

DIPLOMA IN ENGINEERING AND TECHNOLOGY

1025 DEPARTMENT OF PRODUCTION ENGINEERING

SEMESTER PATTERN

N – SCHEME

IMPLEMENTED FROM 2020 - 2021

CURRICULUM DEVELOPMENT CENTRE

DIRECTORATE OF TECHNICAL EDUCATION CHENNAI-600 025, TAMIL NADU Blank Page

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

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Principal, Government Polytechnic College, Purasawalkam, Chennai - 600 012.

DIPLOMA IN PRODUCTION ENGINEERING (1025)

<u>Convener</u>

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Principal, Govt Polytechnic College, Valangaiman, Thiruvarur - 612 804. Cell : 9443849950.

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Cryolor Asia Pacific Chennai,	Lecturer,			
AMIE (Production Engineering),	Department of Mechanical Engineering,			
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DIPLOMA COURSES IN ENGINEERING /TECHNOLOGY

(SEMESTER SYSTEM)

(Implemented from 2020 - 2021)

N – SCHEME

<u>REGULATIONS</u>*

*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 (3¹/₂ 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 4th and/or during 7th 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.

		H.Sc Academic	H.Sc Vocational	H.Sc Vocational		
SI.	Courses		Subjects	Training		
No	Courses	Subjects Studied	Related subjects	Vocational subjects	Courses	
1.	All the	Physics and	Maths / Physics	Related	2 years	
	Bogular and	Chemistry as	/ Chemistry	Vocational	course to	
		compulsory along		Subjects	be passed	
	Sandwich	with Mathematics /		Theory&	with	
	Diploma	Biology		Practical	appropriate	
	Courses				Trade	
2.	Diploma	English &	English &	Accountancy &	-	
	Course in	Accountancy	Accountancy,	Auditing,		
	Commercial English & Elements of Economics	English &	Banking,			
		Elements of Economics,	Business Management,			

	English &	English &	Co-operative
	Elements of	Management	Management,
	Commerce	Principles	
		& Techniques,	International
			Trade,
		English & Typewriting	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:

Diploma Course	Minimum	Maximum	
Dipionia Course	Period	Period	
Full Time	3 Years	6 Years	
Full Time (Lateral Entry)	2 Years	5 Years	
Sandwich	3½ Years	61/2 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

(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

<u>ii) Test #</u>

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

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

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

5 Marks

10 Marks

05 Marks

05 Marks

Without Choice:

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

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

- * 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:

Total	 25 marks
	theory subject pattern)
Attendance	 05 marks (Award of marks same as
Project Review II	 10 marks
Project Review I	 10 marks

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.

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

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

*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:

- 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 $2 / 3 / 3\frac{1}{2} / 4$ 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 $2 / 3 / 3\frac{1}{2} / 4$ 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).

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

ANNEXURE – I

CURRICULUM OUTLINE

1025 DIPLOMA IN PRODUCTION ENGINEERING (FULL TIME)

III Semester

		HOURS PER WEEK			
SUBECT CODE	SUBJECT	Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours
4020310	Strength of Materials*	5	-	-	5
4020320	Manufacturing Technology – I*	5	-	-	5
4025330	Material science and Technology	5	-	-	5
4025340	Engineering Metrology	5			5
4020350	Machine Drawing and CAD Practical*	-	2	2	4
4020360	Manufacturing Technology – I Practical*	-	-	4	4
4025370	Metrology and Metallography Practical	-	-	4	4
		20	2	10	32
Extra / Co	-Curricular activities				
Physical Education					2
	Library	-	-	-	1
TOTAL					35

* COMMON WITH MECHANICAL ENGINEERING BRANCH

COMMON WITH MECHANICAL ENGINEERING BRANCH

IV Semester

		HOURS PER WEEK			
CODE	SUBJECT	Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours
4020410	Fluid Mechanics and Fluid Power*	5	-	-	5
4020420	Manufacturing Technology - II*	5	-	-	5
4020430	Electrical Drives & Controls*	5	-	-	5
4025440	Advanced Manufacturing Technology	5	-	-	5
4020450	Strength of Materials and Fluid Mechanics Practical*	-	-	4	4
4020460	Manufacturing Technology - II Practical*	-	-	4	4
4020470	Electrical Drives & Control Practical*	-	-	4	4
		20	-	12	32
Extra / Co	-Curricular activities				
Physical Education					2
Library				-	1
TOTAL					35

* COMMON WITH MECHANICAL ENGINEERING BRANCH

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V Semester

		HOURS PER WEEK					
CODE	SUBJECT	Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours		
4020510	Design of Machine Elements*	6	-	-	6		
4025520	Thermal Engineering	5	-	-	5		
Elective I Theory							
4020531	Computer Integrated Manufacturing*						
4025532	Mechanical Instrumentation	5	-	-	5		
4020533	Mechatronics*						
4020540	Process Automation Practical*	-	-	4	4		
4025550	Thermal Engineering and IC Engines Practical	-	-	4	4		
Elective I	Practical						
4020561	Computer Integrated Manufacturing Practical*						
4025562	Mechanical Instrumentation Practical	-	-	4	4		
4020563	Mechatronics Practical*						
4020570	Entrepreneurship & Startup Practical **	4	-	-	4		
		20	-	12	32		
Extra / Co-Curricular activities							
	Physical Education	-	-	-	2		
	Library	-	-	-	1		
	TOTAL						

* COMMON WITH MECHANICAL ENGINEERING BRANCH

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VI Semester

SUBECT		HOURS PER WEEK					
CODE	SUBJECT	Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours		
4020610	Industrial Engineering Management*	6	-	-	6		
4020620	E-Vehicle Technology & Policy #	4	-	-	4		
Elective I	Theory						
4025631	Tool Design						
4020632	Refrigeration and Air Conditioning*	5	-	-	5		
4025633	Oil Hydraulics and Pneumatics						
4020640	Solid Modelling Practical*	-	-	6	6		
Elective II Practical							
4025651	Tool Design Practical						
4020652	Refrigeration and Air Conditioning Practical*	-	-	5	5		
4025653	Oil Hydraulics and Pneumatics Practical						
4025660	Project Work and Internship	-	-	6	6		
		15	-	17	32		
Extra / Co-Curricular activities							
Physical Education							
Library							
TOTAL							

- * COMMON WITH MECHANICAL ENGINEERING BRANCH
- # COMMON WITH MECHANICAL ENGINEERING BRANCH
- ** COMMON FOR ALL BRANCHES

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

ANNEXURE – II

SCHEME OF EXAMINATION

1025 DIPLOMA IN PRODUCTION ENGINEERING (FULL TIME)

III Semester

		EXAMINATION MARKS			Min.	
SUBECT CODE	SUBJECT	Internal Assessment Marks	Board Exam Marks	Total Marks	Marks for PASS	Exam Hours
4020310	Strength of Materials*	25	100*	100	40	3
4020320	Manufacturing Technology – I*	25	100*	100	40	3
4025330	Material science and Technology	25	100*	100	40	3
4025340	Engineering Metrology	25	100*	100	40	3
4020350	Machine Drawing and CAD Practical*	25	100*	100	50	3
4020360	Manufacturing Technology – I Practical*	25	100*	100	50	3
4025370	Metrology and Metallography Practical	25	100*	100	50	3

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

- * COMMON WITH MECHANICAL ENGINEERING BRANCH
- **# COMMON WITH MECHANICAL ENGINEERING BRANCH**
- ** COMMON FOR ALL BRANCHES

IV Semester

		EXAMINATION MARKS			Min.	
SUBECT CODE	SUBJECT	Internal Assessment Marks	Board Exam Marks	Total Marks	Marks for PASS	Exam Hours
4020410	Fluid Mechanics and Fluid Power*	25	100*	100	40	3
4020420	Manufacturing Technology - II*	25	100*	100	40	3
4020430	Electrical Drives & Controls*	25	100*	100	40	3
4025440	Advanced Manufacturing Technology	25	100*	100	40	3
4020450	Strength of Materials and Fluid Mechanics Practical*	25	100*	100	50	3
4020460	Manufacturing Technology - II Practical*	25	100*	100	50	3
4020470	Electrical Drives & Control Practical*	25	100*	100	50	3

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

* COMMON WITH MECHANICAL ENGINEERING BRANCH

- **# COMMON WITH MECHANICAL ENGINEERING BRANCH**
- ** COMMON FOR ALL BRANCHES

V Semester

		EXAMINATION MARKS			Min.		
SUBECT CODE	SUBJECT	Internal Assessment Marks	Board Exam Marks	Total Marks	Marks for PASS	Exam Hours	
4020510	Design of Machine Elements	25	100*	100	40	3	
4025520	Thermal Engineering	25	100*	100	40	3	
Elective I Theory							
4020531	Computer Integrated Manufacturing						
4025532	Mechanical Instrumentation	25	100*	100	40	3	
4020533	Mechatronics						
4020540	Process Automation Practical	25	100*	100	50	3	
4025550	Thermal Engineering and IC Engines Practical	25	100*	100	50	3	
Elective I	Practical						
4020561	Computer Integrated Manufacturing Practical						
4025562	Mechanical Instrumentation Practical	25	100*	100	50	3	
4020563	Mechatronics Practical						
4020570	Entrepreneurship & Startup Practical #	25	100*	100	40	3	

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

* COMMON WITH MECHANICAL ENGINEERING BRANCH

COMMON WITH MECHANICAL ENGINEERING BRANCH

VI Semester

		EXAMINATION MARKS			Min.		
SUBECT CODE	SUBJECT	Internal Assessment Marks	Board Exam Marks	Total Marks	Marks for PASS	Exam Hours	
4020610	Industrial Engineering Management	25	100*	100	40	3	
4020620	E-Vehicle Technology & Policy #	25	100*	100	40	3	
Elective II Theory							
4025631	Tool Design						
4020632	Refrigeration and Air Conditioning	25	100*	100	40	3	
4025633	Oil Hydraulics and Pneumatics						
4020640	Solid Modelling Practical	25	100*	100	40	3	
Elective II	Practical						
4025651	Tool Design Practical						
4020652	Refrigeration and Air Conditioning Practical	25	100*	100	40	3	
4025653	Oil Hydraulics and Pneumatics Practical						
4025660	Project Work and Internship	25	100*	100	40	3	

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

* COMMON WITH MECHANICAL ENGINEERING BRANCH

COMMON WITH MECHANICAL ENGINEERING BRANCH

EQUIVALENT PAPER "M SCHEME" TO "N SCHEME"

W.E.F OCTOBER 21							
	M SCHEME		N SCHEME				
SUBJECT CODE	NAME OF THE SUBJECT	SUBJECT CODE	NAME OF THE SUBJECT				
32031	Strength of Materials	4020310	Strength of Materials				
32032	Manufacturing Processes	4020320	Manufacturing Technology – I				
32033	Machine Drawing	4020350	Machine Drawing and CAD Practical				
32034	Computer Applications and CADPractical*	4020350	Machine Drawing and CAD Practical				
32035	Foundry and Welding Practical*	4020360	Manufacturing Technology – I Practical				
32036	Lathe and Drilling Practical	4020360	Manufacturing Technology – I Practical				
32037	Metrology and Metallography Practical*	4025370	Metrology and Metallograhy Practical				
W.E.F APR	IL 22						
32541	Engineering Metallurgy	4025330	Material science and Technology				
32141	Thermal Engineering	4020520	Thermal Engineering				
32043	Fluid Mechanics and Fluid Power	4020410	Fluid Mechanics and Fluid Power				
32044	Electrical Drives & Control	4020430	Electrical Drives & Controls				
32045	Strength of Materials and FluidMechanics Practical	4020450	Strength of Materials and Fluid Mechanics Practical				
32145	Thermal Engineering and IC Engines Practical	4025560	Thermal Engineering and IC Engines Practical				
32047	Electrical Drives & Control Practical	4020470	Electrical Drives & Control Practical				
W.E.F OCT	W.E.F OCTOBER 22						
32051	Design of Machine Elements*	4020510	Design of Machine Elements*				
32042	Special Machines*	4020420	Manufacturing Technology II				
32553	Engineering Metrology	4025340	Engineering Metrology				

Elective - I Theory							
32071	Total Quality Management*	No Equivale	nt Paper				
32572	Modern Machining Processes	No Equivale	nt Paper				
32573	Industrial Robotics	No Equivale	nt Paper				
32555	Metrology and Machine Tool Testing Practical	No Equivale	nt Paper				
32046	Special Machines Practical*	4020460	Manufacturing Technology II Practical				
30002	Life and Employability SkillsPractical **	40001	Communication skills practical				
W.E.F OCT	OBER 23						
32061	Industrial Engineering andManagement*	4025610	Industrial Engineering and Management*				
32062	Computer Aided Design and Manufacturing *	4020531	Computer Integrated Manufacturing				
Elective - I	ll Theory						
32581	Tool Design	4025631	Tool Design				
32582	Mechatronics	4020533	Mechatronics				
32583	Oil Hydraulics and Pneumatics	4025633	Oil Hydraulics and Pneumatics				
32584	Process Planning and Cost Estimation	No Equivale	nt Paper				
32064	Computer Aided Design and Manufacturing Practical*	4020561	Computer Integrated Manufacturing Practical*				
32055	Process Automation Practical	4020540	Process Automation Practical				
Elective - I	I Practical						
32585	Tool Design Practical	4025651	Tool Design Practical				
32586	Mechatronics Practical	4020563	Mechatronics Practical				
32587	Oil Hydraulics and Pneumatics Practical	4025653	Oil Hydraulics and Pneumatics Practical				
32588	Process Planning and Cost Estimation Practical	No Equivalent Paper					
32567	Project Work	4025660	Project Work and Internship				



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR III SEMESTER

4020310 - STRENGTH OF MATERIALS

CURRICULUM DEVELOPMENT CENTRE

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 : 4020310
- Semester : III
- Subject Title : Strength of Materials

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instr	ructions		Examination		
4020310	Hours /	Hours /		Marks		
1020010	nours /	1100137	Internal	Board		Duration
Strength of	Week	Semester	Assessment	Examinations	Total	
Materials	5	80	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	Engineering Materials	15
II	Deformation of Metals	15
	Geometrical Properties of Sections and Thin Shells	15
IV	Theory of Torsion and Springs	14
V	SF and BM Diagrams of Beams and Theory of Bending	14
	Test and Model Exam	7
	Total	80

RATIONALE:

Day by day, engineering and technology experience tremendous growth. Design plays a major role in developing engineering and technology. Strength of material is backbone for design. The strength of material deals generally with the behaviour of objects, when they are subject to actions of forces. Evaluations derived from these basic fields provide the tools for investigation of mechanical structure.

