency response characteristics with and without Current series feedback introduced in it.
11. Construct a circuit to test the switching characteristics of Astable Multivibrator
12. Construct a circuit to test the negative resistance Characteristics of UJT.

## **BOARD EXAMINATION**

### **DETAILED ALLOCATION OF MARKS**

CIRCUIT DIAGRAM	:	25
CONNECTION	:	25
EXECUTION & HANDLING OF EQUIPMENT	:	25
OUTPUT / RESULT	:	15
VIVA – VOCE	:	10
TOTAL	:	100

### **LIST OF EQUIPMENTS**

<b>S.NO</b>	<b>Name of the Equipments</b>	<b>Range</b>	<b>Required Nos.</b>
1.	DC Regulated power supply	0-30V,1A	10
2.	High Voltage Power Supply	0-250V,1A	2
3.	Signal Generator	1MHz	4
4.	Dual trace CRO	20MHz/ 30MHz	5
5.	Digital Multimeter	-	10
6.	DC Voltmeter(Analog/Digital)	Different Ranges	15
7.	DC Ammeter(Analog/Digital)	Different Ranges	15





# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **III SEMESTER**

**2020-21 onwards**

# **ELECTRICAL CIRCUITS, MACHINES & DRIVES PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047350

Semester : III Semester

Subject Title : **Electrical Circuits, Machines & Drives Practical**

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
<b>Electrical Circuits, Machines &amp; Drives Practical</b>	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

#### RATIONALE

To impart practical knowledge to the diploma students, practical subjects are introduced for every corresponding theory subject. This practical supports the aim and objective of Electrical Machines and Electrical Circuit.

#### OBJECTIVES:

- Verify Basic Electrical circuits laws & Theorems - KCL, KVL super position theorem and power transfer theorem
- Conduct load test on single phase transformer
- Conduct Load test and No Load test on DC generator
- Test the speed control methods of DC and AC motor
- Explore the performance of ELCB, MCB.
- Identify the drive circuit for special motors
- Test the speed control circuit of the Electric motors

# 4047350 ELECTRICAL CIRCUITS, MACHINES AND DRIVES PRACTICAL

## DETAILED SYLLABUS

Contents: **Practical**

**Name of the Topics:**

### LIST OF EXPERIMENTS

1. Verify Kirchoff's current Law and Voltage Law
2. Test and Verify Maximum Power Transfer theorem
3. Test and verify Super position theorem
4. Testing of DC starters – 3 point and 4 point starter
5. Load test on DC shunt motor
6. Speed control of DC motor using DIAC and TRIAC
7. Testing of AC starters - DOL , star - Delta starter
8. Speed control of AC motor using DIAC and TRIAC
9. Testing of relays, contactors, push buttons, MCB & ELCB
10. Predetermine the efficiency by open circuit and short circuit test on single phase transformer
11. Conduct Load test on Single phase transformer
12. Testing of Stepper motor drive

### QUESTION PAPER PATTERN

SI. No	Name of the Activity	Mark Allocation
1.	Circuit Diagram	25
2.	Connection & Procedure	30
3.	Reading, Calculation & Graphs	25
4.	Result	10
5.	Viva Voce	10
<b>Total</b>		<b>100</b>

## Equipment Requirements

Sl. No	Name of the Equipment	Range / Specification	Required Quantity
1.	Dual power supply	0-30 V	5 No's
2.	Single phase Transformer	1 KVA, 250V	2 No's
3.	DC Shunt Motor with Loading arrangement	3/5 KW, 220 V DC	1 No
4.	Three Phase Squirrel Cage Induction Motor with loading arrangement	1/3/5 Hp	1 No
5.	Stepper motor Control Kit	-	1 No
6.	DC motor Speed control Kit	-	1 No
7.	AC Motor Speed control Kit	-	1 No
8.	DOL Starter	5Hp, 415 V	1 No
9.	Star Delta Starter	20A,600V	1 No
10.	Variac (Autotransformer)	0 – 250 V	1 No
11.	Three point Starter	20 A, 220 V	1 No
12.	Four Point Starter	20 A, 220 V	1 No
13.	MCB – Single & Three Pole	20 A	Each 1 No
14.	ELCB	2 Pole, 20 A	1 No
15.	DC Ammeter	Different ranges	10 No's
16.	DC Voltmeter	Different ranges	10 No's
17.	AC Ammeter	Different ranges	10 No's
18.	Tachometer	0-1000rpm	1 No
19.	Resistive Load Bank	1 KW	1 No



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **III SEMESTER**

**2020-21 onwards**

# **MANUFACTURING TECHNOLOGY PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engg

Subject Code : 4047360

Semester : III Semester

Subject Title : Manufacturing Technology Practical

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Manufacturing Technology Practical	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### RATIONALE

To impart practical knowledge to the diploma students, practical subjects are introduced for every corresponding theory subject. This practical supports the aim and objective of Manufacturing Technology.

### OBJECTIVES

- Identify the parts of a Lathe and Shaper.
- Identify the Parts of a Milling machine.
- Machine a component using Lathe
- Machine a component using Shaper
- Grind a job to the given specification
- Use a dividing head and indexing plate
- Maintenance of Machines

# 4047360 MANUFACTURING TECHNOLOGY PRACTICAL DETAILED SYLLABUS

Contents: **Practical**

**Name of the Topics:**

## LIST OF EXPERIMENT

### **I Exercises in Lathe:**

1. Plain turning
2. Step turning
3. Step and Taper turning
4. Knurling and thread cutting

### **II Exercises in Drilling Machine**

5. Drilling and tapping
6. Drilling and counter boring
7. Drilling and counter sinking

### **III Exercises in milling machine**

8. Plain milling
9. Spur gear milling
10. Pocket milling

### **IV Exercises in cylindrical grinding:**

11. Shaft grinding
12. Plug gauge grinding

### **V Exercises in Surface Grinding:**

13. Square surface grinding

### **VI Exercises in Shaper:**

14. Shaping round to square
15. Shaping a 'V' block

## QUESTION PAPER PATTERN

<b>Sl. No</b>	<b>Name of the Activity</b>	<b>Mark Allocation</b>
1	Lathe / Milling	50 Marks
2	Drilling / Shaping / Grinding	40 Marks
3	Viva Voce	10 Marks
<b>Total</b>		<b>100 Marks</b>

## EQUIPMENT REQUIREMENTS

<b>Sl. No</b>	<b>Name of the Equipment</b>	<b>Required Quantity</b>
1.	Lathe	15 No's
2.	Milling Machine	3 No's
3.	Cylindrical Grinding Machine	1 No
4.	Surface Grinding Machine	1 No
5.	Shaper	2 No's





# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **III SEMESTER**

**2020-21 onwards**

## **CAD PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engg  
 Subject Code : 4047370  
 Semester : III Semester  
 Subject Title : **CAD Practical**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
<b>CAD Practical</b>	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES**

- Understand the types of sections and sectional views
- Understand limits, fits and Tolerances
- Explain the use of threaded fasteners and the types of threads
- Select different types of fits and tolerances for various mating parts
- Draw assembled drawings of various joints and couplings using CAD
- Draw assembled drawings of various types of machine elements using CAD.

# 4047370 CAD PRACTICAL

## DETAILED SYLLABUS

**Contents:** Practical

### **Name of the Topics: Introduction**

Sectional views, Limits, fits and tolerances - Keys and surface finish -Screw threads and threaded fasteners - Draw Group commands, Osnap options, Drafting setting and Function keys - Commands Practice - Edit and Modify Group commands, Pedit, Text edit - View groups, Inquiry, Block commands - Hatching, Layer, color and line types - Technical drawing with AutoCAD, Creating - File commands, Plotting, External reference

3D Fundamentals - Predefined 3D objects, Creating surfaces, 3D solid primitives, Working with UCS-3D coordinate system - Solid Rendering

### **List of Experiment**

#### **I Isometric Drawing Ex.Practice**

#### **II Drawing Ex. Practice (Machine & Assembly drawings in 2D only)**

- 1 Sleeve and cotter joint
- 2 Stuffing box
- 3 Knuckle joint
- 4 Plummer block
- 5 Universal coupling
- 6 connecting rod
- 7 Machine vice

#### **III 3D solid modeling practice**

- 8 Geneva Mechanism
- 9 Cast iron block
- 10 Bushed bearing
- 11 Bearing block
- 12 Screw jack

## QUESTION PAPER PATTERN

<b>Sl. No</b>	<b>Name of the Activity</b>	<b>Mark Allocation</b>
1	ASSEMBLY DRAWING	35 MARKS
2	SOLID MODEL	30 MARKS
3	ISOMETRIC DRAWING	25 MARKS
4	VIVA VOCE	10 MARKS
TOTAL		100 MARKS

## EQUIPMEN REQUIREMENTS

<b>Sl. No</b>	<b>Name of the Equipment</b>	<b>Required Quantity</b>
1.	Desktop Computer	30 No's
2.	Software - CAD Software	20 No's of Licence



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **IV SEMESTER**

**2020-21 onwards**

# **ANALOG AND DIGITAL ELECTRONICS** **(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : 1040:Electronics and Communication Engineering

Subject Code : 4040430

Semester : IV

Subject title : ANALOG AND DIGITAL ELECTRONICS

### TEACHING AND SCHEME OF EXAMINATION

No of weeks / semester: 16 weeks

Subject	Instruction		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
<b>Analog and Digital Electronics</b>	<b>4</b>	<b>64</b>	<b>25</b>	<b>100*</b>	<b>100</b>	<b>3 Hrs</b>

\* Examination will be conducted for 100 marks and it will be reduced to 75 marks.

### Topics and Allocation of hours

Unit	Topic	Hrs
I	Linear ICs and OP-amps	10
II	A/D, D/A, Special Function ICs and IC Voltage Regulators	13
III	Boolean Algebra and Arithmetic operations	10
IV	Combinational and Sequential Logic Circuits	12
V	Memories	12
	Tests and Model Exam	7
	<b>Total</b>	<b>64</b>

**RATIONALE:**

The subject Analog and Digital Electronics holds applications in all branches of engineering instrumentation and Industrial Automation. This will impart in depth knowledge of Number Systems , Logics of Combinational & Sequential circuits and memories.

**OBJECTIVES:**

On completion of the following units of the syllabus contents, the students must be able to

- Understand the basics of operational amplifier.
- Know the op-amp applications.
- Know the waveform generator and Active filter.
- Know the concept of D/A and A/D converters
- Know the applications of Special function IC, IC 555 Timer.
- Understand various Number Systems used in Digital Circuits
- Understand basic Boolean postulates and laws.
- Understand the De-Morgan's theorem.
- Understand the concept of Karnaugh Map.
- Learn about Basic logic Gates.
- Study about Boolean techniques.
- Learn the different digital logic families
- Learn arithmetic circuits- Adder/Subtractor
- Understand the encoder/decoder & MUX / DEMUX
- Understand the concept of parity Generator and checker
- Understand various types of flip-flops.
- Understand various types of counters
- Understand various modes of shift registers
- Understand various types of memories

# 4040430 ANALOG AND DIGITAL ELECTRONICS

## DETAILED SYLLABUS

Contents: Theory

Unit	Name of the topics	Hours
I	<b>LINEAR ICS AND OP-AMPS</b>	4
	<b>1.1: OPERATIONAL AMPLIFIER</b> Ideal Op-Amp – Block diagram and Characteristics – Op-amp parameters CMRR – Slew rate – Concept of Virtual ground	
	<b>1.2: APPLICATIONS OF OP-AMP</b> Inverting amplifier –Summing amplifier – Non inverting amplifier – Voltage follower - Comparator – Zero crossing detector – Integrator – Differentiator- waveform generation (Schmitt Trigger only)–RC Low pass Active filter.	4
I	<b>1.3: OP-AMP SPECIFICATIONS</b> OP-amp 741 – Symbol – Pin diagram – Specifications	2
	<b>II</b>	
II	<b>A/D, D/A ,SPECIAL FUNCTION ICs AND IC VOLTAGE REGULATORS</b>	2
	<b>2.1: SAMPLING AND QUANTIZATION</b>	
	<b>2.2: A/D CONVERTER</b> Analog to digital conversion using Ramp method – Successive approximation method – Dual slope method – Specifications of A/D converter	3
	<b>2.3: D/A CONVERTER</b> Basic concepts – Weighted Resistor D/A converter – R-2R Ladder D/A converter – Specifications of DAC IC	2
	<b>2.4:SPECIAL FUNCTION ICs</b> 2.4.1:IC 555 Timer – Pin diagram - Functional Block diagram of IC 555 in Astable and Monostable Multivibrator mode - Schmitt trigger using IC 555 2.4.2:IC 565-PLL-Pin diagram-Functional Block diagram of IC 565 2.4.3:IC 566-VCO-Pin diagram-Functional Block diagram of IC 566	3
<b>2.5.: IC VOLTAGE REGULATORS</b> Positive IC Voltage Regulators: 78XX - Negative IC Voltage Regulators: 79XX and General purpose IC Voltage Regulators using LM 723.	3	



III	<p><b>BOOLEAN ALGEBRA AND ARITHMETIC OPERATIONS</b></p> <p><b>3.1: NUMBER SYSTEMS</b>  Decimal – Binary – Octal – Hexadecimal – BCD – Conversion from one number system to other – Boolean Algebra – Basic laws and Demorgan's Theorems</p> <p><b>3.2: UNIVERSAL GATES</b>  Realization of basic logic gates using universal gates NAND and NOR -Tristate Buffer circuit</p> <p><b>3.3: PROBLEMS USING 2, 3, AND 4 VARIABLES</b>  Boolean expression for outputs – Simplification of Boolean expression using Karnaugh map (up to 4 variable)- Constructing logic circuits for the Boolean expressions</p> <p><b>3.4: ARITHMETIC OPERATIONS</b>  Binary Addition-Binary Subtraction-1's compliment and 2's compliment-Signed binary numbers</p> <p><b>3.5: ARITHMETIC CIRCUITS</b>  Half Adder-Full Adder-Half Subtractor-Full Subtractor</p>	<p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>
IV	<p><b>COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS</b></p> <p><b>4.1: PARITY GENERATOR AND CHECKER</b></p> <p><b>4.2: ENCODER</b></p> <p><b>4.3: DECODER</b></p> <p><b>4.4: MULTIPLEXER:</b> 4 to 1 Multiplexer</p> <p><b>4.5: DEMULTIPLEXER :</b>1 to 4 Demultiplexer</p> <p><b>4.6: FLIP-FLOPS (FF)</b>  RS FF– JK FF: Master Slave FF and Edge triggered FF – D and T FF</p> <p><b>4.7: COUNTERS</b>  Asynchronous Binary Counter –Mod N counter – Decade counter – Synchronous counter</p> <p><b>4.8: SHIFT REGISTER</b>  4 bit shift register – Serial in Serial out</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>3</p> <p>2</p>

V	<p><b>MEMORIES</b></p> <p><b>5.1:CLASSIFICATION OF MEMORIES</b></p> <p><b>5.2:RAM</b> RAM organization-Address Lines and Memory Size- Read/write operations- Static RAM-Bipolar RAM cell- Dynamic RAM- SD RAM- DDR RAM.</p> <p><b>5.3:ROM</b> ROM organization-Expanding memory- PROM- EPROM- and EEPROM- Flash memory- Anti Fuse Technologies.</p>	<p><b>6</b></p> <p><b>6</b></p>
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**Reference books:**

1. Albert Paul Malvino and Donald P. Leach – Digital Principles and Applications
2. Roger L. Tokheim Macmillan – Digital Electronics – McGraw – Hill –1994.
3. William H.Goth Mann – Digital Electronics – An introduction to theory and practice – PHI 1998.
4. Linear integrated circuits by B.Suseela & T.R.Ganesh babu -Scitech publications-2018
5. Integrated circuits by K.R.Botkar-Khanna publisher's-1996.
- 6.D.Roychoudhury & shail. B.Jain- Linear Integrated Circuits -New age International publishers - II Edition -2004.
- 7.R.P.Jain – Modern Digital Electronics – TMH 2003.



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **IV SEMESTER**

**2020-21 onwards**

# **MECHANICS OF MATERIALS**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047420

Semester : IV Semester

Subject Title : **Mechanics of Materials**

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Mechanics of Materials	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Deformation of Metals	15
II	Geometrical properties of sections, Friction & Bearings	15
III	Lateral deformation & Theory of simple bending	15
IV	Torsion and Springs	15
V	Gear and Belt drives	13
Test & Model Exam		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

Mechanical Engineers must have knowledge about mechanical properties of material, deformation of material subjected to axial load and shear. This will provide adequate knowledge to work as a design engineer.