OBJECTIVES

- Acquire knowledge about materials properties.
- Calculate the deformation of materials, which are subjected to axial load and shear.
- Determine the moment of Inertia of various sections used in industries.
- Estimate the stresses induced in thin shells.
- Draw the shear force and bending moment diagram of the beam for different load.

4020310 STRENGTH OF MATERIALS DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	ENGINEERING MATERIALS	
	Chapter: 1.1: Engineering materials: Classification - definition of	7
	Mechanical properties - ferrous metals - cast iron - uses - advantages -	
	types of cast iron - properties and applications - effect of impurities on	
	cast iron. steel - classification - alloying elements - purpose of alloying -	
	effect of alloying elements on steel - uses of steels - properties of mild	
	steel - defects in steel - applications - properties of hard steel - market	
	forms of steels – nonferrous metals - properties and uses.	
	Chapter: 1.2: Mechanical testing of materials:	
	Compression test - bend test - hardness test - Brinell hardness test,	6
	Vickers hardness test, Rockwell hardness test - impact test - fatigue test	
	- creep test. Tensile test of mild steel in UTM - stress strain diagram -	

	limit of proportionality - elastic limit - yield stress - breaking stress -	
	ultimate stress - percentage of an elongation and percentage reduction in	
	area - problems.	
	Chapter: 1.3: Friction	
	Introduction - definition - force of friction - limiting friction - static friction -	2
	dynamic friction - angle of friction - coefficient of friction - laws of static	
	and dynamic friction. Description only.	
II	DEFORMATION OF METALS	
	Chapter: 2.1: Simple stresses and strains	4
	Definition - load, stress and strain - classification of force systems:	
	tensile, compressive and shear force systems. 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 forces - simple problems in tension,	
	compression and shear forces.	
	Chapter: 2.2: Elastic constants	7
	Definition - lateral strain – poison's ratio - volumetric strain - bulk	
	modulus - volumetric strain of rectangular and circular bars - problems	
	connecting linear, lateral and volumetric deformations - elastic constants	
	and their relationship - problems on elastic constants. Composite bar -	
	definition - problems in composite bars subjected to tension and	
	compression. Temperature stresses and strains - simple problems.	
	Chapter: 2.3 Strain Energy	4
	Definition – proof resilience – modulus of resilience – the expression for	
	strain energy stored in a bar due to axial load - instatntaneous stresses	
	due to gradual, sudden, impact and shock loads - problems computing	
	instantaneous stress and deformation in gradual, sudden, impact and	
	shock loadings.	
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	
	Chapter: 3.1: Properties of sections	8
	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 –	
	parallel axis theorem and perpendicular axis theorem (statement only).	
	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.	
	Chapter: 3.2: Thin Shells	7
	Definition - Thin and thick cylindrical shell - Failure of thin cylindrical	
	shell subjected to internal pressure – Derivation of Hoop and longitudinal	
	stress causes in a thin cylindrical shell subjected to internal pressure -	
	simple problems - change in dimensions of a thin cylindrical shell	
	subjected to internal pressure - problems - Derivation of tensile stress	
	induced in a thin spherical shell subjected to internal pressure - simple	
	problems – change in diameter and volume of a thin spherical shell due	
	to internal pressure – problems.	
IV	THEORY OF TORSION AND SPRINGS	
	Chapter: 4.1: Theory of Torsion	7
	$\frac{T}{T} = \frac{f_s}{f_s} = \frac{C\theta}{C\theta}$	
	Assumptions – torsion equation $J R l$ - Strength of solid and	
	hollow shafts – power transmitted – Definition – Polar modulus –	
	Torsional rigidity - strength and stiffness of shafts - comparison of	
	hollow and solid shafts in weight and strength considerations -	
	Advantages of hollow shafts over solid shafts – Problems.	
	Chapter: 4.2: Springs	7
	Types of springs – Laminated and coiled springs and applications —	
	Difference between open and closely coiled helical springs - closely	
	coiled helical spring subjected to an axial load – problems to determine	
	shear stress, deflection, stiffness and resilience of closed coiled helical	
	springs.	
V	SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING	
	Chapter: 5.1: SF and BM diagrams	7
	Classification of beams – Definition – shear force and Bending moment –	
	Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment – types of	

loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (UDL) – Determination of Maximum bending moment in cantilever beam and simply supported beam when they are subjected to point load and uniformly distributed load.

Chapter: 5.2: Theory of bending

7

Theory of simple bending – Assumptions – Neutral axis – bending stress distribution – moment of resistance – bending equation – M/I=f/y=E/R – Definition – section modulus - rectangular and circular sections – strength of beam – simple problems involving flexural formula for cantilever and simply supported beam.

Reference Books:

- 1. Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi.
- Strength of Materials, S. Ramamrutham, 15th Edition 2004, DhanpatRai Pub. Co., New Delhi.
- Strength of Materials, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
- 4. Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 9780070668959,
- 5. Strength of Materials, B K Sarkar, I Edition, 2003Tata Mcgraw hill, New Delhi.
- Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2nd Edition, 2007.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR III SEMESTER

4020320 - MANUFACTURING TECHNOLOGY - I

CURRICULUM DEVELOPMENT CENTRE

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 : 4020320
- Semester : III
- Subject Title : Manufacturing Technology I

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Subject Instructions Examination			
4020320	Hours	Hours /		Marks		
Manufacturing	nouis		Internal	Board		Duration
	/ Week	Semester	Assessment	Examinations	Total	
Technology - I	5	80	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	Casting Processes	15
II	Joinng Processes	15
	Bulk Deformation Processes and Heat Treatment	15
IV	Manufacturing of Plastic Componenets and Powder Metalurgy	15
V	Centre Lathe and Special Purpose Lathe	13
	Test and Model Exam	7
	Total	80

RATIONALE:

Manufacturing, the major and the most important aspect in industries needs utmost care and attention. Knowledge about various processes and allied areas will be of great use to the personnel involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJECTIVES:

- Acquire Knowledge about types of pattern, casting, and moulding.
- Describe the various casting processes.
- Knowledge about various welding process and its working principle.
- Appreciate the safety practices used in welding.
- Acquire knowledge about various forming technologies.
- Knowledge about the lathe and its working parts.
- Describe the functioning of semi-automatic lathes.

4020320 MANUFACTURING TECHNOLOGY - I DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	CASTING PROCESSES	
	Chapter: 1.1: Patterns	3
	Definition - pattern materials - factors for selecting pattern materials -	
	Types of Pattern - solid piece, split patterns, loose piece, match plate,	
	sweep, skeleton, segmental, shell – pattern allowances – core prints.	
	Chapter: 1.2: Moulding	6
	Definition – moulding boxes, moulding sand – ingredients – silica – clay	
	- moisture and miscellaneous materials - properties of moulding sand -	
	sand additives – moulding sand preparation - moulding tools – mixing –	
	tempering and conditioning - types of moulding - green sand - dry sand	
	- machine moulding -Top and bottom squeezer machines - Jolting	
	machines – sand slinger- core – CO2 core making – types of core – core	
	boxes.	

	Chapter: 1.3: Casting	6
	Definition sand casting using groon sand and dry sand gravity die	0
	casting prossure dia casting bot and cold chamber processes	
	contributed casting continuous casting chilled casting malleable	
	centing a casting - continuous casting - chiled casting - maleable	
	metals are single furness malting of stack are furnesses induction	
	metals – crucible rumace melting of steel - arc rumaces – induction	
	therme electric purchaster electrics of easting turnhling tripping	
	thermo electric pyrometer – cleaning of casting – tumbling, trimming,	
	sand and shot blasting – defects in casting – causes and remedies –	
	safety practices in foundry.	
II	JOINING PROCESSES	
	Chapter: 2.1: Arc Welding	5
	Definition – arc welding equipment – arc welding methods – carbon arc,	
	metal arc, Metal Inert gas (MIG), Tungsten inert gas (TIG), Atomic	
	hydrogen, Plasma arc, Submerged arc and Electro slag welding.	
	Chapter: 2.2: Gas welding	10
	Definition Gas Welding Equipment- Oxy and acetylene welding - Three	
	types of flame- resistance welding - classification of resistance welding	
	 butt – spot – seam – projection welding – welding related processes – 	
	oxy and acetylene cutting - arc cutting - hard facing bronze welding -	
	soldering and brazing special welding processes - cast iron welding -	
	thermit welding - solid slate welding, ultrasonic, diffusion and explosive	
	welding - explosive cladding - modern welding, electron beam and laser	
	beam welding - types of welded joints - merits and demerits of welded	
	joints - inspection and testing of welded joints - destructive and	
	nondestructive types of tests - magnetic particle test - radiographic and	
	ultrasonic test defects in welding - causes and remedies - safety	
	practices in welding .	
	BULK DEFORMATION PROCESSES AND HEAT TREATMENT	
	Chapter: 3.1: Forming	7
	Hot working, cold working - advantages of hot working and cold	
	working- hot working operations - rolling, forging, smith forging, drop	

	Centre lathe: specifications – simple sketch with principal parts. Head	
	Chapter: 5.1: Centre Lathe	5
V	CENTRE LATHE AND SPECIAL PURPOSE LATHES	
	rules for the power metallurgy process.	
	mechanical properties of parts made by powder metalluray – design	
	electrolysis deposition – compacting – sintering – sizing – infiltration –	
	Methods of manufacturing metal nowders - atomization reduction and	0
	Chanter: 4 3: Powder Metallurov	6
	Design consideration for plastic components	
	mulding of thermosetting materials calendaring and retational moulding	
	neciprocating screw injection - details of injection mould - structural foam	
	extruders and types-injection moulding types : Plunger type	
	Extrusion-general reatures of single screw extrusion - twin screw	
	Unapter: 4.2: Processing of Plastics	б
	structural toam, elastomers - polymer alloys and liquid crystal polymers.	C
	i ypes of plastics-Engineering plastics – thermosets – composite -	
	Chapter: 4.1: Plastic Components	3
	METALLURGY	~
IV	MANUFACTURING OF PLASTIC COMPONENTS AND POWDER	
	hardening and flame hardening.	
	hardening – pack carburizing – cyaniding – nitriding – induction	
	- quenching medium - different types and their relative merits - case	
	annealing – isothermal annealing – normalizing – hardening – tempering	
	full annealing – process annealing stress relief annealing - spherodising	
	various heat treatment processes - Iron - carbon equilibrium diagram -	
	Heat treatment processes - purpose - procedures - applications of	
	Chapter: 3.2: Heat treatment	8
	trimming – notching – lancing.	
	bending – curling – drawing – shearing operations – blanking, piercing,	
	accessories - press working operations - bending operations - angle	
	of presses - Mechanical and Hydraulic presses - press tool and	
	forging, upset forging, press forging – roll forging Press working : Types	

stock: back geared type - all geared type - description only. Working	
principale of tumbler gear mechanism, quick change gear box, apron	
mechanism, carriage cross slide. Feed mechanism: automatic feed,	
longitudinal feed and cross feed. Construction and working of tail stock.	
work holding device: face plate - three jaw chuck - four jaw chuck -	
catch plate and carrier - center. Operations: straight turning - step	
turning - taper turning - knurling-Thread cutting - Facing - Boring -	
chamfering. Cutting speed – feed - depth of cut.	
Chapter: 5.2: Semi-Automatic Lathes	4
Types of semi-automatic lathes - capstan and turret lathes - difference	
between turret and capstan.	
Chapter: 5.3: Automatic Lathes	4
Automatic lathe - Construction and working principle of single spindle	
automatic lathe - automatic screw cutting machines - multi spindle	
automatic lathes.	

Reference Books:

- Elements of workshop Technology Volume I & II Hajra Chowdry & Bhattacharaya - IIth Edition - Media Promoters & Publishers Pvt. Ltd., Seewai Building `B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
- Introduction of basic manufacturing processes and workshop technology Rajendersingh – New age International (P) Ltd. Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi – 110002.
- 3. Manufacturing process Begeman 5th Edition -McGraw Hill, New Delhi 1981.
- Workshop Technology- WAJ Chapman Volume I, II, & III Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
- 5. Workshop Technology Raghuwanshi Khanna Publishers. Jain & Gupta,
- Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi 110 006 - 2006
- Production Technology P. C. SHARMA Edn. X S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 - 2006
- Production Technology HMT Edn. 18 published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008. – 2001.


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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR III SEMESTER

4025330 - MATERIAL SCIENCE AND TECHNOLOGY

CURRICULUM DEVELOPMENT CENTRE

ANNEXURE-I

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

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025330
- Semester : III

Subject Title : MATERIAL SCIENCE AND TECHNOLOGY

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instru	uctions Examination				
Subject	Hours /	Hours /		Marks		Duration
	Week	Semester	Internal Board Assessment Examinations		Total	
MATERIAL						
SCIENCE AND	5	80	25	100*	100	3 Hrs.
TECHNOLOGY						

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

Topics and Allocation of Hours

UNIT	Торіс	Hrs.
I	Structure of Solids	14
	Phase Diagrams, Ferrous Metals & Its Alloys	17
	Non-Ferrous Metals & Its Alloys	14
IV	Failure Analysis & Testing of Materials	14
V	Corrosion & Surface Engineering	14
	Test & Model Exam	7
	Total	80

RATIONALE:

The Production Engineering students should have sound knowledge about materials which are used for engineering applications. So, the student should know the type of metals & its alloy, how to test and analyze the materials, how to protect the material from corrosion and also how to improve the surface textures of the material.

OBJECTIVES:

At the end of the study of Semester the student will be able to

- Acquire knowledge about atomic structure
- Learn the basics and types of crystal structure of solids
- Learn the classification and types of bonds in solids
- Draw the production flow diagram of iron and steel.
- List the classifications of Iron and Steel
- Describe the types of C.I and its properties
- Explain the types of steel and their properties
- Specify Steel as per AISI
- Describe the properties and uses of Aluminium, Copper and its alloys
- Describe the alloys of copper and Aluminium
- State the commercial grades of Non-Ferrous metals/alloys as per ASME
- Describe the types of cutting tool materials and their applications
- Define Failure analysis and describe various types of fracture
- Explain creep and fatigue and their characteristics
- Describe the basic testing carried out on materials
- State the importance of testing of materials
- Define corrosion, state its characteristics and explain the importance of control
- List the factors affecting corrosion and explain types of corrosion
- Describe the basics of various coating and surface treatment methods

DETAILED SYLLABUS

Contents: Theory					
Unit	Name of the Topics	Hours			
I	STRUCTURE OF SOLIDS				
	Chapter: 1.1:	8			
	Crystal Structure: Introduction to Atomic Structure – Crystal Structure:				
	Unit Cell and Space Lattice – Crystal System: The seven basic crystal				
	systems – Crystal structure for Metallic Elements: BCC, FCC and HCP –				
	Coordination Number for Simple Cubic, BCC and FCC – Atomic Radius:				
	Definition, Atomic radius for Simple Cubic, BCC and FCC - Atomic				
	Packing Factor for Simple Cubic, BCC, FCC and HCP – Simple problems				
	on finding number of atoms for a unit cell.				
	Chapter: 1.2:	6			
	Bonds in Solids: Classification: Primary or Chemical Bond, Secondary or				
	Molecular Bond – Types of Primary Bonds: Ionic, Covalent and Metallic				
	Bonds – Types of Secondary Bonds: Dispersion Bond, Dipole Bond and				
	Hydrogen Bond.				
	PHASE DIAGRAMS, FERROUS METALS & ITS ALLOYS				
	Chapter: 2.1:	6			
	Phase Diagrams Isomorphous, Eutectic and Eutectoid systems –				
	Iron Carbon binary diagram Iron and Carbon Steels: Introduction – Flow				
	sheet for production of Iron and Steel – Iron Ores – Pig Iron: Classification,				
	Composition and Effects of impurities on Iron – Cast Iron: Classification,				
	Composition, Properties and Uses – Wrought Iron: Properties,				
	Uses/Applications of Wrought Iron.				
	Chapter: 2.2:	5			
	Steel - Classification of Carbon Steels: Low Carbon Steel, Medium				
	Carbon Steel and High Carbon Steel – Composition, Properties and Uses				
	- Comparison of Cast iron, Wrought Iron and Mild Steel and High Carbon				
	Steel or Hard Steel – Standard Commercial grades of Steel as per AISI.				
	Chapter: 2.3:	6			
	Ferrous Alloys: Alloy Steels – Purpose of alloying – Effects of alloying				
	elements - Important Alloy Steels: Silicon Steel, High Speed Steel (HSS),				

Heat Resisting Steel, Spring Steel, Stainless Steel (SS): Types of SS,	
Applications of SS - Magnet Steel – Composition, Properties and Uses.	
NON-FERROUS METALS & ITS ALLOYS	
Chapter: 3.1:	8
Non-Ferrous Metals & Alloys : Properties and uses of Aluminium,	
Copper, Tin, Lead, Zinc, Magnesium and Nickel. Copper Alloys: Brasses,	
Bronzes – Composition, properties and uses. Aluminium Alloys:	
Duralumin, Hindalium, Magnelium – Composition, properties and uses.	
Nickel Alloys: Inconel, Monel, Nichrome - Composition, properties and	
uses. Anti-friction / Bearing Alloys: Various types of Bearing Bronzes.	
Standard commercial grades as per ASME.	
Chapter: 3.2:	6
Cutting Tool Materials: Characteristic of ideal Cutting Tool Materials	
- Types: Carbon Steels, Medium alloy steel - HSS - Stellites - Cemented	
Carbide – CBN – Diamond and Abrasives. Various standards available for	
selection of ferrous and non- ferrous materials.	
FAILURE ANALYSIS & TESTING OF MATERIALS	
Chapter: 4.1:	7
Failure Analysis: Introduction to failure analysis - Fracture: ductile	
fracture, brittle fracture - Cleavage - Notch sensitivity - Fatigue -	
Endurance limit – Characteristics of fatigue fracture – Variables affecting	
fatigue life – Creep – Creep curve – Creep fracture. (Descriptive treatment	
only).	
Chapter: 4.2:	7
Testing of Materials: Destructive Testing: Tensile Testing – Compression	
Testing – Hardness Testing: Brinell, Rockwell, Scleroscope and Mohrs	
Test – Bend test – Torsion test – Fatigue test – Creep test. Non-destructive	
testing: - Visual Inspection –Magnetic Particle inspection – Liquid	
penetrant test – Ultrasonic inspection, Radiography (Descriptive treatment	
only).	
	 Heat Resisting Steel, Spring Steel, Stainless Steel (SS): Types of SS, Applications of SS - Magnet Steel – Composition, Properties and Uses. NON-FERROUS METALS & ITS ALLOYS Chapter: 3.1: Non-Ferrous Metals & Alloys : Properties and uses of Aluminium, Copper, Tin, Lead, Zinc, Magnesium and Nickel. Copper Alloys: Brasses, Bronzes – Composition, properties and uses. Aluminium Alloys: Duralumin, Hindalium, Magnelium – Composition, properties and uses. Nickel Alloys: Inconel, Monel, Nichrome – Composition, properties and uses. Anti-friction / Bearing Alloys: Various types of Bearing Bronzes. Standard commercial grades as per ASME. Chapter: 3.2: Cutting Tool Materials: Characteristic of ideal Cutting Tool Materials – Types: Carbon Steels, Medium alloy steel – HSS – Stellites – Cemented Carbide – CBN – Diamond and Abrasives. Various standards available for selection of ferrous and non- ferrous materials. FAILURE ANALYSIS & TESTING OF MATERIALS Chapter: 4.1: Failure Analysis: Introduction to failure analysis – Fracture: ductile fracture, brittle fracture – Cleavage – Notch sensitivity – Fatigue – Endurance limit – Characteristics of fatigue fracture. (Descriptive treatment only). Chapter: 4.2: Testing of Materials: Destructive Testing: Tensile Testing – Compression Testing – Hardness Testing: Brinell, Rockwell, Scleroscope and Mohrs Test – Bend test – Torsion test – Fatigue test – Creep test. Non-destructive testing: - Visual Inspection – Magnetic Particle inspection – Liquid penetrant test – Ultrasonic inspection, Radiography (Descriptive treatment only).

V	CORROSION & SURFACE ENGINEERING	
	Chapter: 5.1:	7
	Corrosion: Nature of corrosion: Why corrosion occurs? Electrochemical	
	reactions, Electrolytes – Factors affecting corrosion: Environment,	
	Material properties and Physical conditions - Types of corrosion (eight	
	types) - Determination of corrosion characteristics. Corrosion control :	
	Material selection, Environment control and Design.	
	Chapter: 5.2:	
	Surface Engineering: Reasons for surface engineering - Surface	7
	engineering processes: Coatings and Surface treatments – Cleaning and	
	Mechanical finishing of surfaces – Organic coatings – Electroplating and	
	Special metallic plating – Electro-polishing and Photoetching – Conversion	
	coatings: Oxide, Phosphate and Chromate coatings – Thin film coatings:	
	PVD and CVD – Surface analysis – Hard-facing, Thermal spraying and	
	High-Energy processes – Process / Material selection. Pollution norms for	
	treating effluents as per standards.	

Reference Books

- 1. Introduction to Physical Metallurgy, Sydney Avner, Tata McGraw-Hill Education Private Ltd,
- 2. Material Science & Engineering, R.K.Rajput, S.K.Kataria & Sons, Delhi
- 3. Manufacturing Engineering Processes for Engg. Materials Serope Kalpakjian & Steven R.Schmid. Pearson Education Pvt. Ltd., New Delhi.
- A Text Book of Material Science & Metallurgy, O.P.Khanna, DhanpatRai Publications Pvt. Ltd., New Delhi
- 5. Engineering Materials: Properties and Selection, G.Budinski & K.Budinski, PHI, New Delhi
- 6. Material Science, R.S.Khurmi, S.Chand & Co. Ltd., New Delhi



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR III SEMESTER

4025340 - ENGINEERING METROLOGY

CURRICULUM DEVELOPMENT CENTRE

ANNEXURE-I

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

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025340
- Semester : III
- Subject Title : ENGINEERING METROLOGY

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instru	nstructions Examination				
Subiect	Hours /	M Hours /		Marks	Marks	
•	Week	Semester	InternalBoardAssessmentExaminations		Total	Duration
ENGINEERING METROLOGY	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	Торіс	Hrs.
I	Introduction to Metrology	14
II	Linear and Angular Measurement	14
	Form Measurement	15
IV	Measurement of Surface Finish	15
V	Advanced Metrology & Calibration	15
	Test & Model Exam	7
	Total	80

RATIONALE:

The aim is to provide sufficient training to the students to handle various linear and angular measuring instruments used in mechanical measurements. It also aims to provide sufficient skills to the students to handle alignment of machine tools during installations.

OBJECTIVES:

At the end of the study of Semester the student will be able to

- Use various linear and angular measuring instruments appropriate to the features of the components.
- Handle instruments related to form measurements.
- Design the gauges (GO / NO GO) to ensure the quality of the components.
- Develop the inspection procedure and schedule according to the components based on various standards.
- Develop calibration schedule for various instruments used in the shop floor as per national/ International standards.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	INTRODUCTION TO METROLOGY	
	Chapter: 1.1:	7
	Introduction : Necessity and Objectives of Metrology, Types of	
	Metrology, Need of Metrology; Units and standards; Generalised	
	measurement system - Elements of measuring system; Methods of	
	measurement.	
	Chapter: 1.2:	7
	Basic Metrology Standards : sensitivity, stability, range, Precision and	
	Accuracy - static and dynamic response; Errors - systematic and random	
	errors - Sources of Errors-correction; Selection and Care of instruments;	
	calibration.	
II	LINEAR AND ANGULAR MEASUREMENT	
	Chapter: 2.1:	8
	Linear Measurements : Vernier caliper, Vernier height gauge, Vernier	

	depth gauge, micrometer, Slip gauges and classification, - Tool Makers	
	Microscope- interferometry, optical flats, Comparators: limit gauges	
	Mechanical, pneumatic and electrical comparators, applications.	
	Chapter: 2.2:	6
	Angular Measurements: Sine bar, Sine center, Bevel Protractor, Auto	
	collimator, Angle Decker.	
	FORM MEASUREMENT	
	Chapter: 3.1:	5
	Screw Thread Measurement: Thread gauges, floating carriage	
	micrometer	
	Chapter: 3.2:	6
	Gear Tooth Thickness Measurement: constant chord and base tangent	
	method, using profile projector. Gleason gear testing machine - radius	
	measurements.	
	Chapter: 3.3:	4
	Surface Measurements: equipment and parameters, straightness,	
	flatness and roundness measurements.	
IV	MEASUREMENT OF SURFACE FINISH	
	Chapter: 4.1:	8
	Introduction to Surface Finish: Surface Texture; Methods of Measuring	
	Surface finish- Comparison Methods & Direct Instrument Measurement;	
	Sample Length.	
	Chapter: 4.2:	7
	Texture Measurement: Numerical Evaluation of Surface Texture;	
	Indication of Surface roughness Symbols used; Adverse effects of poor	
	surface finish.	
V	ADVANCED METROLOGY CALIBRATION	
	Chapter: 5.1:	6
	Metrology Integration: Universal Measuring machines; Use of Numerical	
	control for measurements - Precision instruments based on laser -	
	Principles - laser interferometer - application in measurements and	
	machine tool metrology.	

Chapter: 5.2:	4
Coordinate Measuring Machine (CMM): Definition, need, construction,	
types, application - computer aided inspection.	
Chapter: 5.3:	5
Calibration – Definition – calibration of Vernier Caliper, Vernier height	
gauge, Vernier depth gauge, Micrometer, Slip gauges as per standards.	

Reference Books

- 1. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
- Anand K Bewoor & Vinay A Kulkarni, "Metrology & Measurements", Tata McGraw-Hill Education Private Ltd, 2009
- 3. Gupta I.C, "Engineering Metrology", Dhanpat rai Publications, 2005
- 4. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR III SEMESTER

4020350 – MACHINE DRAWING AND CAD PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

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 : 4020350
- Semester : III

Subject Title : Machine Drawing and CAD Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Inst	ructions	Examination			
4020350	Hours	Hours /				
Machine Drawing and	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
CAD 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.

RATIONALE:

Mechanical Engineering Diploma Engineer is expected to possess a thorough understanding of drawing, which includes clear visualization and proficiency in reading and interpreting a wide variety of production drawing. Manufacturing of various parts start from the basic drawing of components. The assembly of components is also carried out from the drawing. So drawing is an important subject to be studied by the students to carry and complete the production and assembly process successfully.

OBJECTIVES:

- To learn the parts and assembly of the machine components.
- To appreciate the need for sectional view and types of sections.
- To draw sectional views.
- To practice manual drawing

- To use Computer Aided Drafting.
- To prepare geometrical model of various machine elements.
- To draw the different views of machine elements.
- To interpret the drawing in engineering field and illustrate three dimensional objects.