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- Define various mechanical properties of materials.
- Calculate the deformation of materials, which are subjected to axial Load and shear
- Determine the moment of inertias of various section used in the industry.
- Estimate the stresses used in thin cylinder under internal pressure.
- Draw the graphical representation of shear force and bending moment of the Beam subjected to different Load.
- Construct SFD and BMD.
- Calculate the power transmitted by the solid & hollow shafts.
- Distinguish different types of spring and their applications.
- Define Types of Friction

**4047420 MECHANICS OF MATERIALS  
DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
I	<p><b><u>Chapter 1.1 Mechanical properties of materials:</u></b> Engineering materials – Ferrous and non-ferrous materials - Definition of mechanical properties - Alloying elements-effect of alloying element - Fatigue, fatigue strength, creep – temperature creep – cyclic loading and repeated loading – endurance limit.</p> <p><b><u>Chapter 1.2 Simple stresses and strains:</u></b> Definition – Load, stress and strain – Classification of force systems – tensile, compressive and shear force systems – Behaviour of mild steel</p>	5
		10

	<p>in tension up to rupture – Stress – Strain diagram – limit of proportionality – elastic limit – yield stress – breaking stress – Ultimate stress – percentage of elongation and percentage reduction in area – Hooke’s law – Definition – Young’s modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity. Linear strain – Deformation due to tension and compressive force – Simple problems in tension, compression and shear force. Definition – Lateral strain – Poisson’s ratio – volumetric strain – bulk modulus – volumetric strain of rectangular and circular bars – problems connecting linear, lateral and volumetric deformation – Elastic constants and their relationship - Problems on elastic constants - Definition – Composite bar – Problem in composite bars subjected to tension and compression – Temperature stresses and strains – Simple problems</p>	
II	<p><b><u>Chapter 2.1 Geometrical Properties of sections:</u></b>  Definition – center of gravity and centroid - position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium- problems to determine the centroid of angle, channel, T and I sections only - Definition-centroidal axis-Axis of symmetry. Moment of Inertia – Statement of parallel axis theorem and perpendicular axis theorem. Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections-Definition- Polar moment of Inertia-radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections.</p> <p><b><u>Chapter 2.2 Friction:</u></b>  Introduction - Definition - Force of friction - Limiting friction – Static friction - Dynamic friction - Angle of friction - co-efficient of friction - Laws of static and dynamic friction.</p> <p><b><u>Chapter 2.3 Bearings:</u></b>  Introduction- Types of bearings. Ball bearing–Angular contact, axial, deep groove. Roller bearing - cylindrical, spherical, tapered, needle.- Applications of bearings - Loads acting on bearing-Selection of bearings-</p>	<p>8</p> <p>4</p> <p>3</p>



	rack and pinion – Velocity of a gear drive – merits and demerits of gear drive – Problems on simple gear train and power transmitted by gear <b><u>Chapter 5.2 Belt drives</u></b> Belt drives – Types – Open Belt drive – Cross belt drive – Flat belt drive – V belt drives – Problems on power transmitted	6
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### Reference Books

1. Strength of Materials, S. Ramamrutham, 18th Edn 2017, DhanpatRai Pub. Co.
2. Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi.
3. Rattan.S.S, —Theory of MachinesII, Tata McGraw -Hill Publishers, New Delhi,2018
4. Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 5th Edition, 2017
5. Thomas Bevan, —Theory of MachinesII, CBS Publishers and Distributors, 6<sup>th</sup> Edition, 2017.
6. Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2018, ISBN 9780070668959





# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **IV SEMESTER**

**2020-21 onwards**

# **INDUSTRIAL INSTRUMENTATION AND SENSORS**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering  
 Subject Code : 4047430  
 Semester : IV Semester  
 Subject Title : **Industrial Instrumentation and Sensors**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
<b>Industrial Instrumentation and Sensors</b>	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	Analog and Digital Instruments	14
II	CRO, Bridge, Displays and Recorders	15
III	Strain and Force Measurements	15
IV	Temperature and Pressure Measurements	15
V	Basic and Advanced Sensors	14
Test & Model Exam		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

Mechatronics Engineers plays a major role in process industries. It needs a brief idea about the basic concepts of instrumentation, various sensors, transducers and their characteristics which can be helpful to them to study the core subjects during their academics. This subject covers the basic needs of instrumentation and it makes the students to understand the importance of instrumentation in industries.

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- Knowing the concept of analog and digital instruments and its characteristics
- Realize the importance of three basic forces required in meters.
- Explain the construction and working of indicating instruments for voltage and current
- Understand the working and applications of Multimeter for  $\Omega$ , V, A measurement.
- Explain the construction, working and applications of CRO.
- Basic knowledge about Bridges ,Displays, Recorders
- Understand the Various types of transducers
- Understand the various types of strain , temperature measurement.
- Understand the various types of force measurement.
- Understand the various pressure measuring devices.
- Understand the Various Flow measuring devices.
- Understand the Various types of Sensors
- Explain ultrasonic, hall effect, pyro electric sensors for various measurements.
- Study advanced sensors for various measurements.
- Understand recent trends in sensors technologies

**4047430 INDUSTRIAL INSTRUMENTATION AND SENSORS**  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
I	<p><b>ANALOG AND DIGITAL INSTRUMENTS</b></p> <p>1.1 General-definition of measurement - Functions of measurement system - indicating, Recording and Controlling functions- Applications of measurement systems</p> <p>1.2 <b>Characteristics of Instruments</b> – True value, Accuracy, Precision, Sensitivity, Reproducibility, Drift, Static Error and Correction, Resolution.</p> <p>1.3 <b>Classification of Instruments</b> – Primary and Secondary Instruments - indicating, Recording and integrating instruments- calibration-Necessity of calibration</p> <p>1.4 <b>Operating forces</b> – Deflecting, Controlling and Damping force.</p> <p>1.5 <b>Instruments</b> - Permanent Magnet Moving Coil instrument, Attraction type Moving Iron Instrument , Analog Multimeter,</p> <p>1.6 <b>Digital Instruments</b> : Auto ranging – Auto zeroing – Auto Polarity – Block diagram of Digital Multimeter, Digital frequency counter, Digital Tachometer</p>	<p>3</p> <p>2</p> <p>2</p> <p>1</p> <p>3</p> <p>3</p>
II	<p><b>CRO , BRIDGE AND DISPLAYS</b></p> <p><b>Chapter 2.1 CRO</b> - Block diagram of oscilloscope, construction and working of CRT, applications of CRO, Digital Storage Oscilloscope.</p> <p><b>Chapter 2.2 Bridges</b> - Bridges –measurement of resistance by wheat stone bridge –measurement of capacitance by Schering Bridge - measurement of inductance by Maxwell’s bridge. (derivation not required)</p> <p><b>Chapter 2.3 Displays</b> – Seven Segment Display, LCD Display</p>	<p>5</p> <p>5</p> <p>5</p>
III	<p><b>STRAIN AND FORCE MEASUREMENTS</b></p> <p><b>Chapter 3.1 Strain Measurements:</b> - Strain transducers-Strain</p>	<p>7</p>

	<p>measuring techniques- Resistance strain gauge-Strain gauge materials – Metal resistance strain gauges – Bonded and Unbonded type – Metal foil gauges – Semiconductor strain gauge.</p> <p><b>Chapter 3.2 Force Measurements :</b> - Force – Work – Torque – scales &amp; balances – equal arm beam balance – pendulum scale- proving Ring – Hydraulic load cell – Pneumatic load cell – Strain gauge load cell</p>	8
IV	<p><b>TEMPERATURE AND PRESSURE MEASUREMENTS</b></p> <p><b>Chapter 4.1 Temperature Measurement :</b>Basic Behaviour– Physical Effects - Temperature Measurement: Mechanical Thermometers - Bi-metallic thermometers- Electrical Thermometers: Resistance Thermometers – Thermistors – Thermocouples – Radiation Pyrometers</p> <p><b>Chapter 4.2 Flow Measurements:</b> Mechanical Flow Meters : Orifice Flow Meter - Venturi flow meter - Turbine Meter - Rota Meter</p> <p><b>Chapter 4.3 Pressure Measurement :</b> Units of pressure – Mechanical Pressure Measurement: U tube manometer- single column Manometers - Elastic type pressure gauges: Bourdon type – Metallic Diaphragm - ring balance - Pirani Vacuum Gauge</p>	5 4 6
V	<p><b>BASIC AND ADVANCED SENSORS:</b></p> <p><b>Chapter 5.1 Sensors and Transducers</b></p> <p>Definition, difference between sensors and transducers, classification – Active and Passive sensors.</p> <p>Ultrasonic Sensors: for Level Measurement and Distance Measurement.</p> <p>Hall effect Sensors: Hall effect, Hall effect sensors for Fluid level measurement.</p> <p><b>Chapter 5.2 Pyro electric Sensors:</b> Pyro electric Sensors as Thermal Detector</p> <p><b>Chapter 5.3 Fiber optic Sensors:</b> Temperature sensors, Liquid level sensing, Micro bend sensors, Advantages of fiber optic sensors</p>	6 2 6

## Reference Books

1. "D.Patranabis", "Principles of industrial instrumentation", Tata McGraw- Hill, ii Edition

2. "Electrical & Electronics Measurements & Instrumentation" – "Sawheney", Dhanpatrai & sons
3. "Krishnaswamy. K, and Vijayachitra. S", —Industrial Instrumentation, 2nd Edition, New Age International Publishers, New Delhi, 2014
4. "Singh S. K" "Industrial Instrumentation and Control", 3rd Edition, Tata McGraw- Hill Publishing Company, New Delhi, 2009
5. "Sensors and Transducers" "D.Patranabis", PHI Learning Private Limited, New Delhi – 110 001, Second Edition 2010.
6. "Modern Electronic Instrumentation & Measurements Techniques" "Albert D.Helfrick and William David Cooper" – PHI
7. "R.K.Jain, "Mechanical and Industrial Measurements", Khanna Publishers, 11th Edition
8. "Instrumentation – Devices & Systems" "C.S.Rangan, G.R.Sarma, VSV.Mani, G.K.Mithal, " TMH
9. [www.nptel.ac.in/courses/112106139/pdf/4\\_4.pdf](http://www.nptel.ac.in/courses/112106139/pdf/4_4.pdf)



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **IV SEMESTER**

**2020-21 onwards**

# **MICROCONTROLLER AND ITS APPLICATIONS**

**(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III****STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU****DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS****N-SCHEME****(Implemented from the Academic year 2020-2021 onwards)**

Course Name : 1040: Electronics and Communication Engineering

Subject Code : 4040520

Semester : V

Subject Title : Microcontroller and its applications

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
<b>Microcontroller and its Applications</b>	<b>5</b>	<b>80</b>	<b>25</b>	<b>100*</b>	<b>100</b>	<b>3 Hrs.</b>

\* Examination will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	Architecture of 8051 Microcontroller	15
II	8051 Instruction set and Programming	16
III	Peripherals of 8051	15
IV	Interfacing techniques	16
V	Advanced Microcontrollers	11
Test & Model Exam		7
<b>Total</b>		<b>80</b>



## **RATIONALE:**

The introduction of this subject will enable the students to learn about microcontroller 8051 architecture, Pin details, Instruction sets, Programming and interfacing. This subject enables the students to do the project effectively. It also helps the students to choose the field of interest. If the student is aiming for higher studies, this subject is foundation.

## **OBJECTIVES:**

On completion of the syllabus, the students must be able to

- > Know the difference between microprocessor and microcontroller.
- > Understand the architecture of 8051.
- > Write programs using 8051 ALP.
- > Understand the programming of I/O ports, Timer, Interrupt and Serial Programming.
- > Use the interfacing techniques
- > Know the types of microcontrollers
- > Explain IoT.

## 4040520 MICROCONTROLLER AND ITS APPLICATIONS

### DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	<b>Architecture Of 8051 Microcontroller</b> <b>1.1 : Architecture</b> Microprocessor-Microcontroller-Comparison of microprocessor and microcontroller-Architecture diagram of microcontroller 8051-Functions of each block-Pin details of 8051-ALU- ROM-RAM-Memory organization of 8051- Special function registers-Program counter-PSW register-Stack-I/O ports-Timer-Interrupt-serial port-External memory- Oscillator and Clock-Reset-Power on reset-Clock cycle-machine cycle-Instruction cycle-Overview of 8051 family.	15
II	<b>8051 Instruction set and programming</b> <b>2.1: Instruction Set Of 8051</b> Instruction set of 8051-Classification of 8051 instructions-data transfer instructions-Arithmetic instructions-Logical instructions-Branching instructions-Bit manipulation instructions- Assembling and running an 8051 program-Structure of Assembly language-Assembler directives-Different Addressing modes of 8051-Time delay routines. <b>2.2: Assembly language programs</b> 16 bit addition and 16 bit subtraction-8 bit multiplication and 8 bit division-BCD to HEX code conversion-HEX to BCD code conversion.-Smallest number/ Biggest number.	8 8
III	<b>Peripherals of 8051</b> <b>3.1: I/O Ports</b> Bit addresses for I/O ports-I/O port programming-I/O bit manipulation programming. <b>3.2: Timer/Counter</b> SFRS for Timer- Modes of Timers/counters- Programming 8051 Timer(Simple programs). <b>3.3: Serial Communication</b> Basics of serial communication-SFRs for serial communication-RS232	3 4 4

	<p>standard-8051 connection to RS 232-8051 serial port programming..</p> <p><b>3.4: Interrupts</b></p> <p>8051 interrupts-SFRs for interrupt-Interrupt priority.</p>	4
IV	<p><b>Interfacing Techniques</b></p> <p><b>4.1: IC 8255</b></p> <p>IC 8255-Block diagram-Modes of 8255-8051 interfacing with 8255</p> <p><b>4.2: Interfacing</b></p> <p>Interfacing external memory to 8051-Relay interfacing- Sensor interfacing -Seven segment LED display interfacing-Keyboard interfacing-Stepper motor interfacing-ADC interfacing- DAC interfacing-DC motor interfacing using PWM-LCD interfacing.</p>	3  13
V	<p><b>Advanced Microcontrollers</b></p> <p><b>5.1: Types of microcontrollers</b></p> <p>PIC microcontroller-General Block diagram-Features-Applications-Arduino- General Block diagram-Variants-Features-Applications-Raspberry pi-General Block diagram-Features-Applications-Comparison of microcontrollers.</p> <p><b>5.2: IoT</b></p> <p>Introduction to IoT-Block diagram of home automation using IoT.</p>	8  3

### Reference Books :

1. "Ajit pal" "Microcontrollers, Principles and Applications ",PHI Ltd,-2011.
- 2 . "Mazidi,Mazidi and D.MacKinlay" "8051 Microcontroller and Embedded Systems using Assembly and C",2006 Pearson Education Low Price Edition.
3. "R. Theagarajan" "Microprocessor and Microcontroller", Sci Tech Publication,Chennai.
4. [www.microchip.com](http://www.microchip.com), [www.raspberrypi.org](http://www.raspberrypi.org),[www.arduino.org](http://www.arduino.org).
5. "J.B. Peatman" "Design with PIC microcontrollers".
6. "Michael McRoberts", "beginning Arduino.
7. "Matt Richardson", "Getting started with Raspberry Pi".
- 8."Samuel Greengard", "The Internet of Things".



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **IV SEMESTER**

**2020-21 onwards**

# **ANALOG AND DIGITAL ELECTRONIC PRACTICAL**

**(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**

**(Implemented from the Academic year 2020-2021 onwards)**

Course Name : 1040, Electronics and Communication Engineering

Subject code : 4040460

Semester : IV

Subject title : ANALOG AND DIGITAL ELECTRONICS PRACTICAL

**TEACHING AND SCHEME OF EXAMINATION**

No. of weeks/ Semester: 16weeks

Subject	Instruction		Examination			
	Hours /week	Hours /semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
<b>Analog and Digital Electronics Practical</b>	<b>5</b>	<b>80</b>	<b>25</b>	<b>100*</b>	<b>100</b>	<b>3 Hours</b>

\* Examination will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE:**

Every Electronic Engineer should have sound knowledge about the ICs used in Electronics Industry. This is vital in R&D Department for Chip level troubleshooting. To meet the industrial needs, diploma holders must be taught about the most fundamental subject, Analog and Digital Electronics Practical. By doing practical experience in this, they will be skilled in handling all types of ICs and able to apply the skill in electronic system design and the designing of PCBs.

**OBJECTIVES:**

On completion of the following experiments, the students must be able to

- Know the Verification of truth table of OR, AND, NOT, NOR, NAND, EX-OR gates
- Know the Realization of basic gates using NAND & NOR gates.
- Know the verification of Half Adder and Full Adder using IC's.
- Know the verification of Half Subtractor and Full Subtractor using IC's.

- Know the Verification of Truth Table for Decoder/Encoder.
- Know the Verification of truth table for RS, D, T & JK flip-flop.
- Test Inverting Amplifier and Non inverting amplifier using Op-amp
- Test Summing Amplifier, Difference Amplifier and Voltage Comparator using Op-amp.
- Test Integrator and Differentiator.
- Test Astable multivibrator using IC 555
- Design IC Voltage Regulator Power Supplies using IC 7805, IC 7912
- Design the PCB of 4-bit ripple counter using FF

## **4040460 ANALOG AND DIGITAL ELECTRONICS PRACTICAL**

### **DETAILED SYLLABUS**

Contents: Practical

#### **Exercises**

**Note: At least 6 experiments should be constructed using breadboard**

1. Realization of basic gates using NAND & NOR gates.
2. Realization of logic circuit for De-Morgans Theorems
3. Test the performance of Half Adder and Full Adder.
4. Test the performance of Half Subtractor and Full Subtractor.
5. Test the performance of Decoder/Encoder.
6. Test the performance of RS, D, T & JK flip-flops.
7. Test the performance of Parity generator and checker using parity checker/generator IC's.
8. Test the performance of Multiplexer/De-multiplexer using IC 4051
9. Test the performance of Inverting Amplifier and Non inverting amplifier using Op-amp IC 741.
10. Test the performance of Summing Amplifier, Difference Amplifier.
11. Test the performance of Zero Crossing Detector and Voltage Comparator using Op-amp IC 741.
12. Test the performance of Integrator and Differentiator using Op-amp IC 741.
13. Test the performance of Astable multivibrator using IC 555.
14. Test the performance of IC Voltage Regulator Power Supplies using IC 7805, IC 7912.

15. Design the PCB of 4-bit ripple counter using FF using Software tool Multisim / OrCAD etc

### **BOARD EXAMINATION**

#### **DETAILED ALLOCATION OF MARKS**

CIRCUIT DIAGRAM	:	25
CONNECTION	:	30
EXECUTION & HANDLING OF EQUIPMENT	:	20
OUTPUT / RESULT	:	15
VIVA – VOCE	:	10
TOTAL	:	100

#### **LIST OF EQUIPMENTS**

S NO	Name of the Equipments	Range	Required Nos
1	DC Regulated power supply	0-30V,1A	5
2	IC Voltage Power Supply	0-5V,1A 15-0-15V, 1A	5 5
3	Signal Generator	1 MHz	4
4	Dual trace CRO	20 MHz/ 30 MHz	5
5	Digital Trainer	-	10
6	DC Voltmeter (Analog / Digital)	Different Ranges	5
7	DC Ammeter(Analog / Digital)	Different Range	5
8	Desk Top Computer	-	5
9	Simulation Tool	Multisim Or CAD	1



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **IV SEMESTER**

**2020-21 onwards**

# **INDUSTRIAL INSTRUMENTATION AND SENSORS PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**



**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**

**(Implemented from the Academic year 2020-2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047460

Semester : IV Semester

Subject Title : **Industrial Instrumentation and Sensors Practical**

**TEACHING AND SCHEME OF EXAMINATION:**

No. of weeks/ Semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Industrial Instrumentation and Sensors Practical	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE:**

Instrumentation and sensors are used in automation in construction, domestic appliances industries, Robotics, transport, space exploration, defense equipment, health services and other applications. Transducers have achieved substantial accuracy and control in Industrial automation.

To impart practical knowledge to the diploma students, practical subjects are introduced for every corresponding theory subject. This practical supports the aim and objective of Industrial instrumentation and sensors subjects.

**OBJECTIVES:**

On completion of the following experiments, the students must be able to

- Calibrate the meters
- Measure the unknown resistance, Capacitance using different bridge circuits
- Measure the physical parameter with various sensors
- Test the various kind of sensors
- Simulate the sensor circuit with simulation software

## **4047460 INDUSTRIAL INSTRUMENTATION AND SENSORS PRACTICAL DETAILED SYLLABUS**

Contents: **Practical**

**Name of the Topics:**

1. Calibration of given ammeter and voltmeter
2. Measurement of power and power factor of single phase load and plot the graph
3. Measurement of unknown resistance using Wheatstone bridge.
4. Measurement of value of unknown capacitance using Schering Bridge
5. Generate different type of Lissajous Patterns using CRO
6. Measure the force using Strain gauge experiment module
7. Measure the sensing range of Inductive proximity sensor
8. Measure the sensing range of capacitive proximity sensor
9. Detect the level of water in a tank using float switch and control the pump based on the level
10. Construct and test the circuit for Detecting metal and non metal object using proximity sensor
11. Construct and test the circuit for Detecting the Object using IR sensor
12. Construct and test the circuit to Measure the temperature using temperature sensor ( Thermocouple OR RTD)

13. Construct and test the circuit to Measure the sensing range of Analog Ultrasonic sensor module

(Students can also be given exposure to simulation software)

### BOARD EXAMINATION

#### DETAILED ALLOCATION OF MARKS

CIRCUIT DIAGRAM	:	25
CONNECTION	:	30
EXECUTION & HANDLING OF EQUIPMENT	:	20
OUTPUT / RESULT	:	15
VIVA – VOCE	:	10
TOTAL	:	100

#### LIST OF EQUIPMENTS

Sl. No	Name of the Equipment	Range	Required Nos
1.	DC Regulated power supply	0-30V, 1A	5 No's
2.	Wheatstone bridge kit	-	1 No
3.	Schering bridge kit	-	1 No
4.	Strain gauge kit	-	1 No
5.	Proximity Sensor – Inductive and Capacitive	-	2 No's Each
6.	IR Sensor	-	2 No's
7.	RTD kit / Thermocouple kit	-	1 No
8.	Water level kit or Construct relay wiring board	-	1 No
9.	Ultrasonic sensor	-	2 No's
10.	DC Voltmeter (Analog/Digital)	Different Ranges	5 No's
11.	DC Ammeter (Analog/Digital)	Different Ranges	5 No's
12.	Desk Top Computer	--	2 No's
13.	Any online Simulation Tool	<a href="http://www.tinkercad.com">www.tinkercad.com</a>	-



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II YEAR**

**N SCHEME**

## **IV SEMESTER**

**2020-21 onwards**

**MICROCONTROLLER PRACTICAL**  
**(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : 1040:Electronics and Communication Engineering

Subject Code : 4040550

Semester : V

Subject Title : Microcontroller Practical

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Microcontroller Practical	4	64	25	100*	100	3 Hrs.

\* Examination will be conducted for 100 marks and it will be reduced to 75 marks.

#### RATIONALE:

The introduction of this subject will enable the students to have hands on experience in using 8051 trainer kit. The students are exposed to learn simple programs using assembly language. They can also get familiar with the C compiler platform. They also gain knowledge by using application specific interfacing boards.

#### OBJECTIVES:

The students are able to

- > Understand the use of instruction set by writing and executing simple ALP.
- > Know the connection details between microcontroller and peripherals.

**4040550 MICROCONTROLLER PRACTICAL**  
**DETAILED SYLLABUS**

Contents: Practical

**Exercises**

**Part A**

**The following experiments should be written using 8051 assembly language program and should be executed in the 8051 microcontroller trainer kit.**

1. 8 / 16 bit addition
2. 8 / 16 bit subtraction
3. 8 bit multiplication
4. 8 bit division
5. BCD to Hex code conversion
6. Hex to BCD code conversion
7. Smallest / Biggest number
8. Time delay routine (Demonstrate by Blinking LEDs).
9. Using Timer/ counter of 8051

**Part B (Interfacing Application Boards)**

**The following experiments can be written using C compiler or 8051 assembly language and to be executed.**

10. Interfacing Digital I/O board
11. Interfacing DAC
12. Interfacing Stepper motor
13. Interfacing Seven segment LED display or LCD
14. Sending data through the serial port between microcontroller kits
15. Interfacing DC motor using PWM.

## BOARD EXAMINATION

**Note:**

1. Students are provided with Hex code sheet for manual hand assembly.

### DETAILED ALLOCATION OF MARKS

I.	Algorithm or Flow chart	: 20 marks
II.	Program	: 30 marks
III.	Execution	: 30 marks
IV.	Result	: 10 marks
V.	Viva	: 10 marks
	TOTAL	: 100 marks

### LIST OF EQUIPMENTS

S.NO	Name of the Equipments	Required Nos
1.	8051 Microcontroller kit	14
2.	Digital I/O Interface board	2
3.	Seven segment LED display interface board	2
4.	8 bit DAC interface board	2
5.	Stepper motor control interface board	2
6.	DC motor control interface board	2
7.	RS 232 serial port cable	2
8.	LCD interface board	2
9.	Laptop / Desktop Computer	6



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

# **INDUSTRIAL AUTOMATION**

**CURRICULUM DEVELOPMENT CENTRE**



## ANNEXURE- III

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047510

Semester : V Semester

Subject Title : **Industrial Automation**

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
<b>Industrial Automation</b>	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Linear actuators, Rotary actuators and Control Valve (Direction, Pressure & flow)	16
II	Hydraulic System & its components	16
III	Pneumatics system	14
IV	Basic concepts of PLC	14
V	Programming and Applications of PLC	13
Test & Model Exam		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

Hydraulics and pneumatics systems plays a vital role in the Automation world. Adequate Knowledge in hydraulic and pneumatic components, principle of working, usage of components & maintenance of components is necessary in the field of automation. Familiarization of PLC, Knowledge about Developing ladder diagrams, usage of timer & counter is necessary in the field of automation.

**OBJECTIVES:**

- To Familiarize Understand & Explain various linear actuators.
- To Understand & Explain various rotary actuators.
- To Understand & Explain various directional control valves.
- To Understand & Explain various pressure control valves.
- To Understand & Explain Various Hydraulic components.
- To Understand & Explain Various Directional Control valves.
- To Understand & Explain Various Pneumatic system.
- Interpolate the hydraulic and pneumatic systems
- Understand Basic concepts of PLC.
- Understand the various module of PLC parts
- Develop ladder diagram for the various process of automation
- Applications of PLC

## 4047510 INDUSTRIAL AUTOMATION

### DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	<p><b>Linear actuators, Rotary actuators and Control Valve (Direction, Pressure &amp; flow)</b></p> <p><b><u>Chapter 1.1 Linear Actuators</u></b>- Hydraulic Cylinders - Cylinder Types- Single Acting cylinder -Gravity Return cylinder–Spring Return cylinder - Telescopic Cylinder – Hydraulic Ram –Tandem Cylinder, Symbols and working principles only</p> <p><b><u>Chapter 1.2 Rotary actuators</u></b>-motor types –gear motor-balanced vane motor-piston motor –two vane rotor actuator-rack AND pinion rotary actuator-motor torque –speed – power –efficiency –symbols – applications –specifications.</p> <p><b><u>Chapter 1.3 Directional Control Valves</u></b>:-Check Valve-Shuttle Valves- Two Way Directional Control Valves -Three Way Directional Control Valves -Four Way Directional Control Valves – Directional Control Valves Actuation types-Symbols- Working Principles-</p> <p><b><u>Chapter 1.4 Pressure Control Valve</u></b>: Pilot Operated, Pressure Relief Valve –Pressure Reducing Valve –Sequence Valve – Symbols- Working Principles</p> <p><b><u>Chapter 1.5 Flow Control Valve</u></b> –Type –Needle Valve –Pressure Compensated Flow Control Valve-Cushioned Cylinders –Flow Dividers – Balanced Spool Flow Divider- Rotary Flow Divider</p>	<p>4</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p>
II	<p><b>Hydraulic System &amp; its components</b></p> <p><b><u>Chapter 2.1 Hydraulic Components</u></b> –Accumulators – types – Diaphragm - Spring Loaded -Weight Loaded -Pressure Intensifiers – Hydraulic Reservoirs-Heat Exchanger types- Air cooled –Water cooled - Filters.</p> <p><b><u>Chapter 2.2 Instrumentation and Measurement</u></b>: Pressure Gauges- Flow meters- Temperature Gauges</p>	<p>5</p> <p>3</p>

	<p><b><u>Chapter 2.3 Conduits and Fittings</u></b> - Pipe - Tubing –Hose - Seals and Bearings – Hydraulic Fluids</p> <p><b><u>Chapter 2.4 Hydraulic Circuits:</u></b> - Counter Balance Circuit –Sequence Circuit- Speed Control Circuit-Meter in Circuit –Meter Out Circuit- Intermittent Feed Control-Speed Control For Continuous Processing</p> <p><b><u>Chapter 2.5 Booster and Intensifier Circuits</u></b> - Force Multiplication – Pressure Intensification.</p>	<p>2</p> <p>4</p> <p>2</p>
III	<p><b>Pneumatics system</b></p> <p><b><u>Chapter 3.1 Pneumatics</u></b> - Basic principles of pneumatics-difference between hydraulics and pneumatics-compressor types-two stage piston compressor –rotary vane compressor-rotary screw compressor –vacuum pumps- double acting pneumatic cylinder–gear motor-pressure regulator –filters-lubricators-FRL unit-water removal – air preparation and distribution</p> <p><b><u>Chapter 3.2 Electronic control of fluid power</u></b> - solenoid valves-servo valves pump controls.</p>	<p>10</p> <p>4</p>
IV	<p><b>BASIC CONCEPTS OF PLC</b></p> <p><b><u>Chapter 4.1 Introduction</u></b> - Introduction to Programmable Logic controller – Hardwired circuits versus PLC control – Advantages of PLC control – Relays – Block diagram of PLC – Processor – Memory – Input and output modules – Digital and Analog I/O's – principle of operation – various modes of operation</p> <p><b><u>Chapter 4.2 PLC Scan</u></b> - PLC scan – memory organization - Communication with PLC</p> <p><b><u>Chapter 4.3 PLC Module</u></b> - Types of Programming Devices - PLC Types (Fixed and Modular) - Sinking and Sourcing I/O modules – Remote I/O –Talking to other PLC and computers – Criteria for selection of suitable PLC – List of various PLCs available</p>	<p>6</p> <p>4</p> <p>4</p>
V	<p><b>PROGRAMMING AND APPLICATIONS OF PLC</b></p> <p><b><u>Chapter 5.1 Programming</u></b> - Different programming languages - Ladder Programming Bit instruction – Logic functions (OR, AND, NAND &amp; EX – OR)- timer- counter –program control instruction – data handling</p>	<p>5</p>

	instruction – math instruction – Time and Date –Printed reports <b>Chapter 5.2 Application of PLC</b> - Ladder diagrams for DOL starter – Ladder diagrams for star- delta starter – Cylinder sequence Application – Cylinder sequence using counter – Ladder diagram using Latch circuit – Ladder diagram using Timer – Ladder diagram using counter – sequence of the operation and ladder diagram for multicylinder application – sequence of the operation and ladder diagram for Compressor control – Message display – operator input and display– Traffic Displays	8
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### Reference Books

1. Industrial Hydraulics –Third Edition John J.Pippenger Tyler, G.Hicks. Mc.Graw-Hill Book Company.
2. Introduction to Fluid Power--James L. Johnson.-Delmar Thomson Learning Inc.
3. Fluid Power Technology-Robert P. Kokernale-Library Of Congress Cataloging-Publication Data
4. Basic Fluid Power - Dudleyt, A Pease and John J Pippenger - Prentice Hall 1987.
5. Fluid Power With Applications - Antony Esposito, Prentice Hall 1980.
6. Hydraulics And Pneumatics - (HB) Adrewparr –Jaico Publishing House.
7. Pneumatic And Hydraulic Systems - Bolton W. Butterworth-Heinemann-1987
8. W. Bolton —Programmable logic controllersII, Elsevier Ltd, 2015.
9. Frank D Petruzella, —Programmable logic controllersII, McGraw-Hill, 2011
10. John R Hackworth and Fredrick D Hackworth Jr., —Programmable Logic Controllers: Programming Methods and ApplicationsII, Pearson Education



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

## **ROBOTICS**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047520

Semester : V Semester

Subject Title : Robotics

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Robotics	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	15
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS	16
III	SENSORS AND MACHINE VISION	14
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	14
V	ROBOT APPLICATIONS	14
Test & Model Exam		7
<b>Total</b>		<b>80</b>

## RATIONALE:

Rapid industrialization and globalization needs industries to be more C competitive and deliver cost effective quality products. This needs industries to implement flexible manufacturing systems where Robotic technology plays major role. Hence study of robotic technology is very essential.

## OBJECTIVES:

On completion of the following syllabus contents, the students must be able to

- Understand fundamentals of robotics
- Acquire knowledge structure and elements of robot
- Gain knowledge on controller and various drives used in robotics
- Develop knowledge on role of sensors and vision system
- Acquire skill to program and control robot
- Understand to adopt robot to various industrial applications.

## 4047520 ROBOTICS DETAILED SYLLABUS

**Contents:** Theory

Unit	Name of the Topics	Hours
I	<b>FUNDAMENTALS OF ROBOT TECHNOLOGY</b>	
	<b><u>Chapter 1.1 History of Robot</u></b> - Introduction – History of robot – Definitions - Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End Effector, Drive system, Controller and Sensors.	5
	<b><u>Chapter 1.2 Robot arm</u></b> - Mechanical arm – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme –Degrees of freedom associated with arm and body -Degrees of freedom associated with wrist	5
	<b><u>Chapter 1.3 Classification of robots</u></b> - Cartesian, Cylindrical, spherical, horizontal articulated (SCARA) vertical articulated – Work envelope, Work	5



	Volume –Comparison of Work envelope and Work volume. Introduction to PUMA robot	
II	<p><b>ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS</b></p> <p><b><u>Chapter 2.1 Robot controller</u></b> – Configuration - Four types of controls – Open loop and closed loop controls –servo systems- Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability</p> <p><b><u>Chapter 2.2 Drive system</u></b> -Pneumatic drives – Hydraulic drives – Electrical drives – Stepper motors, Servo motors – Salient features – Applications and Comparisons of Drives.</p> <p><b><u>Chapter 2.3 Feedback Devices</u></b>- Potentiometers - Optical encoders - Resolvers -dc Tachometer</p> <p><b><u>Chapter 2.4 End effecters</u></b> – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other miscellaneous Devices- Two fingered and three fingered Grippers, Internal and External Grippers – End Of Arm Tooling (EOAT) - Considerations in Gripper Selection and Design considerations</p>	<p>4</p> <p>4</p> <p>4</p> <p>4</p>
III	<p><b>SENSORS AND MACHINE VISION</b></p> <p><b><u>Chapter 3.1 Sensors</u></b> - Requirements of Sensors – Sensor devices used in robot work cell - Principles and applications of the following types of sensors – Piezo - Electric sensors, LVDT – Range sensors – Proximity sensors – Tactile sensors-Touch sensors - Force sensors - Photo electric sensor .</p> <p><b><u>Chapter 3.2 Machine Vision System</u></b> –Sensing and digitizing image data – Signal conversion – Image storage – Lighting techniques – Image processing and analysis – Data reduction- Segmentation: Thresholding, Region Growing Edge detection- Feature extraction and object recognition – Applications – Inspection, Identification, Visual serving and navigation.</p> <p><b><u>Chapter 3.3 Robot operation Aids</u></b> -Teach pendant-Manual data input panel- Computer control</p>	<p>5</p> <p>5</p> <p>4</p>

IV	<p><b>ROBOT KINEMATICS AND ROBOT PROGRAMMING</b></p> <p><b><u>Chapter 4.1 Robot Motion Analysis</u></b>- Forward kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom – Robot dynamics</p> <p><b><u>Chapter 4.2 Robot programming</u></b> – Lead through methods: Powered Lead through method and manual lead through Method- textual robot languages – Methods of Defining Positions in space - Motion interpolation.</p> <p><b><u>Chapter 4.3 Robot languages</u></b> –The Textual Robot Languages - Generation of robot programming languages- Robot Language Structure – On-Line &amp; Off-Line programming – Basic Robot commands – Motion Commands, Speed Commands ,Defining Points and Paths in the work space ,Sensor Commands, End Effector Commands, WAIT, SIGNAL and DELAY COMMANDS, Program Sequence Control and Sub-routines – simple programs - Introduction to Artificial intelligence</p>	<p>4</p> <p>5</p> <p>5</p>
V	<p><b>ROBOT APPLICATIONS AND ECONOMIC ANALYSIS</b></p> <p><b><u>Chapter 5.2 Industrial Applications of Robots</u></b> – Material handling Applications - Material transfer –Pick and Place Operations-Palletizing - DE palletizing – press loading and unloading – Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembly Finishing – Automatic Guided Vehicle-Rail Guided vehicle</p> <p><b><u>Chapter 5.3 Adopting robots to workstations</u></b> - Robot cell layouts – Requisite robot characteristics and Non requisite robot characteristics – Stages in selecting robots for industrial applications – Safety considerations for robot operations – Robotics in the future.</p> <p><b><u>Chapter 5.4 Economic analysis of robots</u></b> – cost data required for the analysis – Methods of economic analysis – Pay back method – Equivalent uniform annual cost method (EUAC)– Return on investment(ROI) method</p>	<p>5</p> <p>5</p> <p>4</p>

## Reference Books

1. Industrial Robotics – Technology, Programming and Applications, .P.Groover, MC Graw Hill, 2001
2. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010
3. Robotics Control, Sensing, Vision and Intelligence, Fu.K.S.Gonzalz.R.C., and Lee C.S.G, McGraw-Hill Book Co., 1987
4. Robotics for Engineers, Yoram Koren, McGraw-Hill Book Co., 1992
5. Robotics and Image Processing, Janakiraman.P.A, Tata McGraw-Hill, 1995
6. John J.Craig , “Introduction to Robotics”, Pearson, 2009
7. A.K Gupta, S.K. Arora, Industrial Automation and Robotics, Laxmi Publications (P) Ltd, 2013



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

# **C PROGRAMMING LANGUAGE**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047531

Semester : V Semester

Subject Title : C Programming Language

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
C Programming Language	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	PROGRAM DEVELOPMENT AND INTRODUCTION TO C	15
II	I/O STATEMENTS, DECISION MAKING AND LOOPING STATEMENTS	15
III	ARRAYS, STRINGS and FUNCTIONS	15
IV	STRUCTURES, UNIONS, POINTERS AND DYNAMIC MEMORY MANAGEMENT	14
V	FILE MANAGEMENT AND PREPROCESSORS	14
TEST & MODEL EXAM		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

C is the most widely used computer language, which is being taught as a core course. C is a general purpose structural language that is powerful, efficient and compact, which combines features of high level language and low-level language. It is closer to both Man and Machine. Due to this inherent flexibility and tolerance it is suitable for different development environments. Due to these powerful features, C has not lost its importance and popularity in recently developed and advanced software industry. C can also be used for system level programming and it is still considered as first priority programming language. This subject covers the basic concepts of C. It will also act as a “Backbone” for all programming languages.