4020350 MACHINE DRAWING AND CAD PRACTICAL DETAILED SYLLABUS

Contents: Practical

PART-A: MANUAL DRAWING PRACTICE

Sectioning - sectional views – representation of sectional plane – hatching – inclination – spacing – hatching large areas – hatching adjacent parts - full section – half section – types of half sections – conventional representation of materials in section – Dimensioning.

Detailed drawings of the machine parts are given to students to assemble and draw any two views of the machine elements in the Drawing Sheet with dimensions. Front View /Full Section / Half SectionFront Viewand Top View / Left Side View / Right Side View.

PART-B: COMPUTER AIDED DRAFTING (CAD)

CAD applications – Hardware requirement – Software requirement – CAD screen interface – menus – Toolbars – types of co-ordinate system – Creating 2D objects – Using draw commands – Creating text – Drawing with precision – Osnap options – drafting settings – drawing aids – Fill, Snap, Grid, Ortho lines – Function keys – Editing and modify commands – Object selection methods – Erasing object – Oops – Cancelling and undoing a command – Copy – Move – Array – Offset – Scale – Rotate – Mirror – Break – Trim – Extend – Explode. Divide – Measure – stretch – Lengthen – Changing properties – Color – line types – LTscale – Matching properties – Editing with grips – Pedit – Ddedit – Mledit - Basic dimensioning – Editing dimensions – Dimension styles – Dimension system variables. Machine drawing with CAD. Creation of blocks – Wblock – inserting a block – Block attributes – Hatching – Pattern types – Boundary hatch – working with layers – Controlling the drawing display – Blipmode – View group commands – Zoom, redraw, regen,

regenauto, pan, viewers – Realtime zoom. Inquiry groups – calculating area – Distance – Time – Status ofdrawing – Using calculator. Plot

Detailed drawings of the machine parts are given to students to assemble and create two views of the machine elements in the CAD package with dimensions. Front View / Sectional Front View (Full Section / Half Section) and Top View / Left Side View / Right Side View.

EXERCISE:

Draw the Front View / Sectional Front View (Full Section / Half Section) and Top View / Left Side View / Right Side View for the following given part drawing of the components after assemble in the drawing sheet and CAD package.

- 1. Sleeve & Cotter joint
- 2. Screw jack
- 3. Plummer Block
- 4. Simple Eccentric
- 5. Machine Vice
- 6. Protected type flanged coupling

Reference Books:

- 1. A Textbook of Machine Drawing, Pritam Singh Gill, S.K.Kataria & Sons.
- 2. Machine Drawing, N.D.Bhatt, V.M.Panchal, Charoter Publishing House.
- Introducing Autocad 2010 and Autocad LT 2010, George Omura, Wiley India Pvt. Ltd.
- 4. A Textbook of Engineering Drawing, R.B.Gupta, Satya Prakasan, Technical India Publications.
- 5. Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi

Internal Mark Allocation

Note:

All the students should maintain the observation cum record note book / manual as per the regulation. The printout of the actual CAD output created by the student during practice should be pasted for every exercise in the observation cum record note work.

For every exercise, manual drawing sheet (Two views) should be submitted and evaluated for 50 Marks. (Front view – 30 Marks and Top view/Side view – 20 Marks). The average of the six exercises should be converted to 10 Marks.

Total	-	25 Marks
Attendance	-	05 Marks
Observation and Record work	-	10 Mark
Drawing Sheet (Six Exercise Average)	-	10 Mark

BOARD EXAMINATION

Note: All the exercises should be completed by Manual and CAD. All the exercise should be given for examination, the students are permitted to select by lot or the question paper from DOTE should be followed. Observation cum Record note book should be submitted during examination along with the drawing file. Part A and Part B should be completed for the examination.

PART A: Manual Drawing in the Drawing sheet

Draw the assemble Front View / Sectional Front View (Full Section / Half Section) for the given part drawing of the components in the drawing sheet.

PART B: Computer Aided Drafting in the CAD package

Create the assemble Front View / Sectional Front View (Full Section / Half Section) and Top View / Left Side View / Right Side View for the given part drawing of the components in any one of the CAD package.

DETAILLED ALLOCATION OF MARKS

Manual Drawing in Drawing	: 30 marks	
Assemble Front view	30	
Computer Aided Drafting		: 60 marks
Drafting	20	
Assembly	20	
Dimensioning	20	
Viva-voce		: 10 marks
Total		: 100 marks

LIST OF EQUIPMENT

(To accommodate a batch of 30 students in Practice / Board Examinations)

- 1. Personal computer 30 Nos.
- 2. Printer 1 No.
- 3. Required Software's: CAD Package Sufficient to the strength.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR III SEMESTER

4020360 – MANUFACTURING TECHNOLOGY – I PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

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 : 4020360
- Semester : III
- Subject Title : Manufacturing Technology I Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
4020360	Hours / Week	Hours /		Marks		
Manufacturing Technology - I		Semester	Internal Assessment	Board Examinations	Total	Duration
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:

- Identify the parts of a center lathe
- Identify the work holding devices
- Set the tools for various operations
- Operate the lathe and Machine a component using lathe
- Identify the tools used in foundry.
- Identify the tools and equipments used in welding
- Prepare sand moulds for different patterns.
- Perform welding operation to make different types of joints.
- Identify the different welding defects.
- Appropriate the safety practices used in welding

4020360 MANUFACTURING TECHNOLOGY - I PRACTICAL DETAILED SYLLABUS

Contents: Practical

Lathe: Study of Lathe parts and its fuctions – Operations - Plain Turning, Step Turning, Taper turning, Knurling, Thread cutting, Bushing, Ecentric Turning Foundry: Study of foundry - green sand – properties – patterns – Types - Solid Pattern - Stepped pulley, Bearing top, Gear wheel. Split Pattern - T Pipe, Bent Pipes, Dumbles - Loose Piece pattern – Dovetail – Core – Cores sand - Cylindrical core making

Welding Exercises

Arc welding principles and components - Arc Welding - Lap Joint - Butt Joint, T Joint, Corner joint. Gas welding equipments – components - Gas welding - Lap Joint, Butt Joint, T Joint, Corner Joint. Gas cutting - Spot Welding

Exercises

PART A – Lathe Exercises

Note: All Dimensions are in mm. All linear dimensions in \pm 0.5mm tolerance. All cylindrical dimensions in \pm 0.2mm tolerance.Estimate the cost of the job for following exercises for M.S. round rod with suitable raw material for the final size. Final job of the raw material should be retained for verification. (student wise or batch wise).

1. Prepare the specimen and make the Step turning & Taper turning as shown in figure using the Lathe.



2. Prepare the specimen and make the Step turning & Knurling as shown in figure using the Lathe.



3. Prepare the specimen and make the Step turning &BSW Thread cutting as shown in figure using the Lathe.



4. Prepare the specimen and make the Shaft and Bush as shown in figure using the Lathe.



5. Prepare the specimen and make the Step turning & BSW and Metric Thread cutting as shown in figure using the Lathe.



6. Prepare the specimen and make the Eccentric turning as shown in figure using the Lathe.



PART B – Exercises

- 1. Prepare the green sand moulding using any one Solid Pattern in the foundry.
- 2. Prepare the green sand moulding using any one Split Pattern in the foundry.
- 3. Prepare the green sand moulding using any one Loose Piece pattern in the foundry.
- Prepare the specimen and make the Lap joint by the Arc Welding (Both side welded). (Raw material 25mm X 6mm MS flat)
- 5. Prepare the specimen and make the corner joint by the Gas Welding. (Raw material 25mm X 3mm MS sheet)
- 6. Prepare the specimen and make the joint by the Spot welding.

BOARD EXAMINATION

Note:

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the exercises 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.

Part - A	:	55 marks
Procedure / Preparation	10	
Machining / Dimensions	35	
Finishing	10	
Part - B	:	40 marks
Procedure / Preparation	10	
Machining / Dimensions	25	
Finishing	5	
Viva voce	:	05 marks
Total	:	100Marks

DETAILED ALLOCATION OF MARKS

LIST OF EQUIPMENT

To accommodate a batch of 30 students in Practice / Board Examinations						
1. Center Lathe 4 ½ ' Bed length	– 10 No's					
2. 4 Jaw / 3 Jaw Chucks	 required Numbers 					
3. Chuck key (10 mm x 10 mm size)	– 10 No's					
4. Box spanner	– 1 No's					
5. Cutting Tool H.S.S ¼ " X ¼ " X 4 " long	– 10 No's					
6. Pitch gauge	– 5 Nos					
7. Vernier Caliper (0-25 and 25-50)	– 5 Nos each					
8. Micrometer, Inside and Outside(0-25 and 25-50)	- 5 each					
9. Vernier Height Gauge(300mm)	- 1 no					
10. Snap gauge	– 1 set					
11. Gear tooth Vernier	- 1 No					
12. Parallel Block	- 2 Nos					
13. Steel Rule (0-150)	– 10 Nos.					
14. Outside and Inside Calipers	- 10 Nos. each					
15. Thread gauge	– 5 Nos.					
16. Bevel Protractor	– 1 No					
17. Jenny Caliper	– 5 Nos.					
18. Dial Gauge with Magnetic Stand	– 5 Nos.					
19. Marking Gauge	– 10 Nos.					
20. Safety Glass	– 10 Nos.					
21. Arc welding booth	– 2 No's					
with oil /air cooledwelding transformer withacce	essories					
22. Gas welding unit (Oxygen and acetylene cylinder)	– 1 Set					
23. Flux	– 500 g					
24. Electrode 10 SWG	– 200 No's					
25. Face shield	– 3 No's					
26.Gas welding goggles	– 2 No's					
27. Leather Glows 18"	– 4 Set					
28. Flux chipping hammer	– 4 No's					
29. Spot welding machine	- 1 No					

30. Shovel	- 10 Nos
31. Rammer set	- 10 Nos
32. Slick	- 10 Nos
33. Strike-off bar	- 10 Nos
34. Riddle	- 10 Nos
35. Trowl	- 10 Nos
36. Lifter	- 10 Nos
37. Sprue pin	- 20 Nos
38.Brush	- 10 Nos
39. Vent rod	- 10 Nos
40. Draw spike	- 10 Nos
41.Gate cutter	- 10 Nos
42. Cope box	- 10 Nos
43. Drag box	- 10 Nos
44. Core box	- 10 Nos
45. Runner & riser	- 20 Nos
46. Moulding board	- 10 Nos
47. Patterns	- 5 Nos each



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR III SEMESTER

4025370 – METROLOGY AND METALLOGRAPHY PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

ANNEXURE- I

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

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025370
- Semester : III

Subject Title : METROLOGY AND METALLOGRAPHY PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instructions		Examination			
Subject	Hours /	Hours / Semester	Marks			
	Week		Internal Assessment	Board Examinations	Total	Duration
METROLOGY AND						
METALLOGRAPHY	4	64	25	100*	100	3 Hrs.
PRACTICAL						

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

RATIONALE:

The aim is to provide the knowledge and skills of various Measuring Instruments and also to increase the skills of measuring complicated parts. Metallography is also an another part to provide the sufficient knowledge about the behaviour of material structure and also increase the skills of using Optical Microscope.

OBJECTIVES:

- Familiarize about measuring techniques of Metrology instruments.
- Select the range of measuring tools.
- Obtain accurate measurements.
- Determine the least count of measuring instruments.

- Study the working principle of Microscope.
- Specimen preparation of ferrous and non-ferrous metals.
- Grinding, polishing and mounting of specimen.
- Non-destructive testing of metals for cracks.
- Crack detection Visual inspection, Die penetration method
- Prepare the record of work for the exercises.

DETAILED SYLLABUS

Contents: Practical

PART – A METROLOGY SECTION:

- 1. Introduction to linear measurement.
- 2. Introduction to angular measurement.
- 3. Introduction to geometric measurements.
- 4. Study of Least Count of measuring instruments.
- 5. Study of accuracy of instruments and calibration of instruments.
- 6. Study of Linear Measuring Instruments: Vernier Caliper, Micrometer, Inside Micrometer, Vernier Height gauge, Depth Gauge and Slip Gauge.
- Study of Angular Measuring Instruments Universal Bevel Protractor, Sine Bar.
- 8. Study of Geometric measurement Gear tooth Vernier, Thread Micrometer.

Exercises:

- 1. Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper.
- 2. Measure the diameter of a wire using micrometer and compare the result with digital micrometer
- 3. Measure the thickness of ground MS plates using slip gauges
- 4. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
- 5. Measure the angle of the machined surface using sine bar with slip gauges.
- 6. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
- 7. Measure the geometrical dimensions of spur gear.

PART – B METALLOGRAPHY SECTION:

- 1. To study the micro structure of the metals using Metallurgical Microscope.
- 2. Determine the micro structure of the ferrous and nonferrous metals.
- 3. Prepare the specimen to study the microstructure.
- 4. Conduct the liquid penetration test to find the crack.
- 5. Conduct magnetic particle test to find cracks.

Exercises:

- 1. Find the grain structure of the given specimen using the Metallurgical Microscope.
- 2. Prepare a specimen to examine the micro structure of the Ferrous and Nonferrous metal.
- 3. Detect the cracks in the specimen using Visual Inspection and ring test.
- 4. Detect of cracks in specimen using Die penetration test.
- 5. Detect the cracks in specimen using Magnetic particle test.

BOARD EXAMINATION

Note:

- 1. The students should be taught theory portion and proper training in all the exercises. All the portions should be completed before examinations.
- The students should maintain theory assignment, observation note book / manual and record notebook. The assignment and record note book should be submitted during the Board Practical Examinations.
- 3. 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. Two experiments will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- 4. All regular students appearing for first attempt should submit record notebook for the examination.
- 5. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- 6. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

Part A (METROLOGY SECTION)	50 Marks
Procedure / Least Count	15
Reading / Calculation	25
Result	10
Part B (METALLOGRAPHY SECTION)	45 Marks
Procedure	10
Preparation and observation	25
Result	10
Viva-voce	05 Marks
TOTAL	100 Marks

DETAILLED ALLOCATION OF MARKS

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

MODEL QUESTION PAPER

4025370 – METROLOGY AND METALLOGRAPHY PRACTICAL

Max. Marks: 100

Duration: 3 Hrs.