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- Define Program, Algorithm and flow chart
- List down and Explain various program development steps
- Write down algorithm and flow chart for simple problems.
- Describe the concepts of Constants, Variables, Data types and operators.
- Develop programs using input and output operations.
- Use of command line arguments.
- Explain compiler controlled directives.
- Understand the structure and usage of different looping and branching statements.
- Define arrays and string handling functions.
- Explain user-defined functions, structures and union.
- Define pointers and using the concept of Pointers.
- Understand the methods of handling files.
- Understand dynamic memory management.

## 4047531 C PROGRAMMING LANGUAGE

### DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	<p><b>Program Development &amp; Introduction to C</b></p> <p><b><u>Chapter 1.1 Program, Algorithm &amp; flow chart:-</u></b> Program development cycle- Programming language levels &amp; features. Algorithm – Properties &amp; classification of Algorithm, flow chart – symbols, importance &amp; advantages of flow chart.</p> <p><b><u>Chapter 1.2 Introduction to C:</u></b> - History of C – features of C- structure of C program – Compile, link &amp; run a program. Diagrammatic representation of program execution process.</p> <p><b><u>Chapter 1.3 Variables, Constants &amp; Data types:</u></b> C character set- Tokens- Constants- Key words – identifiers and Variables – Data types and storage – Data type Qualifiers – Declaration of Variables – Assigning values to variables- Declaring variables as constants.</p> <p><b><u>Chapter 1.4 C operators:-</u></b>Arithmetic, Logical, Assignment, Relational, Increment and Decrement, Conditional, Bitwise, Special Operators, Operator precedence and Associativity. C expressions – Arithmetic expressions – Evaluation of expressions</p>	4 4 3 4
II	<p><b>I/O STATEMENTS, DECISION MAKING AND LOOPING STATEMENTS</b></p> <p><b><u>Chapter 2.1 I/O statements:</u></b> Formatted input, formatted output, Unformatted I/O statements</p> <p><b><u>Chapter 2.2 Branching:-</u></b> Introduction – Simple if statement – if..else statement – else-if ladder, nested if-else statement - switch statement – goto statement – simple programs</p> <p><b><u>Chapter 2.3 Looping statements:-</u></b> while statement, do-while statement, for loop statement, nested looping statements, break &amp; continue statement – simple programs</p>	3 6 6
III	<p><b>ARRAYS, STRINGS AND FUNCTIONS</b></p> <p><b><u>Chapter 3.1 Arrays:-</u></b> Declaration and initialization of One dimensional, Two dimensional and Character arrays – Accessing array elements –</p>	4

	<p>Programs using arrays.</p> <p><b><u>Chapter 3.2 Strings:-</u></b> Declaration and initialization of string variables, Reading String, Writing Strings – String handling functions – String manipulation programs.</p> <p><b><u>Chapter 3.3 Built –in functions:-</u></b> -Math functions – Console I/O functions – Standard I/O functions – Character Oriented functions.</p> <p><b><u>Chapter 3.4 User defined functions:-</u></b> Advantages, Defining functions, Function call, return values, Categories of functions – Recursion – simple programs</p>	<p>3</p> <p>3</p> <p>5</p>
IV	<p><b>STRUCTURES, UNIONS, POINTERS AND DYNAMIC MEMORY MANAGEMENT</b></p> <p><b><u>Chapter 4.1 Structures and Unions:-</u></b> Structure – Definition, initialization, arrays of structures, Arrays with in structures, structures within structures, Structures and functions – Unions – Structure of Union – Difference between Union and structure – simple programs</p> <p><b><u>Chapter 4.2 Introduction to pointers :-</u></b> Definition – advantages of pointers – accessing the address of a variable - declaring of pointer variables - assigning address to pointer variables – accessing variable value through pointer</p> <p><b><u>Chapter 4.3 Dynamic memory management :-</u></b> definition, advantages, Functions used in dynamic memory allocation, allocating a block of memory, allocating multiple blocks of memory, releasing a block of unused memory, altering the size of a block</p>	<p>5</p> <p>5</p> <p>4</p>
V	<p><b>FILE MANAGEMENT AND PREPROCESSORS</b></p> <p><b><u>Chapter 5.1 File Management:</u></b> Introduction-Defining and opening a file-closing a file-Input / Output operations on files — Error handling during I/O operations – Random Access to files</p> <p><b><u>Chapter 5.2 Command line arguments:</u></b> Introduction – argv and argc arguments – simple programs using command Line Arguments</p> <p><b><u>Chapter 5.3 Pre-processor:</u></b> Introduction – Macro Substitution, File inclusion, Compiler control directives.</p>	<p>6</p> <p>4</p> <p>4</p>



**Text book:**

1. Programming in ANSI C 4E by Prof. E. BALAGURUSAMY, TATA McGRAW –HILL publications.

**REFERNCE BOOKS**

<b>S.No</b>	<b>Title</b>	<b>Author</b>	<b>Publisher</b>	<b>Year of Publication / Edition</b>
<b>1</b>	Programming and Problem solving using C	ISR D Group, Lucknow	Tata Mc-GrawHill, New Delhi Sixth Reprint	2010
<b>2</b>	Let us C	Yeswanth	Kanetkar BPB Publications	Fourth Revised Edition
<b>3</b>	A TextBook on C	E.Karthikeyan	PHI Private Limited, New Delhi	2008
<b>4</b>	Programming in C	D.Ravichandran	New Age International Publishers	C First Edition 1996 Reprint 2011
<b>5</b>	Computer Concepts And Programming in C	Dr.S.S.Khandare	S.Chand & Company Ltd. New Delhi	First Edition 2010
<b>6</b>	Complete Knowledge in C	Sukhendu Dey, Debabrata Dutta	Narosa Publishing House, New Delhi	Reprint 2010



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

## **POWER ELECTRONICS**

**(Common with Electrical and Electronics Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Electrical and Electronics Engineering  
 Subject Code : 4030621  
 Semester : VI  
 Subject Title : Elective Theory – II - POWER ELECTRONICS

**TEACHING AND SCHEME OF EXAMINATION**

No of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
POWER ELECTRONICS	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

Unit	Topic	Hours
I	Thyristor Family, Trigger and Commutation Circuits	13
II	Phase Controlled Rectifiers	15
III	Choppers and Inverters	15
IV	Control of DC Drives	15
V	Control of AC Drives	15
Test & Model Exam		7
<b>Total</b>		<b>80</b>

## **RATIONALE**

Developments in Electronics have their own impact in other fields of Engineering. Today all the Controls and Drives for the Electrical Machines are formed by Electronic Components and there are many Electronic Devices available to handle Eclectic Power in terms Kilo-Amps and Kilo-Volts. This subject gives a comprehensive knowledge base about the devices and circuits used in Electrical Power Control.

## **OBJECTIVES**

On completion of these units, the student should be able to:

- Explain the scope and application of Power Electronics
- Explain the operating region and working of Thyristor family devices.
- Explain and state the application for Commutation Circuits and Trigger Circuits of SCR.
- Familiarize the Phase Controlled Rectifier for different kinds of Loads.
- Study the complete protection of Converter Circuits.
- Understand the working and applications of different types of Choppers and Inverters.
- Understand the application of Power Electronics devices as UPS, SMPS.
- Understand the control of DC Drives.
- Know the various methods of Speed Control of DC Drives.
- Familiarize the Control of AC Drives.
- Study the Speed Control of Three Phase Induction Motor using PWM and Slip Power Recovery Scheme.
- Understand the Closed Loop Control of DC Drive and AC Drive.
- Know the operation of Single Phase and Three Phase Cyclo Converter.
- Study the need of Microcomputer Based Motor Control.

## DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	<p><b>THYRISTOR FAMILY, TRIGGER AND COMMUTATION CIRCUITS</b></p> <p>Thyristor Family (Review) –SCS, SUS, SBS, LASCR and GTO. Symbol, Circuit, Working, Characteristics and Applications - UJT, SCR, DIAC, TRIAC, IGBT, GTO and MOSFET. Gate Triggering Circuits — Requirements, Types. Circuit, working of — R, RC, Synchronized UJT Triggering Circuits. Pulse Transformer in Trigger Circuits — IC based Advance Triggering Circuits for SCR &amp; TRIAC (Using IC TCA 785) - Driver and Power circuits for Thyristor.</p>	7
	<p>Commutation Circuits – SCR Turn Off Methods – Natural Commutation –Forced Commutation – Class A, Class B, Class C, Class D, Class E and Class F. SCR rating and their importance.</p>	6
II	<p><b>PHASE CONTROLLED RECTIFIERS</b></p> <p>Introduction — Phase Controlled Rectifiers. Circuit Diagram, Working and Waveform - Half Wave, Full Wave Controlled Rectifier with Resistive, Inductive Loads and Free Wheeling Diode - Single Phase Fully Controlled Bridge, Single Phase Dual Converter with R Load, RL Load - Single Phase Semi Converter with Continuous and Discontinuous Load Current. AC – AC Converter.</p>	8
	<p>Three Phase Half Controlled Bridge, Fully Controlled Bridge with RL Load - Complete Protection of Thyristors against Surge Current, Surge Voltage, Dv/Dt, Di/Dt Protection.</p>	7

III	<p><b>CHOPPERS AND INVERTERS</b></p> <p><b>Choppers</b> — Introduction, Principle of Chopper Operation. Control Strategies — Constant Frequency System and Variable Frequency System. Chopper Circuit Classification — Step Up Chopper, Step Down Chopper, Voltage, Current, Load Commutated Chopper, First Quadrant, Second Quadrant, Two Quadrant and Four Quadrant Choppers. Circuit Diagram, Working and Waveform – Step Up Chopper, Morgan Chopper, Jones Chopper. Applications of Choppers — SMPS</p> <p><b>Inverters</b> — Introduction, Classification of Inverter. Circuit Diagram, Working and Waveform Parallel Inverter, Half Bridge Inverter, Full Bridge Inverter, Modified MC Murray Full Bridge Inverter, MC Murray Bedford Full Bridge Inverter.</p> <p>Three Phase Bridge Inverter Under 180° Mode, 120° Mode Operations - Pulse Width Modulated Inverters, (Single Pulse, Multiple Pulse, Sinusoidal Pulse) Applications of Inverters — UPS - Online, Offline.</p>	8
	<p>3</p>	4
	IV	<p><b>CONTROL OF DC DRIVES</b></p> <p>Introduction — DC Drive. Basic DC Motor Speed Equation — Operating Region, Armature Voltage Control, Field Current Control, Constant Torque and Constant HP Regions - Circuit Diagram, Output Waveforms and Output Equation of — Separately Excited DC Motor in — A) Single Phase Full Converter Drives B) Single Phase Dual Converter Drives C) Three Phase Semi Converter Drives.</p>
<p>DC Chopper for Series Motor Drive – Four Quadrant Control of DC Motor — DC to DC Converter using MOSFET and IGBT - Block Diagram, Explanations of Closed Loop Control of DC Drives, Phase Locked Loop Control of DC Drives - Microprocessor Based Closed Loop Control of DC Drives.</p>		8

V	<p><b>CONTROL OF AC DRIVES</b></p> <p>Introduction AC Drive - Torque Speed Characteristics of Three Phase Induction Motor, Speed Control of Induction Motor, Stator Voltage Control, Variable Frequency Control, Necessity of Maintaining V/F Ratio. Rotor Resistance Control Inverters for Variable Voltage and Variable Frequency Control -Static VAR Compensation.</p>	8
	<p>Speed Control by Rotor Resistance for Slip Ring Induction Motors — Static Scherbius Drive (Slip Power Recovery Scheme) - Closed Loop Control of AC Drive Block Diagram — Micro Computer based PWM Control of Induction Motor – Introduction to Cyclo Converter with Simple Circuit – Single Phase and Three Phase.</p>	7

### TEXT BOOKS

S. No.	Author	Title	Publication	Edition
1	MD Singh, KB Khanchandani	Power Electronics	McGraw Hill Publishing CompanyNew Delhi	Third reprint 2008

### REFERENCE BOOKS

S. No.	Author	Title	Publication	Edition
1.	Mohammed H.Rashid	Power Electronics	New Age Publication.	Third Edition,2004
2.	Mohan, Undeland, Robbins.	Power Electronics	Wiley India Edition.	Media Enhanced Third Edition
3.	Dr.P.S.Bimbhra	Power Electronics	Khanna Publishers.	Fourth Edition, 2011.
4.	M.S.Jamil Asghar	Power Electronics	PHI Learning Private Limited	Eastern Economy Edition, 2010



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

# **GREEN ENERGY AND ENERGY CONSERVATION**

**(Common with Mechanical Engg)**

**CURRICULUM DEVELOPMENT CENTRE**



**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU  
DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : 1020 Diploma in Mechanical Engineering

Subject Code : 4020532

Semester : V Semester

Subject Title : **Green Energy and Energy Conservation**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Green Energy and Energy Conservation	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	Fundamentals of Energy, Geothermal energy, Wind energy	15
II	Bio mass energy, Solar Energy	15
III	Photovoltaic (PV)	15
IV	PV Technologies, Applications	14
V	Energy conservation	14
TEST & MODEL EXAM		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

There is an ever increasing demand for energy in spite of the rising prices of oil & other fossil fuel / depletion of fossil fuels. Energy demand, in particular electricity production has resulted in creation of fossil fuel based power plants that let out substantial greenhouse gas / carbon emission into the atmosphere causing climate change and global warming. We have various forms of renewable energy sources viz., Wind, Solar, Biomass, Biogas, etc. Municipal and Industrial wastes could also be useful sources of energy while ensuring safe disposal. This subject is introduced to learn about the major renewable energy sources and more focus on the PV module solar energy. The government act and guidelines are discussed for the benefit of the Diploma Engineers.

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- 1 Study about the fundamentals of Energy.
- 2 Study of construction and principle of Wind energy, Solar energy, Geo thermal and Bio energy.
- 3 Understand the solar energy.
- 4 Understand the PV design and its components.
- 5 Study the energy conservation process.
- 6 Understand the Government Policies and Acts.
- 7 Study the TEDA projects in Tamil Nadu.

## 4020532 GREEN ENERGY AND ENERGY CONSERVATION

### DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	<p><b>Fundamentals of Energy, Geothermal energy, Wind energy</b></p> <p><b>Energy:</b> Introduction – Energy need and trends - Forms of Energy – First Law of Thermodynamics - Second Law of Thermodynamics – energy requirement and supply – Fossil fuels and climate changes – need of renewable energy sources – Current renewable energy uses – Renewable energy policies in India.</p> <p><b>Geothermal energy:</b> Introduction – Essential characteristic – Sources – Power Plants – Single flash power plant – double flash power plant – Flow diagram and principle only.</p> <p><b>Wind energy:</b> Introduction – energy conversion – site selection considerations – Components of wind energy conversion system – Classification. Wind mill: Horizontal axis machines - Vertical axis machines – working principle, advantages and disadvantages. Schemes for electric generation.</p>	5  4  6
II	<p><b>Bio mass energy, Solar Energy</b></p> <p><b>Bio mass energy:</b> Introduction – conversion technologies: Wet processes – dry processes. Bio gas generation – factors affecting the bio gas generation – classification of bio gas plants – Bio gas plant – construction - advantages and disadvantages. Materials used for bio gas generation – factors to be considered for the selection of site.</p> <p><b>Solar Energy:</b> Introduction – Sun’s energy: advantages – conversion challenges– The Sun-Earth movement - Solar radiation - Different angles - optimal angle for fixed collector, in summer and winter. Sun tracking - measuring instruments of solar radiation – methods to estimate solar radiation.</p>	7  8
III	<p><b>Photovoltaic (PV)</b></p> <p>Photovoltaic (PV): Semiconductors as solar cell – types of unit cells - electronic arrangement of silicon atom – intrinsic semiconductor –</p>	6

	<p>extrinsic semiconductor – Description only. P-N junction diode - forward bias - reverse bias. Solar cell - characteristics - description of short circuit current, open circuit voltage, fill factor and efficiency - losses in solar cells.</p> <p>Growth of solar PV and silicon (Si) requirement – production of metallurgical grade (MGS) – production of electronic grade (EGS) – Production of Si wafers: ingot making - monocrystalline - multicrystalline – wafer dicing. Si sheets. Solar grade silicon (SoG) – refining processes – Si usage in Solar PV. Process flow of commercial Si cell technology – Description of saw damage removal and surface texturing, diffusion process, thin-film layers for anti reflection coating and surface passivation, metal contacts and their deposition.</p>	9
IV	<p><b>PV Technologies, Applications</b></p> <p>PV Technologies: Thin film Technologies – materials for thin film technologies – Thin film deposition techniques: Physical vapour deposition – Evaporation – Sputtering. Chemical vapour deposition – Low pressure – plasma enhanced. Advantages of thin film Si solar cell technologies. Solar cell structures – substrate arrangement – superstrate arrangement. Solar PV module: series and parallel connections of cells – mismatch in cell / module- Design and structure of PV module.</p> <p>Batteries for PV systems – factors affecting battery performance – DC to DC converters – Charge controllers – DC to AC converter (inverter) (Description only).</p> <p>Applications: Flat plate collector - concentrating solar collectors – solar pond – solar water heating – space heating and cooling – solar pumping – solar cooking – solar green house. principle and applications only</p>	6 3 5
V	<p><b>Energy conservation</b></p> <p>Energy conservation act 2001 - Power of state government to facilitate and enforce efficient use of energy and its conservation - Finance, Accounts and Audit of bureau - Penalties and Adjudication - Appellate tribunal for energy conservation – Energy Conservation Guidelines for Industries by BEE, Govt of India - Guide lines – heating, cooling and heat</p>	14

	transfer – waste recovery and usage – conversion of heat to electricity – Prevention of energy loss due to heat radiation and electric resistance – Industry energy management system. Net-metering policies – Tamil Nadu Energy Development Agencies – Projects in Tami Nadu: Solar energy, Bio energy and Wind energy – Tamil Nadu Solar policy 2019.	
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## Reference Books:

### Reference Books

1. Non Conventional Energy Sources, G.D.Rai, Khanna Publishers.
2. Non Conventional Energy Sources and Utilisation, R.K.Rajput, S.Chand & Company Ltd.
3. Renewable Energy, Stephen Peake, Oxford press
4. Non Conventional Energy Resources, B.H.Khan, Tata Mc Graw Hill.
5. Industrial energyconservation- D. A. Ray- Pergaman Press
6. Energy resource management, Kirpal Singh Jogi, Sarup and sons.
7. Solar Photovltaiacs, Chetan Singh Solanki, PHI Learning Pvt. Ltd.
8. Renewable Energy Engineering and Technology, V V N Kishore, TERI.
9. Principles of Solar Engineering, D.Yogi Goswami, Frank Kreith, Jan F.Kreider, Taylor & Francis.
10. Energy conservation act 2001, Government of India.
11. Energy Conservation Guidelines for Industries, Bureau of energy Efficiency, Ministry of Power, Government of India.
12. Tamil Nadu Solar policy 2019
13. <https://teda.in/achievements/solar-energy-4/>
14. <https://teda.in/achievements/bio-energy-2/>
15. [https://teda.in/achievements/wind-energy-2](https://teda.in/achievements/wind-energy-2/)



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

# **INDUSTRIAL AUTOMATION PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering  
 Subject Code : 4047540  
 Semester : V Semester  
 Subject Title : **Industrial Automation Practical**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Industrial Automation Practical	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE**

To impart practical knowledge to the diploma students, practical subjects are introduced for every corresponding theory subject. This practical supports the aim and objective of Industrial automation.

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- Study basic pneumatic system and it's functioning.
- Study basic hydraulic system and it's functioning.
- Design application oriented pneumatic circuits.
- Design of application oriented hydraulic system.

- Study the operation and use of special purpose values.
- Compare working of directional control valves.
- Trouble shoots in pneumatic and hydraulic circuits.
- Develop and test PLC ladder logic diagram

## **4047540 INDUSTRIAL AUTOMATION PRACTICAL DETAILED SYLLABUS**

Contents: **Practical**

**Name of the Topics:**

### **LIST OF EXPERIMENTS**

#### **PNEUMATICS LAB**

1. a. Direct operation of a single Acting cylinder.  
b. Direct operation of Double Acting cylinder.
2. Operations of Single and double Acting Cylinder controlled from two different positions using shuttle valve / quick exhaust valve.
3. Speed control of Double Acting cylinder using metering in and metering out circuit.
4. Automatic operation of Double Acting cylinder in multi cycles -Using limit switches and memory valves.

#### **HYDRAULICS LAB**

5. a. Direct operation of Double Acting cylinder.  
b. Direct operation of Hydraulic Motor.
6. a. Speed control of Double Acting cylinder - Using metering-in and metering-out control.  
b. Speed control Hydraulic Motor - Using metering-in and metering-out control.
7. Automatic operation of two Double Acting cylinder in following sequencing using Pressure sequence valve
8. Operation of a Double Acting cylinder using solenoid operated Directional control valve.

#### **PLC LAB**

9. a. Direct operation of a Pneumatic cylinder using solenoid valve and latch circuit.







# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

## **ROBOTICS PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engg

Subject Code : 4047550

Semester : V Semester

Subject Title : Robotics Practical

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Robotics Practical	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### RATIONALE

To impart practical knowledge to the diploma students, practical subjects are introduced for every corresponding theory subject. This practical supports the aim and objective of Robotics.

### OBJECTIVES

On completion of the following syllabus contents, the students must be able to

- Identify different part of robot
- Record positions using Cartesian co ordinate and joint co ordinates
- Write programmers for pick and place
- Operate and control robot through teach pendant
- Operate and control robot through programming
- Study and use vision system in robot application

# 4047550 ROBOTICS PRACTICAL

## DETAILED SYLLABUS

Contents: **Practical**

### LIST OF EXPERIMENTS

1. Robot system connection and component recognition
2. Robot operation, moving the various axis continuous and intermittent motions.
3. Writing program off-line/on line
  - a. Homing operation
  - b. Recording position
4. Program for operating the gripper using offline/online
5. Program for pick and place the object using online/offline
6. Program for stacking the object using offline/online
7. Write a Looping program using offline/online.
8. Teaching positions via XYZ co-ordinates
9. Write a Program using XYZ Coordinates
10. Write a program using wait, speed commands
11. Measurement of Robot work envelope
12. Measurement of Robot of motion
13. Measurement of Repeatability
14. Test the line follower robotic principle using IR sensors and DC motor without controller

## EQUIPMENT REQUIREMENTS

Sl. No	Name of the Equipments	Required Quantity
1.	ROBOT OFF LINE SIMULATION SOFTWARE	10 USERS
2.	SIX AXIS ROBOT	1 No
3.	COMPUTERS	10 No's
4.	LINE FOLLOWER KIT	2 No's

## SCHEME OF VALUATION

WRITING PROGRAM	35 MARKS
EXECUTION / SIMULATION	40 MARKS
RESULT	15 MARKS
VIVA VOCE	10 MARKS
<b>TOTAL</b>	<b>100 MARKS</b>



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

## **C PROGRAMMING LANGUAGE**

## **PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : DIPLOMA IN ELECTRONICS (ROBOTICS) ENGG (1049) / ..  
MECHATRONICS ENGG (1047)

Subject Code : 4047564

Semester : V Semester

Subject Title : **C PROGRAMMING LANGUAGE PRACTICAL**

#### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
C Programming Language Practical	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

#### OBJECTIVES:

At the end of the course the students will be able to

- \* Analyze the given problem
- \* Think the logic to solve the problem
- \* Understand the concepts of constants, variables, data types and operators.
- \* Develop programs using input and output operations, arithmetic and logic expressions, decision making statements and looping statements
- \* Proficient to write programs using arrays.
- \* Write Programs using string handling functions
- \* Write programs using user-defined functions

# 4047564 C PROGRAMMING LANGUAGE PRACTICAL

## DETAILED SYLLABUS

Contents: **Practical**

### List of Exercises

1. Program to calculate simple and compound interest
2. Program to find the gross salary and net salary of an employee having basic pay, hra, da, ma and income tax. Assume da is 20% of basic pay and income tax is 10% of gross salary.
3. Program to find whether the given number is a positive number, negative number or zero.
4. Program to find the largest and smallest among the three given numbers.
5. Program to read a numeric month and display it in words.
6. Programs to find the sum of series using while, do...while and for loop statements.
7. Programs to find the factorial of a given number using while, do...while and for loop statements.
8. Program to print multiplication table
9. Program to find the sum of digits of a given number
10. Program to implement Fibonacci series.
11. Program to sort a list of numbers
12. Program to sort the strings.
13. Program to add two matrices.
14. Write a function to find the factorial of a value. Write a program to find the  $nCr$  value using the above function.

### HARDWARE REQUIREMENT:

DESKTOP/LAPTOP COMPUTERS	30 NOS
LASER PRINTER	1 NOS

### SOFTWARE REQUIREMENT:

C-COMPILER AND EDITOR



### **SCHEME OF VALUATION**

WRITING PROGRAM	40 Marks
EXECUTION	40 Marks
RESULT	10 Marks
VIVA VOCE	10 Marks
TOTAL	100 Marks



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

# **POWER ELECTRONICS AND DRIVES PRACTICAL**

**(Common with Electrical and Electronics Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : DIPLOMA IN ELECTRONICS (ROBOTICS) ENGG (1049) / ..  
MECHATRONICS ENGG (1047)  
Subject Code : 4047565  
Semester : V Semester  
Subject Title : **Power Electronics and Drives Practical**

#### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Power Electronics and Drives Practical	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

#### RATIONALE:

- The advent of Thyristors has revolutionized art of Electric Power Conversation and its Control.
- The use of the Power Electronic Devices has pervaded the Industrial Applications relating to the field of Electrical, Electronics, Instrumentation and Control Engineering.
- This Subject is introduced to impart practical skills to the Students in using some important Power Electronic Devices and Circuits.

#### OBJECTIVES:

**At the end of the Course, Students will be able to:**

- Construct and test various Triggering Circuits for SCR.

- Construct and test different types of Phase Controlled Converters in various configurations at different load conditions.
- Construct and observe the performance of different types of Chopper and Inverters.
- Construct and test the performance of Open Loop and Closed Loop Control of DC and AC drives.
- Construct and test the performance of Single Phase Cyclo Converter.

### **DETAILED SYLLABUS**

Contents: Practical

**Name of the Topics: Power Electronics and Drives Practical**

#### **Exercise**

1. Construct the Line synchronized Ramp trigger circuit using UJT with AC Load to measure Firing Angles.
2. Construct Lamp control circuit using DIAC – TRIAC to measure various output voltage for Firing Angles.
3. Construct and test the SCR Commutation Circuits (Class B & ClassD)
4. Construct and test the Half Wave Controlled Rectifier with R-Load, RL Load
5. Construct and test the Single Phase Fully Controlled Bridge with RL-Load and Free Wheeling Diode.
6. Construct and test the Single Phase Semi Controlled Bridge with R-Load
7. Construct and test the DC Chopper Control Circuit using Thyristor (any class).
8. Construct and test the Step Up Chopper.
9. Construct PWM based Step Down DC Chopper using MOSFET/IGBT.
10. Construct and test the Single Phase Single Pulse / Sinusoidal PWM Inverter using MOSFET/IGBT.
11. Construct and test the SMPS using MOSFET/IGBT.
12. Construct and test the Control Circuit using TRIAC for Universal Motor.
13. Construct and test the Single Phase to Single Phase Cyclo Converter.

**LIST OF EQUIPMENTS**

<b>S.NO</b>	<b>NAME OF THE EQUIPMENT</b>	<b>NO OF QUANTITY</b>
1.	Line Synchronized Ramp Trigger Circuit Using UJT Trainer Kit.	1
2.	Lamp Control Circuit Using DIAC – TRIAC Trainer Kit.	1
3.	SCR Commutation Circuits (Class B & Class D)	1
4.	Half Wave Controlled Rectifier with R - Load & RL Load Trainer Kit.	1
5.	Single Phase Fully Controlled Bridge with RL - Load And Freewheeling Diode Trainer Kit.	1
6.	Single Phase Semi Controlled Bridge with R- Load Trainer Kit.	1
7.	Construct and Test the DC Chopper Control Circuit using Thyristor (Any Class) Trainer Kit.	1
8.	Step Up Chopper Trainer Kit.	1
9.	PWM Based Step Down DC Chopper using MOSFET/IGBT Trainer Kit.	1
10.	Single Phase Single Pulse / Sinusoidal PWM Inverter using MOSFET / IGBT Trainer Kit.	1
11.	SMPS using MOSFET / IGBT Trainer Kit.	1
13.	Control Circuit Using TRIAC for Universal Motor Trainer Kit.	1
15.	Single Phase Parallel Inverter using MOSFET /IGBT Trainer Kit	1
16.	Single Phase to Single Phase Cyclo Converter Trainer Kit.	1
17.	CRO With Power Probe	4
18.	MultiMeter	5

**BOARD EXAMINATION**  
**DETAILED ALLOCATION OF MARKS**

<b>S.NO</b>	<b>NAME OF THE ACTIVITY</b>	<b>MARK ALLOCATION</b>
1	Circuit Diagram	25
2	Connections	25
3	Procedure	20
4	Reading/Graph/Result	25
5	Viva Voce	05
	<b>Total</b>	<b>100</b>



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

# **GREEN ENERGY AND ENERGY CONSERVATION PRACTICAL**

**(Common with Mechanical Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering

Subject Code : 4020562

Semester : V

Subject Title : Green Energy and Energy Conservation Practical

#### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
Internal Assessment			Board Examinations	Total		
4020562 Green Energy and Energy Conservation Practical	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

#### Objectives:

- To demonstrate the I-V and P-V Characteristics of PV module .
- To show the effect of variation in tilt angle on PV module power.
- To study the characteristics of battery.
- To understand how a solar PV standalone system works
- To workout power flow calculations of standalone PV system AC load DC load with battery.
- To understand how to use various electrical measuring equipments.
- To study the different electrical parameters of a monocrystalline and polycrystalline silicon solar panel
- To study the effect of shading on the output of solar panel.
- To understand and determine the power flow in a solar DC system.

# 4020562 GREEN ENERGY AND ENERGY CONSERVATION PRACTICAL

## DETAILED SYLLABUS

### Experiments

#### **PART A**

1. Study and demonstrate the I-V and P-V Characteristics of PV module with varying radiation and temperature level.
2. Study and demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.
3. Study and demonstrate the effect of shading on module output power.
4. Do a shading analysis on the site where solar PV system needs to be setup.
5. Study the wind power generation status in Tamilnadu.
6. Study the biogas generation status in Tamilnadu.

#### **PART B**

1. Conduct experiment to show the effect of variation in tilt angle on PV module power.
2. Conduct the experiment to demonstrate the working of diode as Bypass diode and blocking diode.
3. Conduct the experiment to draw the charging and discharging characteristics of battery.
4. Conduct the experiment for the power flow calculations of standalone PV system of AC load with battery.
5. Conduct the experiment for the power flow calculations of standalone PV system of DC load with battery.
6. Conduct the experiment to determine the different electrical parameters of a monocrystalline and polycrystalline silicon solar panel.



## BOARD EXAMINATION

Note:

- All the experiments in both sections should be completed. Two experiments will be given for examination by selecting one from PART A and one from PART B.
- All the experiments should be given in the question paper and students are allowed to select by a lot or Question paper issued from the DOTE should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

### **ALLOCATION OF MARKS**

<b>Part – A Study explanation</b>		<b>: 30</b>
<b>Part-B</b>		<b>: 60</b>
Procedure	15	
Observation / Reading / calculation	35	
Result	10	
<b>Viva-voce</b>		<b>: 10</b>
<b>Total</b>		<b>: 100</b>

### Equipment / Tools Required

S.No.	Description	Qty.
1	150 /160 Wp Polycrystalline Solar PV Modules	2 Nos.
2	340/350 Wp Mono crystalline Solar PV Modules	2 Nos.
3	80 / 90 Wp Thinfilm Solar PV Modules	2 Nos.
4	1000W/1500W Off-grid Grid Inverter with MPPT Charge Controller	1 No.
5	Solar Structure	1 No.
6	Wall mountable ACDB Box	1 No.
7	Earthing kit	3 No.
8	DC Wire , AC Wire, PVC items	1 No.
9	Accessories like MC4 connectors, Lugs, Screws etc	Sufficient quantity
10	Solar System Analyser	1 No.
11	Solar Power Meter	1 No.
12	Solar Module Analyser	1 No.
13	Thermal Imaging Camera	1 No.
14	Drill m/c, Multimeters, Clamp meters, Tools & Tackles, Safety gear	1 Set
15	Electrical Measuring Instruments	Sufficient Quantity
16	Shop Floor Tools	Sufficient Quantity



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **V SEMESTER**

**2020-21 onwards**

# **ENTREPRENERUSHIP AND STARTSUPS**

**(Common with All Branches)**

**CURRICULUM DEVELOPMENT CENTRE**

**Annexure – III**

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU  
DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS  
N-SCHEME**

**(implemented from the Academic year 2020-2021 onwards)**

Course Name : 1020 Diploma in Mechanical Engineering

Subject Code : 4020570

Semester : V

Subject Title : Entrepreneurship & Startup

**TEACHING AND SCHEME OF EXAMINATION**

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
4020570 Entrepreneurship & Startup	4	64	25	100*	100	3 Hrs.

\*Examinations will be conducted for 100 marks and it will be reduced for 75 marks for result

Topics and Allocation of Hours

UNIT	Topic	Hours
1	Entrepreneurship – Introduction and Process	10
2	Business Idea and Banking	10
3	Start ups, E-cell and Success Stories	10
4	Pricing and Cost Analysis	10
5	Business Plan Preparation	10
Revision, Field visit and Preparation of case study report		14
Total		64

## **RATIONALE:**

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspiration of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promoting concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs, relevant to social prosperity and thereby ensure good means of living for every individual, provides jobs and develop Indian economy.