Part - A

1. Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper.

Part - B

2. Determine the micro structure of the ferrous.

LIST OF EQUIPMENTS

1.	Vernier Caliper	-	2 Nos.
2.	Digital Vernier Caliper	-	2 Nos.
3.	Dial Vernier Caliper	-	2 Nos.
4.	Micrometer	-	2 Nos.
5.	Digital Micrometer	-	2 Nos.
6.	Slip gauges	-	2 Nos.
7.	Universal bevel protractor.	-	2 Nos.
8.	Sine bar	-	2 Nos.
9.	Thread micrometer	-	2 Nos.
10	. Surface plate	-	2 Nos.
11	. Vernier height gauge	-	1No.
12	Metallurgical Microscope.	-	2 Nos.
13	Die penetration	-	2 Nos.
14	Magnetic particle test	-	1 No.
15	Abrasive belt grinder	-	1 No.
16	Polishing machine	-	1 No.
17	Mounting machine	-	1 No.
18	. Specimen	-	Sufficient quantity (Ferrous / Non-ferrous metals)
19	. Consumable	-	Sufficient quantity



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR IV SEMESTER

4020410 – FLUID MECHANICS AND FLUID POWER

CURRICULUM DEVELOPMENT CENTRE

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 : 4020410
- Semester : IV
- Subject Title : Fluid Mechanics and Fluid Power

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Instructions Examination			
4020410	Hours /	Hours /		Marks		
Fluid Mechanics	Week	Semester	Internal Assessment	Board Examinations	Total	Duration
and Fluid Power	5	80	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	Properties of Fluids & Fluid Pressure	12
11	Fluid Flow, Flow Through Pipes & Impact of Jet	17
	Hydraulic Turbines, Centrifugal Pumps & Reciprocating Pumps	16
IV	Hydraulic Systems	16
V	Pneumatic Systems	12
	Test and Model Exam	7
	Total	80

RATIONALE:

The purpose of this subject is to teach the students the fundamentals of engineering fluid mechanics in a very general manner so that they can understand the way that forces are produced and transmitted by fluids that are, first, essentially at rest and, second, in motion. This will allow them to apply the physical principles behind some of the most common applications of fluid mechanics in engineering.

OBJECTIVES:

- To study the basic fluid properties and types of flow;
- To understand the transmission of pressure in liquids and its application to hydraulics;
- To calculate hydrostatic forces on plane and curved submerged surfaces;
- To employ the concept of continuity of flow and use Bernoulli's equation to measure flow rate and velocity;
- To apply the momentum principle to liquids in jets and pipes.
- To understand the working of hydraulic machines like, turbines, pumps.
- To identify the various components of a Hydraulic & Pneumatic systems and select them for design of hydraulic and pneumatic circuits for Engineering applications.

4020410 FLUID MECHANICS AND FLUID POWER DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	PROPERTIES OF FLUIDS & FLUID PRESSURE	
	Chapter: 1.1: Properties of Fluids	4
	Fluid – definition-classification. Properties – density, specific gravity,	
	specific weight, specific volume, dynamic viscosity, kinematic viscosity,	
	surface tension, capillarity, vapour pressure and compressibility -	
	Problems	
	Chapter: 1.2: Fluid Pressure & Its Measurement	8
	Fluid Pressure – Hydrostatic law - Pressure head, Pascal's Law – proof -	

	applications - Hydraulic press- Hydraulic jack. Concepts of absolute,	
	vacuum, gauge and atmospheric pressures.	
	Pressure measurements – Simple U tube manometers and differential	
	manometers and their types – Problems - Bourdon tube pressure gauge.	
	Pressure sensor technologies - classification only.	
	Total Pressure, Centre of pressure on immersed bodies (flat vertical., flat	
	vertical) – Problems.	
II	FLUID FLOW, FLOW THROUGH PIPES & IMPACT OF JET	
	Chapter: 2.1: Fluid Flow	6
	Types of Fluid flow - Laminar, turbulent, steady, unsteady, uniform,	
	non-uniform, rotational, irrotational. Continuity equation, Bernoulli's	
	theorem - assumptions- derivation - applications and limitations -	
	Problems.	
	Venturimeter – Construction - working principle, coefficient of discharge -	
	derivation for discharge. Orificemeter - Construction working principle,	
	coefficient of discharge- derivation for discharge. Problems. Pitots Tube	
	 Construction and working principle only. 	6
	Chapter: 2.2: Flow through Pipes	
	Laws of fluid friction for Laminar and turbulent flow- Darcy's equation and	
	Chezy's equation for frictional losses - Problems. Minor Losses -	
	description. Hydraulic gradient line and Total energy line. Hydraulic	
	Power transmission through pipes – problems.	5
	Chapter: 2.3: Impact of Jet	
	Impact of jet on fixed vertical plate - Impact of jet on moving vertical flat	
	plates in the direction of jet - Impact of jet on a series of moving plates or	
	vanes - Problems on work done and efficiency.	
	HYDRAULIC TURBINES, CENTRIFUGAL PUMPS &	
	RECIPROCATING PUMPS	
	Chapter: 3.1: Hydraulic Turbines	4
	Classification of hydraulic turbines and their applications. Construction	
	and working principle of Pelton wheel, Francis and Kaplan turbine. Draft	
	tubes – types and construction, Concept of cavitation in turbines, Surge	
	tank and its need.	

	Chapter: 3.2: Centrifugal Pumps	6
	Construction - Principle of working. Types of casings and impellers.	
	Concepts of multistage. Priming and its methods. Manometric head, work	
	done, manometric, mechanical and overall efficiencies - problems	
	Chapter: 3.3: Reciprocating Pumps	6
	Construction, working principle and applications of single and double	
	acting reciprocating pumps. Discharge - Theoretical power required	
	coefficient of discharge – Problems	
	Concepts of slip - negative slip. Cavitation and separation. Use of air	
	vessel. Indicator diagram with effect of acceleration head and friction	
	head.	
IV	HYDRAULIC SYSTEMS	
	Chapter: 4.1: Introduction to Fluid power systems	4
	Fluid power systems - general layout - components of hydraulic &	
	Pneumatic systems. Practical applications of Fluid power systems.	
	Comparison - Advantages and limitations.	
	Chapter: 4.2: Components of Hydraulic systems	8
	Types, construction, working Principle and symbol of the following	
	components. Pump - vane, gear and piston pumps. Valves: Pressure	
	Control valves – pressure relief . valve, pressure reducing valve,	
	pressure unloading valve. Direction control valve - poppet valve, spool	
	valve, 3/2, 4/2 & 4/3 DC valves, sequencing valve.Flow control valve -	
	pressure compensated – non pressure compensated.Actuators – Linear	
	actuactors – single acting & double acting – rotory actuators – hydraulic	
	motors. Accessories – Intensifiers and Accumulators.	
	Chapter: 4.3: Hydraulic Circuits	4
	Double acting cylinder with Meter in, Meter out circuits, Pump unloading	
	cut, Bleed off circuit, sequencing circuit. Hydraulic circuits for milling	
	machine, shaping machine. Motion synchronisation circuit.	
V	PNEUMATIC SYSTEMS	
	Chapter: 5.1: Components of pneumatic systems	8
	Types, construction, working Principle and symbol of the following	
	components. Compressor - Reciprocating & Rotary Compressors.	
Valves. Pressure Control valves - pressure relief valve, pressure		
---	---	
regulating valves. Direction control valves - 3/2, 5/2 & 5/3 DC valves,		
sequencing valve.Flow control valve - throttle valves - shuttle valves-		
quick exhaust valves. Actuators - Linear actuactors - single acting &		
double acting – rotary actuators – air motors. Accessories FRL unit.		
Chapter: 5.2: Pneumatic Circuits		
Double acting cylinder with Meter in, Meter out circuits, speed control	4	
circuit and sequencing circuit		

Reference Books:

- A Textbook of Fluid Mechanics and Hydraulic Machines, R. K. Bansal, Laxmi Publications (P).,Ltd, New Delhi, 2010
- 2. Hydraulics and Fluid Mechanics, Modi P.N. and Seth, S.M. Standard Book House, New Delhi, 2013.
- 3. Fluid Power with Applications, Anthony Esposito,, Pearson Education 2005.
- 4. A Textbook of Fluid Mechanics, R. K Rajput, S.Chand & Co, New Delhi, 2019
- 5. Engineering Fluid Mechanics, Kumar K. L., Eurasia Publishing House (P) Ltd., New Delhi, 2016.
- 6. Oil Hydraulics Systems- Principles and Maintenance", Majumdar S.R., Tata McGraw- Hill, 2001.
- Hydraulic and Pneumatic Controls, Shanmugasundaram.K, Chand & Co, 2006



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR IV SEMESTER

4020420 - MANUFACTURING TECHNOLOGY - II

CURRICULUM DEVELOPMENT CENTRE

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 : 4020420
- Semester : IV
- Subject Title : Manufacturing Technology II

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		bject Instructions Examination			
	Hours	Hours /		Marks		
4020420	/ Week	Semester	Internal	Board	Total	Duration
Manufacturing	/ Week	Comester	Assessment	Examinations	TOLAI	
Technology - II	5	80	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	Theory of Metal Cutting, Drilling Machine & Abrasive	15
	Process	
II	Reciprocating Machines and Broaching	15
	Milling Machines and Gear Generating	14
IV	Unconventional Machining Processes	14
V	CNC Machine and CNC Programming	15
	Test and Model Exam	7
	Total	80

RATIONALE:

In the process of manufacturing we should possess adequate and through knowledge about the working of conventional as well as non-conventional machines. The topics included aim to inculcate in the students the skills of metal cutting, milling, grinding, CNC machines and other machining processes which are very much essential.

OBJECTIVES:

- Study the working of various machine tools: Planer, Shaper, Drilling and Slotter.
- Study the various work holding devices
- Study various types of milling cutter.
- Study the different types of grinders and grinding wheels.
- Study the broaching operation and their applications.
- Study the milling procedure for spur, helical and bevel gears.
- Study the various types of gear generating processes
- Study the use of non-conventional machining processes.
- Study the CNC machines working principle and its components.

4020420 MANUFACTURING TECHNOLOGY - II

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	THEORY OF METAL CUTTING, DRILLING MACHINE & ABRASIVE	
	PROCESS	
	Chapter: 1.1: Theory of metal cutting	4
	Introduction – orthogonal cutting – oblique cutting – single point cutting	
	tool - nomenclature - types of chips - chip breakers - cutting tool	
	materials - properties - tool wears - factors affecting tool life - cutting	
	fluids – functions – properties of cutting fluid.	
	Chapter: 1.2: Drilling machines	4
	Drills - flat drills - twist drills - nomenclature of twist drill - types of	

drilling machines – bench type – floor type – radial type – gang drill – multi spindle type – principle of operation in drilling – methods of holding drill bit – drill chucks – socket and sleeve – drilling operation – reaming, counter sinking, counter boring, spot facing, tapping and deep hole drilling.

Chapter: 1.3: Abrasive process

Types and classification – specifications – rough grinding – pedestal grinders - portable grinders – belt grinders. Precision grinding – cylindrical grinder – centerless grinders - surface grinder – tool and cutter grinder – planetary grinders – principles of operations – grinding wheels – abrasives – natural and artificial diamond wheels – types of bonds – grit, grade and structure of wheels – wheel shapes and sizes – standard marking systems of grinding wheels – selection of grinding wheel – mounting of grinding wheels – dressing and truing of wheels – balancing of grinding wheels.

RECIPROCATING MACHINES

Chapter: 2.1: Planer

Introduction – description of double housing planner – specifications – principles of operation – drives – quick return mechanism – feed mechanism - operations.

Chapter: 2.2: Shaper

Introduction – specifications – principles of operations – standard shaper – quick return mechanism – crank and slotted link – hydraulic shaper – feed mechanism – operations.

Chapter: 2.3: Slotter

Introduction - specifications – method of operation – whitworth quick return mechanism - feed mechanism – types of tools.

Chapter: 2.4: Broaching

Types of broaching machine – horizontal, vertical and continuous broaching – principles of operation – types of broaches – classification – broach tool nomenclature – broaching operations.

7

4

4

3

4

	MILLING MACHINES AND GEAR GENERATING PROCESSES	
	Chapter: 3.1: Milling machines	10
	Types – column and knee type, plain, vertical and universal milling	
	machines - principles of operation - specification of milling machines -	
	work holding devices - tool holding devices - arbor - stub arbor - spring	
	collet – adaptor. Milling cutters – cylindrical milling cutter - slitting cutter	
	 side milling cutter – angle milling cutter – T slot milling cutter – woodruff 	
	milling cutter - fly cutter - nomenclature of cylindrical milling cutter.	
	Milling operations - straddle milling - gang milling - vertical milling	
	attachment. Indexing plate - differential indexing - simple indexing and	
	compound indexing – simple problems.	
	Chapter: 3.2: Generating processes	4
	Gear shaper – gear hobbing – principle of operations only. Gear finishing	
	processes – burnishing – shaving – grinding and lapping – gear	
	materials.	
IV	UNCONVENTIONAL MACHINING PROCESSES	
	Chapter: 4.1: Mechanical energy based process	5
	Introduction – classification – process selection – advantages –	
	limitations – demerits of conventional processes. Mechanical energy	
	based process: Introduction – abrasive jet machining – metal removal	
	rate process parameters – water jet machining – hydrodynamic jet	
	machining – ultrasonic machining process – advantages – disadvantages	
	- applications - compare ultrasonic machining with traditional abrasive	
	machining.	
	Chapter: 4.2: Electrical energy based processes	5
	Introduction – electrical discharge machine (EDM) – flushing system in	
	EDM - tool (electrode) materials - tool wear - metal removal rate and	
	surface finish - factors affecting the metal removal rate - advantages -	
	disadvantages – applications – wire cut EDM , features of wire cut EDM	
	 difference between EDM and wire cut EDM. 	
	Chapter: 4.3: Thermal energy based processes	4
	Introduction – electron beam machining – laser beam machining – lasing	
	materials - machining applications of laser - plasma arc machining -	

	gases used in plasma arc machining - types of plasma arc torches -	
	advantages – disadvantages – applications.	
V	CNC MACHINE AND ITS COMPONENTS	
	Chapter: 5.1: CNC machines	5
	Numerical control - definition - working principle of a CNC system -	
	features of CNC machines - advantages of CNC machines - difference	
	between NC and CNC - construction and working principle of turning	
	centre - construction and working principle of machining centre -	
	machine axes conventions turning centre and machining centre - co-	
	ordinate measuring machine – construction and working principle.	
	Chapter: 5.2: Components of CNC machine	4
	Slide ways - requirement - types - friction slide ways and anti-friction	
	slide ways – linear motion bearing – recirculation ball screw – ATC – tool	
	magazine – feedback devices – linear and rotary transducers – encoders	
	 in process probing – tool material – tool inserts. 	
	Chapter: 5.3: CNC Programming	6
	Introduction – Cartesian coordinate system – Polar coordinate system –	
	Absolute and incremental positioning – Purpose of G and M codes. Basic	
	codes – basic CNC program. CNC turning program using linear	
	interpolation and circular interpolation. Machine control panel – Homing	
	position – Offset setting – Auto. CNC milling program using linear	
	interpolation and circular interpolation. Compensation – Machine control	
	panel – Home position – Work offset setting procedure – Tool offset .	

Reference Book:

- Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, Edn. 11, published by Media Promoters and Publishers Pvt. Ltd., Seervai Buildings `B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
- Production Technology, Jain & Gupta, Khanna Publishers, 2-B, North Market, Naisarak, New Delhi – 110 006 – 2006.
- Production Technology, HMT, Edn. 18, published by Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.

- 4. Manufacturing process, Myro N Begman, , Edn. 5, Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.
- 5. Workshop Tech Vol I,II, III, WAJ. Chapman, published by Viva Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
- Production processes, NITTTR, published by 5, Tata McGraw Hill Publishing Co. Ltd., West Patel Nagar, New Delhi 110 008.
- Principles of the manufacturing of Composite materials Suong V Hoa, DES tech publication. Inc, 439, North Duke street, Lancaster, Pennsylvania – 17602 U.S.A.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR IV SEMESTER

4020430 - ELECTRICAL DRIVES AND CONTROLS

CURRICULUM DEVELOPMENT CENTRE

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 : 4020430
- Semester : IV
- Subject Title : Electrical Drives and Control

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		ject Instructions Examination			
4020430	Hours	Hours /		Marks		
Electrical	/ Week	Semester	Internal Assessment	Board	Total	Duration
Drives and			Assessment	Examinations		
Control	5	80	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	Dc Circuits and Dc Machines	15	
II	Ac Circuits and Ac Machines	15	
	Special Machines & Drives	15	
IV	Power Supplies, Control Elements and Electrical Safety	14	
V	Display Devices, Logic Gates and PLC	14	
Test and Model Exam			
	Total	80	

RATIONALE:

The automation is being the order of the day to improve the production with high quality consciousness. Such automation involves electrically operated switches, sensors controlled through electrically driven motors and actuators. The subject aims in introducing the basic electrical DC and AC circuits and motors and also focuses on the various special control devices like stepper, servo drives and its controlling elements.

OBJECTIVES:

- Explore fundamental electric circuit laws.
- Explain the working principle of DC and AC Electrical machines.
- Identify the effective uses of drives of Electrical machines.
- Analyze the various power supply circuits.
- Select the field controlled elements.
- Explain the construction and working of Transformer.
- Compare the different types of Logic gates.
- Appreciate the safety practices followed in Electrical system.
- Compare the use of servo motors and stepper motors in electrical driving system
- Identify PLC Input outputs.
- Identify the use of Control elements.

4020430 ELECTRICAL DRIVES AND CONTROL DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	DC CIRCUITS AND DC MACHINES	
	Chapter: 1.1:	7
	Definition- Electric Current, Voltage and Resistance -Ohm's law and	
	Kirchoff's law. Resistance in series, parallel and series parallel –	
	simple problems - Electromagnetism (definitions only) – Magnetic	
	flux, Fluxdensity, Magnetic field intensity, MMF, Permeability,	

	Reluctance, Faraday's law of Electromagnetic induction, Electrical	
	and Mechanical units.	
	Chapter: 1.2:	8
	DC Generators – Construction, Principle of operation and	
	Applications. DC Motors: - Construction, Principle of operation and	
	Applications.	
	Necessity of starters: Three point, four point starters.	
II	AC CIRCUITS AND AC MACHINES	
	Chapter: 2.1:	7
	Fundamentals of AC voltage, and current – Peak, Average, RMS	
	value of sine wave, frequency, time period, amplitude, power and	
	power factor (definition only).	
	Transformer: Principle of operation and construction – EMF equation	
	- Losses in Transformer – Efficiency – Applications.	
	Alternator construction – Principle of operation and Applications.	
	Chapter: 2.2:	8
	AC machine: AC Motors- Principle of operation of Single Phase,	
	Capacitor Start induction motor - universal motor - Applications-	
	Three Phase Induction Motors – Squirrel Cage and Slip ring	
	Induction motors (Construction and Working Principle only) -	
	Applications – Speed control of 3Φ Induction Motor - DOL and	
	star/delta starter.	
III	SPECIAL MACHINES & DRIVES	
	Chapter: 3.1:	7
	PMDC Motor, Stepper motor- Construction and Working Principle	
	and Applications - Servo motor – types.	
	Permanent Magnet Servo motor Construction and Applications.	
	Brushless Servo motor - Construction and Applications.	
	Chapter: 3.2:	8
	Industrial drives- types, Group drive, Individual drive, Multi motor	
	drive. Block diagram of Variable Frequency Drive (VFD).	
	Stepper motor Drive: Single stepping and Half stepping Servo drives.	
	DC Servo drive, AC Servo drive and BLDC Servo drive.	

IV	POWER SUPPLIES, CONTROL ELEMENTS AND ELECTRICAL	
	SAFETY	
	Chapter: 4.1:	5
	Rectifiers - Half wave, Full wave and Bridge rectifiers - Necessityof	
	Filters- Regulated Power Supplies: IC Voltage Regulators.Batteries -	
	Working, Constructions, Maintenances and Trouble shooting.	
	Chapter: 4.2:	5
	Fuses – Selection of Fuse – Necessity of Fuse- Fuse switch units.	
	Sensors: Photo electric sensor, Inductive Proximity sensors,	
	Temperature sensors. Contactors - usage – Necessity of Contactor-	
	Solenoid type Contactor.	
	Chapter: 4.3:	4
	Circuit breakers – Miniature Circuit Breaker (MCB), Earth	
	Leakage Circuit Breaker (ELCB). Electrical Safety: - Importance of	
	Earthing - Electric shock: First aid, Precautions - Causes of Accident	
	and their Preventive measures.	
V	DISPLAY DEVICES, LOGIC GATES AND PLC	
	Chapter: 5.1:	4
	Display devices – LED, 7 segments LED, LCD, applications.	
	Chapter: 5.2:	5
	Logic gates: Positive and Negative Logic, Definition, Symbol and	
	truth table.Boolean expression for OR, AND, NOT, NOR, NAND,	
	EXOR AND EXNOR gates. Universal Logic Gates: NAND, and NOR.	
	Chapter: 5.3:	5
	Features of PLC - PLC Block diagram - PLC scan. Fixed and	
	Modular PLC. Ladder logic - NO, NC contacts - Coils - AND logic,	
	OR logic.	

Reference Books

- 1. Fundamentals of physics, Brijlal and Subramaniam.
- 2. Fundamentals of Electricity, D.N. Vasudeva, S. Chand & co.
- 3. Electric motors and drives, Austin Hughes
- 4. A text bookof Electrical Technology, Volume II, B.L.Theraja, S. Chand & co.
- 5. Programmable Logic Controllers John R Hackworth Frederick D.Hackworth Jr., Pearson Education.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR IV SEMESTER

4025440 – ADVANCED MANUFACTURING TECHNOLOGY

CURRICULUM DEVELOPMENT CENTRE

ANNEXURE-I

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

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025440
- Semester : IV

Subject Title : ADVANCED MANUFACTURING TECHNOLOGY

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instru	ictions		Examination		
Subject	Hours /	Hours / Semester	Marks			
	Week		Internal Assessment	Board Examinations	Total	Duration
ADVANCED						
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	Торіс	Hrs.			
I	Advanced Plastic Materials and Plastic Forming	14			
II	Modern Machineries and Manufacturing Plant	15			
	Advanced Smelting and Welding Processes	14			
IV	IV Super Finishing Process				
V	V Advanced Measurements and Testing				
	Test & Model Exam	7			
	Total	80			

RATIONALE:

The Trend of globalization has put forth on industries the need and compulsion to adopt not only new and innovative methodologies but also advanced Manufacturing processes to lay emphasis on accuracy, cost effectiveness and promptness. The areas like special purpose machines, various energy based processes will go long way in giving the students an insight into the areas of material removal by using various kinds of energy and the need to preserve accuracy and cost effectiveness essential in industries.

OBJECTIVES:

At the end of the study of Semester the student will be able to

- Explain the working of automatic Machineries.
- Compare different types of Advanced Plastic Materials.
- Explain the construction and working of New Instruments and Testing Machines.
- Explain the working of Super Finishing Process.
- Compare different Superfinishing Process.
- Explain the working of Large Plant machinery.
- Explain the applications and limitations of Advanced Furnaces.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	ADVANCED PLASTIC MATERIALS AND PLASTIC FORMING	
	Chapter: 1.1:	7
	Advance Plastic Materials : Introduction - Polymerization - types of	
	polymerization - Advanced Plastic Materials - PET, PP, Polyamides,	
	PPS, PTFE, PE, PMMA, Poly Carbonates, NORYL, LDPE, HDPE -	
	Engineering Ceramics – Properties of Ceramics – Types – Abrasives –	
	Applications of Ceramics - Composite Materials - Classification -	
	Components in a Composite Materials – Nano Composites – Bio	
	Composites.	
	Chapter: 1.2:	7
	Advanced Plastic Forming : Thermoforming: Introduction- pressure	
	forming – vacuum forming – Techniques of vacuum forming – Simple	

	vacuum forming- drape forming - plug assisted forming - snap - back	
	vacuum forming - pressure snap -back forming - blow back forming-	
	merits and demerits of vacuum forming- moulds –Matched dies forming –	
	continuous forming methods – application.	
II	MODERN MACHERIES AND MANUFACTURING PLANT	
	Chapter: 2.1:	8
	Modern Machineries: .Tube Bending Machine - Types - Working -	
	Merits, Demerits and Application – Tube Milling Machines - Working –	
	Merits, Demerits and Application. Automatic Moulding Machine - Types -	
	Working - Merits, Demerits and Application - Automatic Shearing	
	Machine - Types - Working – Merits, Demerits and Application - Automatic	
	Forging Machine - Types - Working – Merits, Demerits and Application –	
	Automatic Riveting Machine - Types - Working - Merits, Demerits and	
	Application	
	Chapter: 2.2:	7
	Manufacturing Plant: Crude oil Refining Process - Plant Layout -	
	Working – Various Fuel Outputs – Merits, Demerits and Application – Rice	
	Mill Plant – Types – working - Merits, Demerits and Application – Paper	
	Mill - Types – working - Merits, Demerits and Application.	
	ADVANCED SMELTING AND WELDING PROCESSES	7
	Chapter: 3.1:	1
	Advanced Smelting Process: Furnace: Blast Furnace – Working and its	
	Application – Hydrogen Furnace Working and its Application – Muffle	
	Furnace - Working and its Application – Smelting Furnace - Working	
	Principle – Merits, Demerits and Application - Billet Heating Furnace –	
	Working Principle – Merits, Demerits and Application.	
	Chapter: 3.2:	7
	Advanced Welding Process: Butt Fusion Welding - Working – Merits,	
	Demerits and Application Semiautomatic Welding – Working – Merits,	
	Demerits and Application – Automatic Welding - Working – Merits,	
	Demerits and Application – Robot Welding – Working – Merits, Demerits	

	and Application - CNC Laser Welding – Working – Merits, Demerits and	
	Application	
IV	SUPER FINISHING PROCESS	
	Chapter: 4.1:	9
	With Metal Removal Methods: Shot Blasting - Classification – Working	
	 Merits, Demerits and Application - Lapping – Classification – Working – 	
	Merits, Demerits and Application – Honing - Classification – Working –	
	Merits, Demerits and Application – Burnishing - Classification – Working –	
	Merits, Demerits and Application – Shot Peening - Classification – Working	
	 Merits, Demerits and Application - Buffing - Classification – Working – 	
	Merits, Demerits and Application - Slitting Process - Classification -	
	Working – Merits, Demerits and Application	
	Chapter: 4.2:	6
	Without Metal Removal Methods: Glazing – Types - Working – Merits,	
	Demerits and Application – Tumbling - Types - Working – Merits, Demerits	
	and Application - Polishing - Classification – Working – Merits, Demerits	
	and Application.	
V	ADVANCED MEASUREMENTS AND TESTING	
	Chapter: 5.1:	8
	Measuring Instrument: 2D Measuring Instruments - Principle – Types -	
	Advantages and Limitations – Applications - Electrical Conductivity Meter	
	 working – Merits – Demerits – Application – Coating Thickness Meter - 	
	working – Merits – Demerits – Application – Optical Light Band Flatness	
	Instrument – Types – Working – Merits, Demerits and Application –	
	Roughness Average Tester - Types - Working - Merits, Demerits and	
	Application - pH Meter – Hydrometer (Descriptive Only)	
	Chapter: 5.2:	7
	Testing Instruments: Scanning Electron Microscope - Principle – Types	
	- Advantages and Limitations – Applications – Spectroscopy - Principle –	
	Types - Advantages and Limitations - Applications - Wet Analysis -	
	Principle – Types - Advantages and Limitations – Applications – Salt Spray	
	Analysis - Principle – Types - Advantages and Limitations – Applications.	