## **OBJECTIVES:**

At the end of the study of 5<sup>th</sup> semester the students will be able to

- To excite the students about entrepreneurship
- Acquiring Entrepreneurial spirit and resourcefulness
- Understanding the concept and process of entrepreneurship
- Acquiring entrepreneurial quality, competency and motivation
- Learning the process and skills of creation and management of entrepreneurial venture
- Familiarization with various uses of human resource for earning dignified means of living
- Know its contribution in and role in the growth and development of individual and the nation
- Understand the formation of E-cell
- Survey and analyze the market to understand customer needs
- Understand the importance of generation of ideas and product selection
- Learn the preparation of project feasibility report
- Understand the importance of sales and turnover
- Familiarization of various financial and non financial schemes
- Aware the concept of incubation and starts ups

**4020570 ENTREPRENEURSHIP & STARTUP  
DETAILED SYLLABUS**

Unit	Name of the Topics	Hours
1	<p><b>ENTREPRENEURSHIP – INTRODUCTION AND PROCESS</b></p> <ul style="list-style-type: none"> <li>• Concept, Functions and Importance</li> <li>• Myths about Entrepreneurship</li> <li>• Pros and Cons of Entrepreneurship</li> <li>• Process of Entrepreneurship</li> <li>• Benefits of Entrepreneur</li> <li>• Competencies and Characteristics</li> <li>• Ethical Entrepreneurship</li> <li>• Entrepreneurial Values and Attitudes</li> <li>• Motivation</li> <li>• Creativity</li> <li>• Innovation</li> <li>• Entrepreneurs - as problem solvers</li> <li>• Mindset of an employee and an entrepreneur</li> <li>• Business Failure – causes and remedies</li> <li>• Role of Networking in entrepreneurship</li> </ul>	10
2	<p><b>BUSINESS IDEA AND BANKING</b></p> <ul style="list-style-type: none"> <li>• Types of Business: Manufacturing, Trading and Services</li> <li>• Stakeholders: Sellers, Vendors and Consumers</li> <li>• E- Commerce Business Models</li> <li>• Types of Resources - Human, Capital and Entrepreneurial tools</li> <li>• Goals of Business and Goal Setting</li> <li>• Patent, copyright and Intellectual Property Rights</li> <li>• Negotiations - Importance and methods</li> <li>• Customer Relations and Vendor Management</li> <li>• Size and Capital based classification of business enterprises</li> </ul>	10

	<ul style="list-style-type: none"> <li>• Role of Financial Institutions</li> <li>• Role of Government policy</li> <li>• Entrepreneurial support systems</li> <li>• Incentive schemes for State Government</li> <li>• Incentive schemes for Central Government</li> </ul>	
<b>3</b>	<p><b>STARTUPS, E-CELL AND SUCCESS STORIES</b></p> <ul style="list-style-type: none"> <li>• Concept of Incubation centre's</li> <li>• Activities of DIC, financial institutions and other relevance institutions</li> <li>• Success stories of Indian and global business legends</li> <li>• Field Visit to MSME's</li> <li>• Various sources of Information</li> <li>• Learn to earn</li> <li>• Startup and its stages</li> <li>• Role of Technology – E-commerce and Social Media</li> <li>• Role of E-Cell</li> <li>• E-Cell to Entrepreneurship</li> </ul>	<b>10</b>
<b>4</b>	<p><b>PRICING AND COST ANALYSIS</b></p> <ul style="list-style-type: none"> <li>• Calculation of Unit of Sale, Unit Price and Unit Cost</li> <li>• Types of Costs - Variable and Fixed, Operational Costs</li> <li>• Break Even Analysis</li> <li>• Understand the meaning and concept of the term Cash Inflow and Cash Outflow</li> <li>• Prepare a Cash Flow Projection</li> <li>• Pricing and Factors affecting pricing</li> <li>• Understand the importance and preparation of Income Statement</li> <li>• Launch Strategies after pricing and proof of concept</li> <li>• Branding - Business name, logo, tag line</li> <li>• Promotion strategy</li> </ul>	<b>10</b>

<b>5</b>	<p><b>BUSINESS PLAN PREPARATION</b></p> <ul style="list-style-type: none"> <li>• Generation of Ideas,</li> <li>• Business Ideas vs. Business Opportunities</li> <li>• Selecting the Right Opportunity</li> <li>• Product selection</li> <li>• New product development and analysis</li> <li>• Feasibility Study Report – Technical analysis, financial analysis and commercial analysis</li> <li>• Market Research - Concept, Importance and Process</li> <li>• Marketing and Sales strategy</li> <li>• Digital marketing</li> <li>• Social Entrepreneurship</li> <li>• Risk Taking-Concept</li> <li>• Types of business risks</li> </ul>	<b>10</b>
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**REFERENCE BOOKS:**

1. Dr. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra - 282002
2. Dr. G.K. Varshney, Business Regulatory Framework , Sahitya Bhawan Publications, Agra - 282002
3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship , McGraw Hill (India) Private Limited, Noida - 201301
4. M.Scarborough, R.Cornwell, Essentials of Entrepreneurship and small business management, Pearson Education India, Noida - 201301
5. Charantimath Poornima M. Entrepreneurship Development and Small Business Enterprises, Pearson Education, Noida - 201301
6. Trott, Innovation Management and New Product Development, Pearson Education, Noida - 201301
7. M N Arora, A Textbook of Cost and Management Accounting, Vikas Publishing House Pvt. Ltd., New Delhi-110044
8. Prasanna Chandra, Financial Management, Tata McGraw Hill education private limited, New Delhi



9. I. V. Trivedi, Renu Jatana, Indian Banking System, RBSA Publishers, Rajasthan
10. Simon Daniel, HOW TO START A BUSINESS IN INDIA, BUUKS, Chennai - 600018
11. Ramani Sarada, The Business Plan Write-Up Simplified - A practitioners guide to writing the Business Plan, Notion Press Media Pvt. Ltd., Chennai 600095.

### **Board Examination – Evaluation Pattern**

#### **Internal Mark Allocation**

Assignment (Theory portion)*	-	10
Seminar Presentation	-	10
Attendance	-	5
<b>Total</b>	-	<b>25</b>

**Note: \* Two assignments should be submitted. The same must be evaluated and converted to 10 marks.**

#### **Guidelines for assignment:**

- |                                     |            |
|-------------------------------------|------------|
| First assignment                    | – Unit I   |
| Second assignment                   | – Unit II  |
| Guidelines for Seminar Presentation | - Unit III |

Each assignment should have five three marks questions and two five marks questions.

## **BOARD EXAMINATION**

#### **Note**

1. The students should be taught all units and proper exposure and field visit also arranged. All the portions should be completed before examinations.
2. The students should maintain theory assignment and seminar presentation. The assignment and seminar presentation should be submitted during the Board Practical Examinations.
3. The question paper consists of theory and practical portions. All students should write the answers for theory questions (45 Marks) and practical

portions (55 Marks) should be completed for board examinations.

4. All exercises should be given in the question paper and students are allowed to select by lot. If required the dimensions of the exercises may be varied for every batch. No fixed time allotted for each portion and students have liberty to do the examination for 3Hrs.
5. For Written Examination: theory question and answer: 45 Marks  
 Ten questions will be asked for 3 marks each. Five questions from each unit 1 & 2. (10 X 3 = 30).  
 Three questions will be asked for 5 marks each. One question from each unit 1, 2 & 3. (3 X 5 = 15)
6. For Practical Examination: The business plan/Feasibility report or Report on Unit 4 & 5 should be submitted during the board practical examinations. The same have to be evaluated for the report submission (40 marks).

### **DETAILED ALLOCATION OF MARKS**

<b>Sl. No</b>	<b>Description</b>	<b>Marks</b>
Part A	Written Examination - Theory Question and answer  10 questions x 3 marks = 30 marks  3 questions x 5 marks = 15 marks	45
Part B	Practical Examination – Submission on Business Plan/Feasibility Report or Report on Unit 4 & 5	40
Part C	Viva voce	15
<b>Total</b>		<b>100</b>



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

# **INDUSTRIAL ENGINEERING AND MANAGEMENT**

**(Common with Mechanical Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N - SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering

Subject Code : 4020610

Semester : VI

Subject Title : Industrial Engineering and Management

#### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
Internal Assessment			Board Examinations	Total		
4020610 Industrial Engineering and Management	6	96	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

#### Topics and Allocation of Hours:

Unit No	Topics	Hours
I	Plant Engineering and Plant Safety	18
II	Work Study, Method Study and Work Measurement	18
III	Principles, Personnel Management and Organizational Behavior:	19
IV	Financial and Material Management	18
V	Engineering Ethics and Human Values	16
TEST AND REVISION		07
<b>Total</b>		<b>96</b>

**RATIONALE:**

In the Indian Economy, Industries and Enterprises always find prominent place. After globalization, the students should be trained not only in manufacturing process but also in managing activities of industries. The knowledge about plant, safety, work study techniques, personnel management, financial management and engineering ethics and human values will definitely help the students as managers to suit the industries.

**OBJECTIVES:**

- To study the different types of layout.
- To study the safety aspects and its impacts on an organization.
- To study different work measurement techniques.
- To study engineering ethics and human values.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control system.
- To study about organization and it's behavior.

4020610 INDUSTRIAL ENGINEERING AND MANAGEMENT  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Time
<b>I</b>	<b>Plant Engineering and Plant Safety</b> <b>Chapter: 1.1:Plant Engineering :</b> Plant – Selection of site of industry – Plant layout – Principles of a good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plantmaintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance.	<b>9</b>
	<b>Chapter: 1.2:Plant Safety:</b> Importance –accident-causes and	<b>9</b>

	cost of an accident-accident proneness-prevention of accidents-Industrial disputes-settlement of Industrial disputes-Collective bargaining, conciliation, Mediation, arbitration-Indian Factories Act 1948 and its provisions related to health, welfare and safety.	
<b>II</b>	<p><b>Work Study, Method Study and Work Measurement</b></p> <p><b>Chapter: 2.1: Work Study:</b> Productivity – Standard of living – method of improving productivity – Objectives – Importance of good working conditions.</p> <p><b>Chapter: 2.2:Method Study:</b> Definition – Objectives – Selection of a job for method study –Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man Machine chart, String diagram and flow diagram.</p> <p><b>Chapter: 2.3:Work Measurement:</b> Definition – Basic procedure in making a time study – Employees rating factor – Application of time allowances – Rest, Personal, Process, Special and Policy allowances – Calculation of standard time – Problems – Basic concept of production study – Techniques of work measurement-Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS).</p>	<p><b>4</b></p> <p><b>6</b></p> <p><b>8</b></p>
<b>III</b>	<p><b>Principles, Personnel Management and Organizational Behavior:</b></p> <p><b>Chapter: 3.1:Principles of Management:</b> Definition of management – Administration - Organization – F.W. Taylor’s and Henry Fayol’s Principles of Management – Functions of Manager – Directing – Leadership –Types of Leadership – Qualities of a good leader – Motivation – Positive and negative motivation --Modern management techniques- Management Information Systems – Strategic management – SWOT Analysis - Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) –Activity Based Management (ABM) – Global Perspective – Principles and brief description.</p> <p><b>Chapter: 3.2:Personnel Management:</b> Responsibility of human</p>	<p><b>7</b></p> <p><b>7</b></p>

	<p>resource management – Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training – Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages – Wage fixation – Type of wage payment – Halsey’s 50% plan, Rowan’s plan and Emerson’s efficiency plan – Problems.</p> <p><b>Chapter: 3.3:Organizational behavior:</b> Definition – organization-- Types of Organization – Line, Staff, Taylor’s Pure functional types – Line and staff and committee type –Organizational Approaches, individual behavior - causes - Environmental effect - Behavior and Performance, Perception - organizational implications.</p>	<b>5</b>
<b>IV</b>	<p><b>Financial and Material Management</b></p> <p><b>Chapter: 4.1:Financial Management:</b>Fixed and working capital – Resources of capital – shares preference and equity shares – debentures – Type of debentures – Public deposits, Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit – Problems. Depreciation – Causes – Methods - Straight line, sinking fund and percentage on diminishing value method – Problems.</p> <p><b>Chapter: 4.2:Material Management:</b> Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level - Economic order quantity - problems – supply chain management - Introduction – Purchasing procedure – Store keeping – Bin card.</p>	<b>9</b>
<b>V</b>	<p><b>Engineering Ethics and Human Values</b></p> <p><b>Chapter: 5.1:Engineering Ethics:</b> Definition-engineering ethics- personal and business ethics- duties and rights-engineering as a profession - core qualities of professional practitioners-environment and their impact-code of ethics- procedure for solving ethical conflicts - ethical judgement- Kohiberg’s stages of moral development - value based ethics- engineers as managers, consultants and leaders-environmental ethics- computer ethics- Intellectual Property Rights</p>	<b>9</b>

	(IPRs). <b>Chapter: 5.2:Human values</b> : morals – values – integrity- service learning-civic virtue - respect for others- living peacefully- caring – sharing – honesty- courage - valuing time cooperation - commitments – empathy- selfconfidence – character- stress management.	<b>7</b>
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**Reference Books :**

1. Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications(P)Ltd – 2004, 67/4 Madras House, Daryaganj, NewDelhi– 110002.
2. Engineering Economics and Management, T.R. Banga& S.C. Sharma, McGraw Hill Edition. 2 – 2001, NewDelhi.
3. HeraldKoontz and Heinz Wehrich,' Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition.Latest
4. Govindarajan .M, Natarajan. S, Senthilkumar V.V, Engineering ethics , prentice hall of India New Delhi, 2004.
5. Management, Aglobal perspective, Heinz Wehrich, Harold Koontz, 10<sup>th</sup> Edition, McGraw Hill International Edition.Latest.
6. Essentials of Management,4<sup>th</sup> Edition, Joseph L.Massie,Prentice- Hall of India, NewDelhi 2004.
7. S.Chandran, Organizational Behaviours,Vikas Publishing House Pvt. Ltd. Latest
8. M.Govindarajan and S.Natarajan ,Principles of Management ,Prentce Hall of India Pvt.Ltd. NewDelhi.Latest.
9. Charles B. Fledderman, Engineering ethics, pearson prentice hall, New Jersey, 2004.





# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

# **COMPUTER INTEGRATED MANUFACTURING**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047620

Semester : VI Semester

Subject Title : **Computer Intergrated Manufacturing**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Computer Integrated Manufacturing	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	Introduction to CIM and Computer Aided Design & Analysis	15
II	Computer Aided Manufacturing and Rapid Prototyping	15
III	CNC Machine and Components	15
IV	Part Programming	14
V	FMS, Integrated Material Handling	14
Test & Model Exam		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

As per the latest requirements in the industries, This enables to learn the assistance of computer in the field of design and manufacturing areas. The application of material handling equipment is learnt based on the automation in the industries.

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- Understand the concept and requirement of the integration of the design and manufacturing.
- Acquire knowledge about the computer assistance in the design process and analysis.
- Understand the concepts of manufacturing with computer assistance in the shop floor.
- Learn the principle and working of the CNC machines.
- Understand the principle of latest manufacturing machines like EDM and RPT.
- Learn the method of CNC programming with international codes.
- Acquire the knowledge in the material handling equipment.

**4047620 COMPUTER INTERGRATED MANUFACTURING  
DETAILED SYLLABUS**

**Contents:** Theory

Unit	Name of the Topics	Hours
I	<b>INTRODUCTION TO CIM AND COMPUTER AIDED DESIGN &amp; ANALYSIS</b>	
	<b>Chapter 1.1 CIM:</b> Introduction of CIM – concept of CIM - evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM.	3
	<b>Chapter 1.2 CAD:</b> Computer Aided Design – Introduction – CAD definition – Shigley’s design process – CAD activities – benefits of CAD. Types of CAD system – Host and terminal based CAD system - PC based CAD system – workstation based CAD system – graphics	5

	<p>workstation – CAD software packages. 2D&amp;3D transformations – translation, scaling, rotation and concatenation.</p> <p><b>Chapter 1.3 Geometric modeling:</b> Techniques: Wire frame modeling – surface modeling -solid modeling: Boundary representation – Constructive Solid Geometry-Comparison.</p> <p>Graphics standard – Definition –Need - GKS – IGES – PHIGS – DXF.</p> <p><b>Chapter 1.4 Finite Element Analysis:</b> Introduction – Development - Basic steps – Advantage.</p>	<p>4</p> <p>3</p>
II	<p><b>COMPUTER AIDED MANUFACTURING AND RAPID PROTOTYPING</b></p> <p><b>Chapter 2.1 CAM:</b> Definition – functions of CAM – benefits of CAM – Group technology – Part families - Parts classification and coding - coding structure – Optiz system, MICLASS system and CODE System - process planning</p> <p><b>Chapter 2.2 CAPP:</b> – Types of CAPP : Variant type, Generative type – advantages of CAPP - production planning and control – computer integrated production management system – Master Production Schedule (MPS) – Capacity planning – Materials Requirement Planning (MRP)–Manufacturing Resources Planning (MRP-II)– Shop floor control system - Just in time manufacturing philosophy- Introduction to enterprises resources planning.</p> <p><b>Chapter 2.3 Rapid proto typing:</b> concept and applications – materials – types - Stereo lithography (STL) – selective laser sintering(SLS) – Fused Deposition Modeling (FDM) - 3D printing.</p>	<p>4</p> <p>6</p> <p>5</p>
III	<p><b>CNC MACHINE AND COMPONENTS</b></p> <p><b>Chapter 3.1 CNC Machines:</b> Numerical control – definition – components of NC systems – development of NC – DNC – Adaptive control systems – working principle of a CNC system – Features of CNC machines - advantage of CNC machines – difference between NC and CNC – Construction and working principle of turning centre – Construction and working principle of machining centers – machine axes conventions turning centre and machining centre – design considerations</p>	<p>6</p>

	of NC machine tools <b>Chapter 3.2 CNC EDM machine</b> – Working principle of die sinking and wire EDM machines - Coordinate Measuring Machines: construction and working principles. <b>Chapter 3.3 Components of CNC machine.</b> - Drives: spindle drive – dc motor – Feed drives – dc servo motor and stepper motor – hydraulic systems – Slide ways – requirement – types – friction slide ways and anti friction slide ways - linear motion bearings – recirculation ball screw – ATC – tool magazine – feedback devices – linear and rotary transducers – Encoders - in process probing	4 5
IV	<b>PART PROGRAMMING:</b> <b>Chapter 4.1 NC part programming</b> – methods - manual programming– coordinate system – types of motion control: point-to-point, paraxial and contouring – Datum points: machine zero, work zero, tool zero NC dimensioning – reference points – tool material – tool inserts - tool offsets and compensation - NC dimensioning – preparatory functions and G codes, miscellaneous functions and M codes –interpolation: linear interpolation and circular interpolation - CNC program procedure. <b>Chapter 4.2 Part Program</b> – macro – sub-program – canned cycles: stock – mirror images – thread cutting – Sample programs for lathe : Linear and circular interpolation - Stock removal turning – Peck drilling – Thread cutting and Sample programs for milling: Linear and circular interpolation – mirroring – sub program – drilling cycle – pocketing	8 6
V	<b>FMS, AGV, INTEGRATED MATERIAL HANDLING AND INDUSTRY4.0</b> <b>Chapter 5.1 FMS</b> - Types of manufacturing - introduction to FMS – FMS components – FMS layouts – Types of FMS: flexible manufacturing cell – flexible turning cell – flexible transfer line – flexible machining systems – benefits of FMS - introduction to intelligent manufacturing system – virtual machining. <b>Chapter 5.2 AGV</b> - Computer Integrated material handling – AGV: working principle – types - benefits – Automatic Storage and Retrieval	6 4

	Systems (ASRS). Augmented reality(AR) <b>Chapter 5.3 Industry 4.0:</b> -various industrial revolution - Artificial Intelligence-Internet of things(IOT) – Industrial internet of things(IIOT) – smart manufacturing – Big data	4
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## Reference Books

### Text Books :

1. CAD/CAM/CIM , R.Radhakrishnan, S.Subramanian, New Age International Pvt. Ltd.
2. CAD/CAM , Mikell P.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.
3. NC Programming, S.K.Sinha, Galgotia Publications Pvt. Ltd.