Reference Books

- 1. "New Technology", Amitadha Bhattacharyya, The Institution of Engineers, (India).
- 2. "Production Technology", HMT Banglore, Tata Mc Graw–Hill Publishing Company Limited, New Delhi, 2006.
- 3. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010
- 4. ,"Text Book of Production Engineering", P.C. SharmaS. Chand & Company Ltd., Ramnagar, New Delhi.
- 5. "Elements of workshop Technology", S.K. Hajra Choudhury, S.K.Bose, A.K. Hajra Choudhury, Nirjhar roy.
- George Odian, "Principles of polymerisation", Wiley international publishers, 2004, 4th Edition.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR IV SEMESTER

4020450 – STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

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 : 4020450
- Semester : IV
- Subject Title : Strength of Materials and Fluid Mechanics Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		ubject Instructions Examination			
4020450	Hours	Hours /		Marks		
Strength of Materials and Fluid	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
Mechanics 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:

- Acquire skills on different types of testing methods of metals.
- Conduct material testing on elasticity, hardness, shear strength
- Determine modulus of rigidity of open coil spring and closed coil springs.
- Determine the co-efficient of discharge of venturimeter and mouth piece
- Determine the co-efficient of friction in pipes.
- Conduct performance test on reciprocating pump.
- Conduct performance test on impulse turbine.

4020450 STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL DETAILED SYLLABUS

Experiments:

PART A : Strength of Materials Laboratory

1. Test on Ductile Materials:

Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.

2. Hardness Test:

Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.

3. Torsion test:

Torsion test on mild steel – relation between torque and angle of twistdetermination of shear modulus and shear stress.

4. Impact test:

Finding the resistance of materials to impact loads by Izod test and Charpy test.

5. Tests on springs of circular section:

Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open or Closed coil spring)

6. Shear test:

Single or double shear test on M.S. bar to finding the resistance of material to shear load.

PART B: Fluid Mechanics Laboratory

- 1. Verify the Bernoulli's Theorem.
- 2. Determination of co-efficient of discharge of a mouth piece by variable head method.
- 3. Determination of co-efficient of discharge of a venturimeter.
- 4. Determination of the friction factor in a pipe.
- 5. Performance test on reciprocating pump and to draw the characteristics curves.
- 6. Performance test on impulse turbine and to find out the Efficiency.

BOARD EXAMINATION

Note:

- All the experiments in both sections have to be completed. Two experiments will be given for examination by selecting one exercise from PART A and one exercise 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.

Part-A	:	45 marks
Procedure / Observation	10	
Tabulation / Calculations	25	
Result / Graph	10	
Part-B	:	45 marks
Procedure / Observation	10	
Tabulation / Calculations	25	
Result / Graph	10	
Viva-voce	:	10 marks
Total	:	100 Marks

DETAILED ALLOCATION OF MARKS

LIST OF EQUIPMENTS:

(To accommodate a batch of 30 students in Practice / Board Examinations)

1.	UTM.	01
2.	Rockwell's Hardness Testing Machine.	01
3.	Torsion testing machine.	01
4.	Impact testing machine.	01
5.	Spring testing arrangements.	01
6.	Shear testing machine.	01
7.	Vernier calliper.	02
8.	The Bernoulli's Apparatus.	01
9.	An open tank fitted with an external mouth piece and a collecting tank v	vith
	Piezometer.	01
10.	An arrangement to find friction factor of pipe.	01
11.	A reciprocating pump with an arrangement for collecting data to find our	the
	efficiency and plot the characteristics curves.	01
12.	A impulse turbine with an arrangement for calculating data to find out the	ne
	efficiency.	01
13.	An arrangement of Venturimeter fitted in horizontal water pipe line to fin	d
	coefficient of discharge.	01



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR IV SEMESTER

4020460 – MANUFACTURING TECHNOLOGY – II PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

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 : 4020460
- Semester : IV
- Subject Title : Manufacturing Technology II Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions			Examination		
4020460	Hours	Hours /		Marks		
Manufacturing	/ Week	Semester	Internal	Board	Total	Duration
Technology - II			Assessment	Examinations		
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:

- Identify a milling machine and its parts
- Identify a cylindrical grinder, surface grinder and tool and cutter grinder
- Identify shaper, Slotter and its parts
- Identify the tools and instruments used in milling.
- Study the components of the CNC machine and setting.
- Handle the different types of work holding devices
- Machine a component using different machine tools.
- Calculate the indexing for a work
- Machine a gear using milling machine.
- Machine a cutting tool using Tool and Cutter grinder.
- Machine a plug gauge using Cylindrical grinding machine.
- Machine components by shaping machine
- Machine components by slotting machine.
- Machine components by the CNC machines.

4020460 MANUFACTURING TECHNOLOGY - II PRACTICAL DETAILED SYLLABUS

EXERCISES:

Raw Material: M.S. / C.I

1. Make 'V' Block using shaping machine



		Dimensions				
	Sl.No	Part Name	Actual	Obtained		
	-		<u> 8</u>			
-						

2. Make dovetail using shaping machine



Dimensions					
SI.No	Part Name	Actual	Obtained		
		s6			
		ē v			

3. Make groove cut using slotting machine



Dimensions					
Part Name	Actual	Obtained			
	<u> </u>				
	e s				
	Dime Part Name	Dimensions Part Name Actual			

4. Make round to hexagon in milling machine.



Dimensions					
SI.No	Part Name	Actual	Obtained		
	-	÷			
	-	9 - 50			
		1			
	-	10 - J			

5. Make Spur Gear using milling machine.



	Dime	nsions		
SI.No	Part Name	Actual	Obtained	
		-		
1		i s		

6. Make Helical Gear using milling machine.



	Dimensions				
SI.No	Part Name	Actual	Obtained		
		÷			
		ē v			

7. Make slot cut using milling machine.



8. Make Progressive type Plug gauge using Cylindrical Grinding machine



9. Make a turning tool using Tool and Cutter Grinder



	Dimensions				
SI.No	Part Name	Actual	Obtained		
	1	S			
	-	÷			
-	-	e v			

10. Make plain surfaces (four surfaces)using surface Grinder





	Dimensions				
SI.No	Part Name	Actual	Obtained		
		S2			
		s			
	2	8 - S			

11. Make the component in the CNC Turing Centre.



12. Make the component in the CNC Milling Centre.



BOARD EXAMINATION

Note:

- All the exercises should be completed. Any one exercise will be given for examination.
- All the exercises 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.

DETAILED ALLOCATION OF MARKS

Description	Marks
Procedure	10
Preparation of the Specimen	15
Setting and Machining	30
Dimensions	25
Finishing	10
Viva-voce	10
Total	100

LIST OF EQUIPMENTS

(To accommodate a batch of 30 students in Practice / Board Examinations)

1	Vertical milling machine / Vertical	-	2 Nos.
	attachment		
2.	Universal Milling Machine	-	2 Nos.
3.	Surface Grinding Machine	-	1 No.
4.	Cylindrical Grinding Machine	-	1 No.
5.	Tool and Cutter Grinder	-	1 No.
6.	Shaping Machine	-	2 Nos.
7.	Slotting Machine	-	1 No.
8.	CNC Turning centre	-	1 No.
9.	CNC Milling Centre	-	1 No.
10	Tools and Measuring instruments	-	Sufficient quantity.
11	Consumables	-	Sufficient quantity.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> II YEAR IV SEMESTER

4020470 – ELECTRICAL DRIVES AND CONTROL PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

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 : 4020470
- Semester : IV
- Subject Title : Electrical Drives and Control Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
4020470	Hours	Hours /		Marks		
Electrical Drives and	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
Control 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:

- Identify starters for different motors.
- Study and prepare earthing
- Test the characteristics of DC and AC machines.
- Identify and select controlling elements.
- Explore the performance of ELCB, MCB.
- Design regulated power supplies.
- Identify display devices-LED, 7 segment LED, LCD.
- Identify the drive circuit for special motors. Test the speed control circuit of the special motors.

4020470 ELECTRICAL DRIVES AND CONTROL PRACTICAL

EXPERIMENTS:

Part A:

- 1. Verification of Ohm's Law
- 2. Load test on DC shunt motor
- 3. Load teston single phase induction motor
- 4. Load test on three phase squirrel cage motor
- 5. Testing of relays, contactors, push buttons and limit switch
- 6. Connection and Testing of MCB, ELCB

Part B

- 1. Construction and testing of Halfwave and Fullwave rectifier.
- 2. Construction and testing of IC voltage regulator using IC 7805.
- 3. Verification of truth tables for logic gates.
- 4. Verification of universal gates.
- 5. Identification and testing of display devices LED, 7segment LED, Laser diode.
- 6. Testing of Stepper motor drive.
- 7. Testing of Servomotor drive.

BOARD EXAMINATION

Note:

- All the experiments in both sections have to 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 the 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.

DETAILLED ALLOCATION OF MARKS

Part A:		45
Circuit diagram	10	
Connections & Readings	20	
Calculations & Graph	15	
Part B:		45
Circuit diagram	10	
Connections & Readings	20	
Execution	15	
Viva Voce		10
Total		100

LISTOF EQUIPMENTS (To accommodate a batch of 30 students in Practice / Board Examinations)

Electrical Lab

1. DC ammeter 0-5A	-	1 no
2. DC ammeter 0-25A	-	1 no
3. DC voltmeter 0-30V	-	1 no
4. DC voltmeter 0-300V	-	1 no
5. Rheostat 10.8 ,8.5A	-	1 no
6. AC ammeter 0-5A	-	1 no
7. AC ammeter 0-10A	-	2 nos.
8. AC voltmeter 0-50V	-	3 nos
9. ACwattmeter 5A-10A	-	3 nos
(0-750W,0-600V)		
10. Loading rheostat 5A,230V	-	1 no
11. Tachometer 0-1000rpm	-	1 no
(Analog type)		
12. Variac 20A,250V	-	2 nos
(Auto transformer)		
13. Over load relay1 to 2.5A	-	1 no
14. Air breakcontactors 20A,220V	-	4 nos

15.Push button 2A ,220V	-	2 nos
16. Limit switch 20A,220V	-	1 no
17.MCB 20A single pole	-	1 no
18.MCB 20A double pole	-	1 no
19. ELCB 2pole 20A,100mA	-	1 no
20. ELCB 4POLE 20A,100mA	-	1 no

Electronics Lab

1.	Transformer 230 / 9-0-9V, 1A	-	4 nos.
2.	Resistor 1 K ₀ / ½W	-	3 nos.
3.	Capacitor 1000 ^µ F/25V	-	4 nos.
4.	IC 7805	-	1 no.
5.	Logic Gates IC		
	7400, 7408, 7432, 7404,7402,	7486-	1 each
6.	Stepper Motor Drive kit	-	1no.
7.	Servo Motor Drive Kit	-	1no
8.	Digital Multimeter	-	1no.
9	LED, 7 Segment LED, Laser Diode	- 1	each


DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

4020510 - DESIGN OF MACHINE ELEMENTS

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 : 4020510
- Semester : V
- Subject Title : Design of Machine Elements

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Inst	ructions	Examination			
4020510	Heuro	Hours /	Marks			
Design of Machine	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
Elements	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					
I	Engineering Materials and Joints					
II	Design Of Shafts, keys and Couplings	18				
III	Design of Flat Belts and V-Belts	18				
IV	Design of Bearings & Spur Gears	18				
V	V Computer Aided Design (CAD) and Geometrical Modelling					
Test and Model Exam						
	Total					

RATIONALE:

The main objective of Machine Design is to create new and better machine components to improve the existing one. A mechanical engineer should have thorough knowledge of design of machine elements to avoid the failure of machines or components.

OBJECTIVES:

- Design sleeve and cotter joint, knuckle joint and Welded joints
- Design shafts, keys and couplings required for power transmission.
- Compare the different types of couplings.
- Design flat and V-belt for power transmission.
- Study the various types of bearings and their applications.
- Design journal bearings.
- Design Spur gear.
- Role of CAD in design and analysis.

4020510 DESIGN OF MACHINE ELEMENTS DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	Engineering Materials and Joints	
	Chapter: 1.1:	
	General Considerations in Machine Design. Engineering	10
	materials - Factors affecting selection of material – BIS	
	designation of Ferrous materials - Preferred number - Factor of	
	safety and allowable stress – Stresses: Tension, Compression,	
	Shear, Bearing pressure Intensity, Crushing, bending and torsion	
	- problem. Creep strain and Creep Curve- Fatigue, S-N curve,	
	Endurance Limit - Stress Concentration – Causes & Remedies.	
	Theories of Elastic Failures - Principal normal stress theory,	
	Maximum shear stress theory & maximum distortion energy	
	theory.	
	Chapter: 1.2:	8
	Joints: Design of sleeve and cotter joint, knuckle joint and	
	welded joint.	