### Reference Books:

4. CAD/CAM Principles and Applications, Dr.P.N.Rao, Tata Mc Graw Hill publishing Company Ltd.
5. CAD/CAM, Ibrahim Zeid, Mastering Tata McGraw-Hill Publishing Company Ltd., New Delhi.
6. Automation, Production Systems, and Computer-Integrated Manufacturing,
7. Mikell P. Groover, Pearson Education Asia.
8. Computer control of manufacturing systems,Yoram Koren, McGraw Hill Book.



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

# **PROCESS CONTROL**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering  
 Subject Code : 4047631  
 Semester : VI Semester  
 Subject Title : **Process Control**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Process Control	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	SIMPLE PROCESS CONTROL SYSTEMS AND TERMINOLOGY	15
II	CONTROLLER PRINCIPLES	15
III	TUNING OF CONTROLLERS	14
IV	PROCESS INSTRUMENTATION AND FINAL CONTROL ELEMENTS	15
V	COMPLEX CONTROL SYSTEMS WITH MULTIPLE LOOPS	14
TEST & MODEL EXAM		7
<b>Total</b>		<b>80</b>



**RATIONALE:**

In process industries, controllers are used in controlling temperature, pressure, flow, liquid level, and other process variables. This is provided to get necessary knowledge that may help the students getting employed in process industries

**OBJECTIVES:**

On completion of the following syllabus contents, the students must be able to

- Study the basic concepts of process control variables
- Interpret the characteristics of processes and propose the suitable control modes
- Examine the tuning of controllers
- Recommend the advanced control system for various process
- Choose the instrumentation to control the process
- Measurement technique of strain, force torque and power
- Measurement technique of pressure, temperature and flow.

### **4047631 PROCESS CONTROL DETAILED SYLLABUS**

**Contents:** Theory

Unit	Name of the Topics	Hours
I	<p><b>SIMPLE PROCESS CONTROL SYSTEMS AND TERMINOLOGY</b></p> <p><b>1.1</b> Definition – Process Control – Functional block diagram of an Automatic process control system – Need for Automatic process control in industry -Terminology used in control system : Set point – Measured variable – Comparator – Error – Controller – Final control element. Controlled variable – Manipulated variable – disturbances</p> <p><b>1.2</b> Automatic control system- significance - Advantages of Automatic control system -Mathematical Modeling of Processes – First order process systems - level, temperature and pressure - Self Regulation – Capacitance and Capacity. Piping and Instrumentation flow diagram for the above system</p>	7
		8

II	<p><b>CONTROLLER PRINCIPLES</b></p> <p><b>2.1</b> Controller – Block diagram, Types, General properties – Reverse and Direct action, Controller modes – Discontinuous – On – Off Control with differential gap, without differential gap – Neutral zone– Continuous – Proportional controller – Proportional band (PB) – Effect of PB on a controller output – Offset –Integral control – PI – PD – PID – Definition, salient features, applications and limitations of the above controllers</p> <p><b>2.2</b> Selection of control action – Electronic controllers – Error detector – Two position controller – P,I,D,PI,PD, PID controllers –reverse action – pneumatic controllers – Flapper – Nozzle mechanism, Pneumatic relay.</p>	<p>8</p> <p>7</p>
III	<p><b>TUNING OF CONTROLLERS</b></p> <p><b>3.1</b> Concept of tuning – Evaluation Criteria: Performance Criteria - Quarter decay ratio, IAE, ISE,ITAE</p> <p><b>3.2</b> Methods of tuning – Open loop response method – Process reaction curve method –Closed loop response method – Ultimate cycle method, Damped oscillation method-Frequency response method of turning-Self tuning controllers.</p>	<p>5</p> <p>9</p>
IV	<p><b>PROCESS INSTRUMENTATION AND FINAL CONTROL ELEMENTS</b></p> <p><b>4.1</b> Signal converters – P to I Converter, I to P Converter – Actuators – Electrical, Pneumatic, Hydraulic and Electro pneumatic – Valve Positioners –Control valve –Characteristics Quick opening, Linear, Equal percentage – Control valve sizing – Cv rating – Selection of a control valve – Effects of Cavitations and Flashing on control valve performance.</p> <p><b>4.2</b> Introduction to transmitters, two wire and four wire transmitters, Smart and intelligent transmitters.</p>	<p>10</p> <p>5</p>
V	<p><b>COMPLEX CONTROL SYSTEMS WITH MULTIPLE LOOPS</b></p> <p><b>5.1</b> Advanced control systems- Cascade control system, Ratio control systems, feed forward control system- Selective control systems- split</p>	<p>8</p>

	<p>range control-adaptive control-Multi variable control-Comparison of feedback control system and feed forward control system. (One specific application for each of the above systems)</p> <p><b>5.2</b> Introduction DCS and SCADA Block Diagram of Fuzzy logic controller – block diagram – typical application-washing machine</p>	<p>6</p>
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**Reference Books:**

1. “ Donald P Eckman” “ Process control”,Wiely Eastern limited,1991
2. “ Peter Hariot” “Process control”,TataMcgraw Hill.
3. “B. Sankara Gomathi” “Process control”, (Principles and applications), J J publications,1981.
4. “Krishnaswamy K” “Process Control”, 2nd Edition, New Age International Pvt. Ltd.Publishers, New Delhi, 2013.
5. “C.D.Johnson” “ Process control instrumentation Technology”, Prentice Hall of India Pvt, Ltd
6. <http://nptel.ac.in/courses/103103037/PDF>



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

# **AUTO ELECTRONICS**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering  
 Subject Code : 4047632  
 Semester : VI Semester  
 Subject Title : **Auto Electronics**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Auto Electronics	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	AUTOMOBILE COMPONENTS	15
II	STORAGE BATTERY, CHARGING AND LIGHTING SYSTEM	15
III	SENSORS AND ENGINE MANAGEMENT SYSTEMS	15
IV	AUTOMOTIVE CONTROL SYSTEMS	14
V	RECENT TRENDS IN AUTOMOBILE TECHNOLOGY	14
TEST & MODEL EXAM		7
<b>Total</b>		<b>80</b>

## RATIONALE:

Auto Electronics is introduced with the aim of providing necessary knowledge on automobiles that may help the students getting employed in automobile industry

## OBJECTIVES:

On completion of the following syllabus contents, the students must be able to

- Understand the basic concepts and components
- Understand different ignition systems
- Study about the lead acid battery, testing and lighting system
- Study the sensor based electronic engine management and control devices
- Study about Future Trends in Automobile Techniques

## 4047632 AUTO ELECTRONICS DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	<b>Automobile components:</b>	
	<b>1.1 Engine Components:</b> The engine-components- engine block, cylinder, crank shaft, piston, cam shaft, valves, intake system, ignition, exhaust, cooling system -Lubrication system	5
	<b>1.2 Engine Starting System:</b> Fuel feed system ignition system- spark plug- high voltage circuit and distribution- compression ignition system - steering system, Ackerman steering mechanism. Suspension systems.	5
	<b>1.3 Fuel injection and Ignition system:</b> Fuel injection-types-throttle body versus port injection- Fuel injectors- different types- - High pressure diesel fuel injection- Introduction to Electronic ignition system	5
II	<b>Storage Battery, Charging and Lighting System:</b>	
	<b>Chapter 2.1 Battery:</b> Principle of lead acid cells, plates and their characteristics, construction, electrolyte, effect of temperature on electrolyte, specific gravity, capacity and efficiency	4
	<b>Chapter 2.2 Charging system:</b> Methods of charging from D.C. mains, defects and remedies of batteries, care of idle and new batteries.	4

	<p>Recycling Process - Recent developments - Procedure for charging</p> <p><b><u>Chapter 2.3 Electrical actuators:</u></b> D.C. Generators, Alternators -their Characteristics. Control, cut out, Electrical, Electro-mechanical and electronic regulators.</p> <p><b><u>Chapter 2.4 Lighting system:</u></b> Details of head light and side light, LED lighting system, head light dazzling and preventive methods. Static and Dynamic Bending lights</p>	<p>4</p> <p>3</p>
III	<p><b>Sensors and Engine Management Systems</b></p> <p><b><u>Chapter 3.1 Introduction to sensors and transducers</u></b> -Types-Air flow rate sensor, Engine crankshaft angular position sensor, Engine speed sensor, Timing sensor, Throttle angle sensor Pressure sensor, Temperature sensors, Pressure sensor- Flow sensor, Exhaust gas oxygen sensors, Knock Sensor, Engine torque sensors, Automotive engine control actuators, Exhaust gas recirculation actuator.</p> <p><b><u>Chapter 3.2 Engine Management system:</u></b></p> <p>Electronic Engine Management System, Brake actuation warning system, flash system, oil pressure warning system, engine over heat warning system, air pressure warning system, speed warning system, door lock indicators, neutral gear indicator, horn design, permanent magnet horn, air &amp; music horns. Wind shield wiper. Window washer, electronic instruments, dash board illumination and MIL.</p>	<p>8</p> <p>7</p>
IV	<p><b>Automotive control and Safety systems :</b></p> <p><b><u>Chapter 4.1 Automotive Control:</u></b> Engine Control Objectives, Engine control functions, Fuel delivery systems, Electronic fuel Ignition Systems– Emission control</p> <p><b><u>Chapter 4.2 Automotive Transmission Control Systems :</u></b></p> <p>Cruise control system, Antilock braking system (ABS), Tire-slip control, Active suspension, Traction control, Electronic Suspension system, Steering control, Stability control, Integrated engine control.</p> <p><b><u>Chapter 4.3 Safety System:</u></b></p> <p>Central locking, Air bags and seat belt tensioners - Voice warning system, Travel information system, GPS-Introduction to CAN protocol</p>	<p>5</p> <p>5</p> <p>4</p>

V	<b>Recent trends in automobile technology</b>	
	<b>Chapter 5.1 Electric Vehicle:</b> Electrical and Hybrid Vehicles, Introduction-Electric Vehicle development- system layout- basic system components- Electric battery solar cells- Rapid charging system-Motor drive system-fuel cell Electric vehicle- Hybrid vehicles- Parallel Hybrid Vehicle-CNG Electric Hybrid Vehicle	4
	<b>Chapter 5.2 Emission standards:</b> Euro and Indian standards	2
	<b>Chapter 5.3 Vehicle Intelligence</b> :Introduction – Base structure- Vision based autonomous road vehicles- Architecture for vision system- Features- applications –image processing	4
	<b>Chapter 5.4 Intelligent robot vehicles</b> - obstacle detection, collision warning and avoidance system –Blind spot detection-on board and off board diagnostics in automobiles-connected car technology- Automatic climate control	4

**Reference Books:**

Text Books:

1. Automobile engineering vol- 1, vol – 2, Kirpal singh, Standard publishers distributors New Delhi.
2. Automobile Engineering, G.B.S.Narang, Khanna Publishers, New Delhi.
3. Tom Denton, “Automobile Electrical and Electronic Systems”, Edward Arnold, London, 2011.

Reference Book:

4. Vehicle and Engine technology. Vol. I, Heinz Heisler, , ELBS
5. Automobile Engineering, R.B.Gupta, Satya Prakashan, New Delhi
6. Understanding Automotive Electronics, Fourth Edition, William B. Ribbens
7. Sensor and Transducers, Ronald K. Jurgen, SAE-2003
8. Electric and Hybrid-electric vehicles, Ronald K. Jurgen, SAE 2002





# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

## **EMBEDDED SYSTEMS**

**(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE – III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**

(To be Implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1040 Electronics and Communication Engineering

Subject Code : 4040633

Semester : VI

Subject Title : Embedded Systems

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Embedded Systems	5	80	25	100*	100	3 Hrs.

\* Examination will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

UNIT	Topic	Hrs.
I	Introduction to Embedded systems and ARM processor	16
II	ARM Instruction Set	16
III	LPC 2148 controller	16
IV	LPC 2148 peripherals	15
V	Operating System	10
Test & Model Exam		7
<b>Total</b>		<b>80</b>

**RATIONALE:**

This subject makes the students to understand the definition for Embedded Systems. It also enables the students to have the knowledge about the different architectures, RISC and CISC processors. This subject makes the students to understand about RTOS. To specific, the subject deals with ARM7 RISC processor and the on chip peripherals of LPC2148 .

**OBJECTIVES:**

On completion of the syllabus, the students must be able to

- > Understand ARM7 processor .
- > Understand the architecture of LPC 2148.
- > Understand ARM7 instruction set.
- > Understand the types of buses.
- > Explain On chip peripherals.
- > Have clear knowledge about RTOS concepts.

## 4040633 EMBEDDED SYSTEMS

### DETAILED SYLLABUS

**Note: Bit level details in registers should not be asked in board theory examination.**

Contents: Theory

Unit	Name of the Topics	Hours
I	<b>Introduction to Embedded Systems and ARM Processor</b> <b>1.1 : Embedded Systems</b> Definition of Embedded System – Features of Embedded System – Types of Embedded System – List of Embedded System Devices- Harvard and Von-Neumann architectures-RISC and CISC Processors.	8
	<b>1.2:ARM Processor Architecture Fundamentals</b> Block diagram of ARM based embedded system with hardware components - Pipeline-Data Flow Model-CPU registers – Modes of Operation – PSW -Processor State and Instruction Set-Exceptions- Interrupts-Vector table-Little Endian and Big Endian.	8

II	<p><b>ARM Instruction Set</b></p> <p><b>2.1:Instruction Set</b> ARM state instruction set- Thumb State Instruction sets(Brief introduction only)-Data processing instructions-Branch instructions-Load-store instructions-Software interrupt instruction-Program status register instructions-stack instructions-Conditional execution.</p> <p><b>2.2:Simple programs</b> Addition, Subtraction and Multiplication using ARM processor assembly language.</p>	12  4
III	<p><b>LPC 2148 Controller</b></p> <p><b>3.1:Introduction to LPC 2148 ARM controller</b> LPC 2148 ARM Controller – Features-Block diagram – Memory and on chip peripheral devices – ARM 7 TDMI-S Nomenclature– Memory Map – Memory re-map and boot block-Types of buses.</p> <p><b>3.2:System control functions</b> Crystal oscillator-PLL-Power control-RESET-VPB Divider-Wakeup timer-Vector Interrupt controller-(VIC)-Register description-External Interrupts.</p>	8  8
IV	<p><b>LPC 2148 Peripherals</b></p> <p><b>4.1:Peripherals</b> Pin connect block-Features-pin connect block register description-GPIO (Slow)- Features-register description -- Timer/Counter – Block diagram – Register description --PWM-features-register description-ADC -features-register description-DAC-features-register description.</p> <p><b>4.2:Serial communication in LPC 2148</b> UART features – UART0 Block diagram—UART0 register description.</p>	10  5
V	<p><b>Operating System</b></p> <p><b>5.1:Embedded OS and RTOS</b> Introduction to OS- -Functions of OS-Embedded OS- Foreground/background systems -Real time system concepts-Resources-shared resources-Critical section- multitasking-Tasks-kernel-</p>	10

	Scheduler-Round Robin-Non Pre-emptive and Pre-emptive scheduling- Context switch- re-entrancy- task priorities- Event flag-mutual exclusion- semaphores and types-Message mail box-Message Queues.	
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## Reference Books

1. "Andrew N Sloss" "ARM System Developer's Guide Designing and Optimizing" Elsevier publication, 2004.
2. "B.Kanta Rao" "Embedded systems", PHI publishers.
3. "Tammy Noergaard" "Embedded Systems Architecture", Newness edition.
4. "Steve Furbe" "ARM System on chip Architecture", 2<sup>nd</sup> edition, Pearson Education, 2000.
5. "Dr.K.V.K.K Prasad" "Embedded Real Time Systems", Dream tech press, 2009.
6. "David Seal" "ARM Architecture Reference Manual".
7. LPC 2148 User Manual.



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

## **CNC PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

## ANNEXURE- III

### STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

#### N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engineering

Subject Code : 4047640

Semester : VI Semester

Subject Title : **CNC Practical**

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
CNC Practical	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### RATIONALE

To impart practical knowledge to the diploma students, practical subjects are introduced for every corresponding theory subject. This practical supports the aim and objective of CIM.

### OBJECTIVES:

On completion of the following syllabus contents, the students must be able to

- Develop and test CNC program
- Simulate various part diagram
- Generate and execute the various CNC program

# 4047640 CNC PRACTICAL

## DETAILED SYLLABUS

Contents: **Practical**

**Name of the Topics:**

### **LIST OF EXPERIMENTS**

#### **Introduction**

1. Study of CNC Lathe, Milling
2. Study of international standards G-codes, M codes
3. Program writing – Turning simulator – Milling simulator, IS practice – commands – menus

#### **Exercise Practice CNC Lathe**

1. Simulate and Produce a part for step turning.
2. Simulate and Produce a part for taper turning
3. Simulate and Produce a part for circular interpolation
4. Simulate and Produce a part for multiple turning operation
5. Simulate and Produce a part for thread cutting and grooving
6. Simulate and Produce a part for internal drills and boring

#### **CNC Milling**

1. Simulate and Produce a part for grooving
2. Simulate and Produce a part for drilling
3. Simulate and Produce a part for mirroring with subroutine
4. Simulate and Produce a part for rectangular and circular pocketing

### **SCHEME OF VALUATION**

<b>SI. No</b>	<b>Name of the Activity</b>	<b>Mark Allocation</b>
1.	CNC PROGRAM	30
2.	SIMUALTION	20
3.	MACHINE SETTING AND OPERATION	30
4.	RESULT	10
5.	VIVA VOCE	10
<b>Total</b>		<b>100</b>



## Equipment Requirements

<b>Sl. No</b>	<b>Name of the Equipments</b>	<b>Range / Specification</b>	<b>Required Quantity</b>
1.	CNC Turning Machine	-	2 No's
2.	CNC Milling Machine	-	2 No's



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

# **PROCESS CONTROL PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : Diploma in Mechatronics Engineering / Electronics (Robotics) Engg  
 Subject Code : 4047654  
 Semester : V Semester  
 Subject Title : **Process Control Practical**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Process Control Practical	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE**

This is the key subject in an Mechatronics Engineering. It is mandatory to study various control strategy being used in process industries. Various elements involved in controlling a plant such as controller, Final control elements are compact in detail in this practical subject.

**OBJECTIVES**

On completion of the following syllabus contents, the students must be able to

- To get practice of controlling temperature in a single feedback loop
- To get practice of On-Off controlling of temperature, pressure, level of a process
- To get practice of Proportional control of Temperature process
- To get practice of Proportional-Integral control of pressure process

- To get practice of Proportional-Integral-Derivative control of level process
- To get practice of Proportional –Derivative of level process
- To get practice of Tuning of controller to achieve optimum control
- To understand the characteristics of control valve practically
- To get practice of working with P to I converter

## **4047654 PROCESS CONTROL PRACTICAL DETAILED SYLLABUS**

Contents: **Practical**

### **LIST OF EXPERIMENTS**

1. Characteristics of different temperature sensors like
  - a. Thermocouple module,
  - b. RTD,
  - c. Thermistor Module
2. Measurement of Pressure using Strain Gauge type Transducer
3. Measurement of Pressure using Bourdon type Transducer
4. Level measurement by using Air purge method and Differential pressure transmitter
5. Experimentally implement On- off control of temperature process
6. Experimentally implement On – off control of pressure process
7. Experimentally implement On off control of level process
8. Experimentally obtain the Characteristics of control valve
9. Measurement of displacement using LVDT
10. Conduct experiment to understand the Tuning of Controller
11. Conduct experiment to observe response of PI controller in a Pressure Process

12. Measurement of PID controller using Pressure controller trainer kit by monitoring the process in SCADA mode / InTouch software / analog mode
13. Conduct experiment to observe response of PD controller in a Liquid Level process
14. Experimentally obtain the characteristics of P to I converter

### EQUIPMENT REQUIREMENTS

Sl. No	Name of the Equipments	Required Quantity
1.	ON-OFF LEVEL PROCESS	1
2.	ON-OFF PRESSURE PROCESS	1
3.	TEMPERATURE PROCESS	1
4.	LVDT TRAINER MODULE	1
5.	RTD TRAINER MODULE	1
6.	PID CONTROLLER	1
7.	THERMISTER TRAINER MODULE	1
8.	MOTORISED CONTROL VALVE SETUP WITH ACCESSORIES	1
9.	THERMO COUPLE KIT WITH ACCESSORIES	1

### SCHEME OF VALUATION

BLOCK/ CIRCUIT DIAGRAM	30 MARKS
CONNECTIONS	30 MARKS
READING AND GRAPH	20 MARKS
RESULT	10 MARKS
VIVA VOCE	10 MARKS
<b>Total</b>	<b>100 Marks</b>



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

# **AUTO ELECTRONICS PRACTICAL**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE- III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N-SCHEME**  
**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : DIPLOMA IN ELECTRONICS (ROBOTICS) ENGG (1049) / ..  
 MECHATRONICS ENGG (1047)  
 Subject Code : 4047655  
 Semester : VI Semester  
 Subject Title : **Auto Electronics Practical**

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Auto Electronics Practical	5	80	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE:**

The introduction of this subject as an elective will enhance the knowledge of students in the field of automobile engineering and improve the placement opportunity in automotive sector. After undertaking this course, the student develops skills to dismantle, test, check, fine tune and assemble the various components in an automobile.

**OBJECTIVES:**

At the end of the course the students will be able to

- To dismantle and test various components in Automobile
- To test and replace battery in Automobile
- To test the various sensors used in the Automobile

- To measure Engine parameters
- To assembly and test bike wiring harness circuit
- To assembly and test the E-Bicycle

## **4047655 AUTO ELECTRONICS PRACTICAL DETAILED SYLLABUS**

Contents: **Practical**

### **List of Exercises**

1. Testing the Battery: Hydrometer Test – Open Circuit Voltage and High Rate Discharge Testing
2. Adjust the Beam of the Head Lamp
3. Adjust the Ignition Timing with Timing Light and Start the engine
4. Servicing and tune up of the Horn and Wiper Motor
5. Identification of various components of Ignition system
6. Removing, charging and replacing the Battery from a any vehicle
7. To test Engine crankshaft angular position sensor & Engine speed sensor
8. Wiring and troubleshooting of Electrical accessories for any two wheeler
9. Test Brake actuation warning system
10. Wiring and troubleshooting the door lock indicators
11. Test Electronic fuel Ignition Systems for any vehicle
12. Wiring the E-Bicycle



## EQUIPMENT REQUIREMENTS

Sl. No	Name of the Equipments	Required Quantity
1.	Lead acid battery	3 No's
2.	Hydrometer	3 No's
3.	Head lamp control board	1 No
4.	Horn and Wiper motor control board	1 No
5.	Ignition system control board	1 No
6.	Battery Charger	1 No
7.	Engine crankshaft angular position sensor	2 No's
8.	Speed sensor	2 No's
9.	Brake actuation warning system kit or board	1 No
10.	Car door with door lock indicators control board	1 No
11.	Electronic fuel Ignition Systems kit	1 No
12.	E – Bike cycle kit	1 No

## SCHEME OF VALUATION

CIRCUIT DIAGRAM / ASSEMBLY DIAGRAM	30 Marks
DISMANTLING / WIRING	30 Marks
IDENTIFICATION / TROUBLESHOOTING	20 Marks
RESULT	10 Marks
VIVA VOCE	10 Marks
TOTAL	100 Marks



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

**EMBEDDED SYSTEMS PRACTICAL**  
**(Common with Electronics and Communication Engg)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE – III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

(To be Implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1040:Electronics and Communication Engineering

Subject Code : 4040653

Semester : VI

Subject Title : Embedded Systems Practical

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	
Embedded Systems Practical	5	80	25	100*	100	3 Hrs.

\* Examination will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE:**

The introduction of this subject will enable the students to have hands on experience in using ARM Based trainer kit. The students are exposed to use the on chip peripherals using embedded C language. They can also get familiar with the use of ARM instruction set. They are learning the different methods for providing time delay and use of serial communication. 32 bit ARM is a RISC processor which makes the students to expose to the new dimension in the field of embedded systems.

## **OBJECTIVES:**

The students are able to

- Understand the use of instruction set by writing simple ARM ALP and simulate to see output.
- Know the application details of on chip peripherals.
- Familiarize with the register map of on chip Timer / counter.
- Know the use of serial communication concepts using on chip UART0.
- Understand the use of GPIO and the connection of peripheral devices using these on chip GPIO programmable port Pins.
- Use the interrupts with the help of VIC.
- Get used with pin connect block registers for programming the GPIO port pins.
- Interface stepper motor and its operation.
- Understand the multiplexing of seven segment LED display device.

## **4040653 EMBEDDED SYSTEMS PRACTICAL**

### **DETAILED SYLLABUS**

Contents: Practical

#### **Exercises**

1. Study of ARM Processor kit.(Example LPC 2148 kit)
2. Write assembly language program for addition, subtraction and multiplication and simulate.
3. Write and execute C program to blink the LEDs using software delay routine.
4. Write and execute C program to blink the LEDs using on chip TIMER// COUNTER for the delay(Using Polling method).
5. Write and execute C program to blink the LEDs using on chip TIMER// COUNTER for the delay(Using interrupt method).
6. Write and execute C program to read the switch and display in the LEDs.
7. Write and execute C program to count external interrupt pulses EINTx (using VIC) and Show the binary count value in LEDs.
8. Write and execute C program to display a number in seven segments LED.

9. Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by Polling method.
10. Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by Interrupt method.
11. Write and execute C program for accessing an internal ADC and display the binary output in LEDs.
12. Write and execute C program to generate square wave using on chip DAC.

### **BOARD EXAMINATION**

**Note:**

1. Manual for the ARM instruction sets and manual for the trainer kit (Excluding sample program) can be allowed for their board exam.
2. Definition for built in function for the board can be given to students for their board function.
3. Manual containing procedure for program down loading through boot loader or JTAG can be given to students for their board exam.
4. Bit details of Registers of on chip peripheral devices can be given for the board practical examination.

#### **DETAILED ALLOCATION OF MARKS**

I.	Algorithm or Flow chart	:	20 marks
II.	Program	:	30 marks
III.	Execution	:	30 marks
IV.	Result	:	10 marks
V.	Viva	:	10 marks
	TOTAL	:	100 marks

## LIST OF EQUIPMENTS

1. ARM7 TDMI KIT – 15 numbers with interface boards for the above experiments .The chip set may be TMS4701,LPC2138,LPC2148 or STR7 etc.
2. Desktop computer / Laptop -15 Nos
3. Interfaces: Seven segment display. LEDS ,switches and stepper motor .
4. Manual for the trainer kit and Interfaces.
5. Manual for the built in function for the board.
6. Bit details of registers of on chip peripherals.



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VI SEMESTER**

**2020-21 onwards**

# **PROJECT WORK & INTERNSHIP** (Common with all Branches)

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE – III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N - SCHEME**

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : DIPLOMA IN ELECTRONICS (ROBOTICS) ENGG (1049) / ..  
 . MECHATRONICS ENGG (1047)  
 Subject Code : 4047660  
 Semester : VI  
 Subject Title : Project Work and Internship

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
Internal Assessment			Board Examinations	Total		
4047660 Project Work and Internship	6	96	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**RATIONALE:** This subject ‘Project Work and Internship’ is the continuation of the previous semester subjects. The students are to implement the detailed project plan, which they have prepared. This project are generally an integration of the various types of skills acquired during their course of study. Hence it is essential that students are given opportunity to develop and integrate the highly essential industry oriented competencies and skills. This subject build up greater confidence to face in the world of work.

**OBJECTIVES:**

- Implement the theoretical and practical knowledge gained through the curriculum into an application suitable for a real practical working environment preferably in an industrial environment.



- Implement the planned activity as a team.
- Take appropriate decisions on collected information.
- Carry out cooperative learning through synchronous guided discussions within the class in key dates, asynchronous documents sharing and discussions, as well as to prepare collaborative edition of the final project report.

### **Project Work and Internship:**

The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. **The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.**

#### **a) Internal assessment mark for Project Work and Internship:**

Project Review I	...	<b>10 marks</b>
Project Review II	...	<b>10 marks</b>
Attendance	...	<b>05 marks</b> (Award of marks same as theory subject pattern)

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<b>Total</b>	...	<b>25 marks</b>
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Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Board Exams results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

#### **b) Allocation of Marks for Project Work and Internship in Board Examinations:**

Demonstration/Presentation	25 marks
Report	25 marks
Viva Voce	30 marks
Internship Report	20 marks

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<b>Total</b>	<b>100* marks</b>
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\*Examination will be conducted for 100 marks and will be converted to 75 marks.

**c) Internship Report:**

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV / V semester during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year “Project Work & Internship” for 20 marks. The internship shall be undertaken in any industry / Government or Private certified agencies which are in social sector / Govt. Skill Centres / Institutions / Schemes.

**A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work and Internship Board examination.**



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **III YEAR**

**N SCHEME**

## **VII SEMESTER**

**2020-21 onwards**

**PROJECT WORK**  
**(Only for Sandwich Diploma Courses)**

**CURRICULUM DEVELOPMENT CENTRE**

**ANNEXURE – III**  
**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**  
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**  
**N - SCHEME**

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : DIPLOMA IN ELECTRONICS (ROBOTICS) ENGG (1049) / ..  
 . MECHATRONICS ENGG (1047)  
 Subject Code : 4047710  
 Semester : VII  
 Subject Title : Project Work

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			Duration
	Hours / Week	Hours / Semester	Marks			
Internal Assessment			Board Examinations	Total		
4047710 Project Work	4	64	25	100*	100	3 Hrs.

\* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**RATIONALE:**

This subject 'Project Work' is the continuation of the previous semester subjects. The students are to implement the detailed project plan, which they have prepared. This project are generally an integration of the various types of skills acquired during their course of study. Hence it is essential that students are given opportunity to develop and integrate the highly essential industry oriented competencies and skills. This subject build up greater confidence to face in the world of work.

**OBJECTIVES:**

- Implement the theoretical and practical knowledge gained through the curriculum into an application suitable for a real practical working environment preferably in an industrial

environment.

- Implement the planned activity as a team.
- Take appropriate decisions on collected information.
- Carryout cooperative learning through synchronous guided discussions within the class in key dates, asynchronous document sharing and discussions,as well as to prepare collaborative edition of the final project report.

### **Project Work:**

The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. **The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.**

#### **a) Internal assessment mark for Project Work:**

Project Review I	...	<b>10 marks</b>
Project Review II	...	<b>10 marks</b>
Attendance	...	<b>05 marks</b> (Award of marks same as theory subject pattern)
<hr/>		
Total	...	<b>25 marks</b>

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Board Exams results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

#### **b) Allocation of Marks for Project Work and Internship in Board Examinations:**

Demonstration / Presentation	40 marks
Project Report	30 marks
Viva Voce	30 marks

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<b>Total</b>	<b>100* marks</b>
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\*Examination will be conducted for 100 marks and will be converted to 75 marks.

**A**

**neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work Board examination.**



# **DIRECTORATE OF TECHNICAL EDUCATION**

**DEPARTMENT OF ELECTRONICS (ROBOTICS) / MECHATRONICS  
ENGINEERING**

## **II & IV YEAR**

**N SCHEME**

## **IV & VII SEMESTER**

**2020-21 onwards**

**INDUSTRIAL TRAINING**  
**(Common with all Sandwich courses)**

**CURRICULUM DEVELOPMENT CENTRE**

## SANDWICH DIPLOMA COURSE-INDUSTRIAL TRAINING

**4047480** Industrial Training I (Report writing & Viva Voce)

**4047720** Industrial Training II (Report writing & Viva Voce)

### 1. Introduction


The main objective of the sandwich Diploma course is to mould a well rounded technician acclimated with industrial environment while being a student in the institution.

The Sandwich Diploma Course study is pursued by students, in 7 Semesters of 3 ½ years duration, the subjects of 3years-Full Time Diploma Course being regrouped for academic convenience.

While in the 4th semester students under Industrial Training for 6 months(December through May). They also do course work in the institution for one day in a week, While in the 7<sup>th</sup> semester they undergo another spell of 6 months (June through November) Industrial training.

The Apprenticeship (Amendment) Act 1973 is followed in regulating the Industrial training procedure for Sandwich Course.



 Institutional Study

 Industrial Training

### 2. Attendance Certification

Every month students have to get their attendance certified by industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and



submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

### **3. Training Reports**

The students have to prepare two types of reports:

- Weekly report in the form of diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal Assessment marks.
- Comprehensive report at the end of each spell which will be used for Board Examination.

#### **3.1 Industrial Training Diary**

Students are required to maintain the record of day-to-day work done. Such record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc). The concern Industrial supervisor is to check periodically these progress reports.

#### **3.2 Comprehensive Training Report**

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should be incorporating study of plant / product / process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc should be incorporated with the consent of the Organisation.

## **a. Scheme of Evaluation**

### 1.1 Internal Assessment Marks

First Review (during 3rd month)	: 10 marks
Second Review (during 5th month)	: 10 marks
Attendance *	: 05 marks (Awarded same as in Theory)
<b>Total</b>	<b>: 25 marks</b>

### 1.2 Board Examination

Presentation about Industrial Training	: 30 marks
Comprehensive Training Report	: 45 marks
Viva-voce	: 25 marks
<b>Total</b>	<b>: 100 marks</b>

**\* For awarding marks to attendance, the Industrial Training attendance has to be considered.**