II	Design Of Shafts, Keys and Couplings	
	Chapter: 2.1:	9
	Shafts: Design of shafts subjected to - twisting moment -	
	bending moment – combined twisting and bending moments –	
	fluctuating loads – design of shafts based on rigidity.	
	Chapter: 2.2:	9
	Keys: Types of keys - design of sunk keys only - Effect of	
	keyways on shaft - problems.	
	Couplings: Requirements of good couplings – types - design of -	
	rigid protected type flange couplings - marine couplings - pin type	
	flexible coupling (Description only).	
	Design of Flat Belts and V-Belts:	
	Chapter: 3.1:	9
	Flat Belts: Types of belts - materials for belt types of belt	
	drives – Speed ratio – effect of slip - length of flat belts –Tension	
	Ratio T1/T2= $e^{\mu\theta}$ - centrifugal tension - power transmitted –	
	condition for maximum power - transmission - Initial Tension -	
	problems - design procedure of flat belts - design of flat belt	
	based on manufacturer's data only – problems.	
	Chapter: 3.2:	9
	V-belt drive - comparison with flat belt drive - designation of V-	
	belts – length of belt - power transmitted – Design of V-belt using	
	manufacturer's data only – Problem.	
IV	Design of Bearings & Spur Gears	
	Chapter: 4.1:	10
	Bearings: Classifications of bearings – sliding contact and rolling	
	contact bearings - radial and thrust bearings - roller bearing -	
	types - Designation of ball bearings - materials used for bearings	
	- journal bearings - heat generated - heat dissipated - cooling oil	
	requirement – problems - design of journal bearings – Problems.	
	(Design based on approved data books only.).	
	Chapter: 4.2:	8
	Spur Gears: Gear drives - Types of gears - applications -	

	materials - spur gear terminology - design of spur gear based on	
	Lewis and Buckingham equation (design procedure only) - speed	
	reducer – types.	
V	Computer Aided Design (CAD) and Geometric Modelling	
	Chapter: 5.1:	9
	CAD - Roles of CAD in design - Development and uses -	
	Applications – Advantages – Product cycle – Design process:	
	Shigley Model - Pahl and Beitz Model – Sequential Engineering –	
	Concurrent Engineering – 2D and 3D Transformation.	
	Chapter: 5.2:	
	Geometric Modelling: Solid modelling – entities – advantages and	8
	disadvantages – Boolean operations - Boundary representation –	
	Constructive Solid Geometry - Comparison - Finite Element	
	analysis – Steps.	

Reference Book:

- Machine Design, Pandya & Shah, Edn. 1995, Charotar Publishing House.
- Machine Design, T. V. Sundararajamoorthy & N. Shanmugam, Revised Edition June-2003–Anuradha Publications.
- Design Data Book by PSG College of Technology, DPV Printers.
- A text book of Machine Design, R.S. Khurmi & J.K.Gupta, Edn. 18, Eurosia Publishing House Pvt. Limited.
- Machine Design, Bandari,
- Theory and Problems of Machine Design, Holowenko, Laughlin, Schaum's outline series.
- R.Radhakrishnan, and S.Subramanian, "CAD/CAM/CIM", New Age International Pvt Limited.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

4025520 – THERMAL ENGINEERING

ANNEXURE-I

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

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025520
- Semester : V
- Subject Title : THERMAL ENGINEERING

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instru	ictions				
Subiect	Hours /	Hours /	Marks			
•	Week	Semester	Internal Assessment	Board Examinations	Total	Duration
THERMAL ENGINEERING	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	Торіс	Hrs.			
I	Thermodynamics, Properties of Perfect Gases & Thermodynamics Processes	15			
II	Air Cycles, Fuels and Combustion	15			
	Properties Of Steam, Steam Boiler, Steam Engine And Steam	15			
IV	IC Engines, Performance of IC Engines and Air Compressors	14			
V	Refrigeration and Air Conditioning	14			
	Test & Model Exam				
	Total				

RATIONALE:

Day by day, engineering and technology experience tremendous growth. Design plays a major role in developing engineering and technology. Strength of material and Fluid Mechanics is backbone for design. The strength of material and Fluid Mechanics deals generally with the behaviour of objects and Fluids, when they are subject to actions of forces. Evaluations derived from these basic fields provide the tools for investigation of mechanical structure and is to impart knowledge of pumps, hydraulic and pneumatic operation of tools and equipments.

OBJECTIVES:

At the end of the study of Semester the student will be able to

- Acquire knowledge about basic details of Thermodynamics
- Learn the important need of Heat and Work in day to day process
- Calculate Heat and Work for various process like Adiabatic etc.,
- Distinguish the working principle of Air Cycles and Fuels and Combustion
- Explain the working principles of Air Compressors and IC Engines.
- Learn about the Stream and their Properties and need of Steam and some Steam related Components.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	THERMODYNAMICS	
	Chapter: 1.1:	5
	Basics of Thermodynamics : Definition - fundamental units - derived	
	units – SI units – Laws of motion –Newton's first law of motion - Newton's	
	second law of motion - Newton's third law of motion – mass and weight –	
	pressure, work – gauge and absolute pressure – temperature – absolute	
	temperature - heat - specific heat - thermodynamic systems - properties	
	of system – laws of thermodynamics – Zeroth law of thermodynamics –	
	First law of thermodynamics – Second law of thermodynamics.	

	Chapter: 1.2:	5
	Properties of perfect gases: Introduction - Laws of perfect gases -	
	Boyle's law – Charles law – general gas equation – Joule's law –	
	characteristic equation of gas – Avogadro's law – Universal gas constant	
	- Specific heats of a Gas - Specific heat at constant volume- Specific heat	
	at constant pressure - relation between specific heats - ratio of specific	
	heats.	
	Chapter: 1.3:	5
	Thermodynamics processes of perfect gases: Constant volume	
	process - constant pressure process - hyperbolic process - isothermal	
	process - adiabatic process - polytropic process - throttling process -	
	Derivation of heat transfer, change of internal energy, change of entropy	
	and Work done – Simple problems.	
II	AIR CYCLES, FUELS AND COMBUSTION	
	Chapter: 2.1:	5
	Air cycles: Introduction – assumptions – classifications – efficiency of	
	the cycle – reversible cycle – irreversible cycle – types of thermodynamic	
	cycles – Carnot cycle – Joules cycle – Otto cycle – Diesel cycle – Dual	
	combustion cycle – derivation – simple problems.	
	Chapter: 2.2:	5
	Fuels: Classification – solid fuels – liquid fuels – gaseous fuels - merits	
	and demerits – requirement of good fuel – calorific value of fuels –	
	Higher calorific value – lower calorific value – Construction and working	
	of bomb calorimeter and gas calorimeter.	
	Chapter: 2.3:	5
	Combustion : Elements and compounds – atoms and molecules – atomic	
	weight - molecular weight - combustion of solid fuels - combustion of	
	gaseous fuels - theoretical weight of air required for complete combustion	
	- theoretical volume of air required for complete combustion – gravimetric	
	analysis – Volumetric analysis– Weight of carbon in flue gases – weight of	
	flue gases per kg of fuel burnt –Excess air supplied – weight of excess air	
	supplied – flue gas analysis by Orsat Apparatus - simple problems.	

III	PROPERTIES OF STEAM, STEAM BOILER, STEAM ENGINE AND	
	STEAM	
	Chapter: 3.1:	5
	Properties of Steam: Formation of steam -Temperature vs Heat -	
	Important terms for steam - latent heat of steam - dryness fraction -	
	wetness fraction - types of steam - dry and saturated steam, wet steam	
	and superheated steam - advantages of super heated steam - steam	
	tables and their uses – Total heat – volume –internal energy – entropy –	
	simple problems using steam tables. Mollier Chart - Measurement of	
	dryness fraction of steam - barrel calorimeter - combined separating and	
	throttling calorimeter – working principle - problems.	
	Chapter: 3.2:	4
	Steam Boiler : Important terms - essentials of good steam boiler -	
	selection of a steam boiler - classification - Working principle of	
	Locomotive boiler – Lamont boiler – BHEL boiler – merits and demerits.	
	Chapter: 3.3:	3
	Steam Engine: Classification – important parts of steam engine – working	
	of a single cylinder double acting reciprocating steam engine - theoretical	
	indicator diagram – actual indicator diagram.	
	Chapter: 3.4:	3
	Steam Condenser: Advantages of a condenser in steam power plant –	
	Requirement – Classification – Working principle of Jet condenser – types	
	 working principle of surface condenser - types. 	
IV	IC ENGINES, PERMORMANCE OF IC ENGINES AND AIR	
	COMPRESSORS	
	Chapter: 4.1:	4
	IC Engines : Introduction- classifications - four stroke cycle petrol and	
	diesel engines- merits and demerits – two stroke cycle – petrol and diesel	
	engines – comparison	
	Chapter: 4.2:	5
	Performance of IC Engines: Performance of I.C engines - indicated	
	power - brake power - friction power efficiencies of I.C engines- indicated	
	thermal, brake thermal, mechanical, relative efficiencies and Specific Fuel	

	Consumption - Morse test- procedure - problems - heat balance sheet -					
	problems.					
	Chapter: 4.3:	5				
	Air compressors: Air Compressor – uses of compressed air					
	classifications of Air compressor-reciprocating compressor-single stage					
	reciprocating compressor- multi stage compression – merits and demerits					
	-Two stage compressor with imperfect cooling - with perfect inter cooling					
	- rotary compressors - Roots blower - vane blowers - centrifugal and					
	axial flow air compressors					
V	REFRIGERATION AND AIR CONDITIONING					
	Chapter: 5.1:	7				
	Refrigeration : Refrigeration - refrigerators and heat pumps-types and					
	applications of refrigeration - vapour compression refrigeration system -					
	vapour absorption system - comparison - refrigerating effect - capacity					
	of refrigerating unit - C.O.P - actual C.O.P – power required – mass of ice					
	produced – problems - refrigerants-desirable properties - classification of					
	refrigerants.					
	Chapter: 5.2:	7				
	Air Conditioning : Air conditioning - psychrometric properties - dry Air -					
	moist air – water vapour - saturated air – dry bulb temperature - wet bulb					
	depression - dew point depression - dew point temperature - humidity -					
	specific and relative humidity - psychrometric chart - psychometric					
	processes - sensible heating and cooling – humidification –					
	dehumidification - classification and applications of air conditioning					
	system – room air conditioning - central air conditioning – comparison –					
	differences between comfort and industrial air conditioning - factors to be					
	considered in air conditioning - loads encountered in air conditioning					
	systems.					

Reference Books

 Applied Thermodynamics, P.K. Nag, 2nd Edition, TATA McGraw - Hill Publishing Co., New Delhi.

- 2. Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition, S.Chand & Co, New Delhi
- 3. Thermal Engineering ,P.L Ballaney , 24th Edition ,Khanna Publishers, New Delhi.
- 4. Applied Thermodynamics, Domkundwar and C.PKothandaraman, 2nd Edition,Khanna publishers, New Delhi.
- 5. Refrigeration and Air conditioning, P. L. Ballaney, , 4th edition, Khanna Publishers, Newdelhi.
- Power Plant Engineering Thermodynamics, Domkundwar and C.P Kothandaraman., 2nd Edition, Khanna Publishers.
- 7. Power plant Engineering, G.R. Nagpal, Khanna Publishers, New Delhi.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

ELECTIVE THEORY - I 4020531 – COMPUTER INTEGRATED MANUFACTURING

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 : 4020531
- Semester : V

Subject Title : Computer Integrated Manufacturing

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Inst	ructions		Examination			
4020521	Hours	Hours /		Marks			
4020531	Tiours	nours/	Internal	Board		Duration	
Computer Integrated	/ Week	Semester	Assessment	Examinations	Total		
Manufacturing	5	80	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	Computer Aided Design	15
II	Computer Aided Manufacturing	14
III	CNC programming	16
IV	FMS, AGV, AS/RS, Robotics	14
V	Advanced concepts of CIM	14
	Test and Model Exam	7
	Total	80

RATIONALE:

As per the latest requirements in the Industries this enables to learn the various concepts of Computer Aided Design and Manufacturing. They are able to operate CNC machines and write part program. They are able to understand the advanced concepts adopted in automated industries.

OBJECTIVES:

- Acquire knowledge in the field of Computer aided Design
- Explain the various concepts of Computer Aided manufacturing
- Write part program for manufacturing components in CNC machines
- Explain the concepts of automatic material handling and storage systems and robotics
- Explain the advanced concepts of CIM

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	Computer Aided Design	
	Computer Aided Design: Introduction – definition – Shigley's design	6
	process - CAD activities - benefits of CAD - CAD software packages -	
	point plotting, drawing of lines, Bresenham's circle algorithm,	
	Transformations: 2D & 3D transformations - translation, scaling, rotation	
	and concatenation.	
	Geometric modelling: Techniques - Wire frame modelling – applications –	6
	advantages and disadvantages. Surface modelling - types of surfaces -	
	applications – advantages and disadvantages – Solid modelling – entities –	
	advantages and disadvantages – Boolean operations - Boundary	
	representation – Constructive Solid Geometry – Comparison.	
	Graphics standard: Definition – Need - GKS –IGES – DXF. Finite Element	3
	Analysis: Introduction – Development - Basic steps – Advantages.	
II	Computer Aided Manufacturing	
	CAM – Definition - functions of CAM – benefits of CAM. Introduction of CIM	3
	- concept of CIM - evolution of CIM - CIM wheel - Benefits - integrated	
	CAD/CAM.	

	Group technology: Part families - Parts classification and coding - coding	6
	structure – Opitz system, MICLASS system and CODE System. Process	
	Planning: Introduction – Computer Assisted Process Planning (CAPP) –	
	Types of CAPP - Variant type, Generative type – advantages of CAPP.	
	Production Planning and Control (PPC): Definition – objectives - Computer	5
	Integrated Production management system – Master Production Schedule	
	(MPS) - Capacity Planning - Materials Requirement Planning (MRP) -	
	Manufacturing Resources Planning (MRP-II) – Shop Floor Control system	
	(SFC) - Just In Time manufacturing philosophy (JIT) - Introduction to	
	Enterprise Resources Planning (ERP).	
III	CNC Programming	16
	NC in CAM, tooling for CNC – ISO designation for tooling – CNC operating	
	system. Programming for CNC machining – part program - Manual part	
	programming - coordinate system - Datum points: machine zero, work	
	zero, tool zero - reference points - NC dimensioning - G codes and M	
	codes - linear interpolation and circular interpolation - CNC program	
	procedure - sub-program - canned cycles - stock removal - thread cutting	
	- mirroring - drilling cycle - pocketing. Rapid prototyping: Classification -	
	subtractive – additive – advantages and applications – materials – Virtual	
	machining.	
IV	FMS, AGV, AS/RS, Robotics	
	FMS: Introduction – FMS components – FMS layouts – Types of FMS:	5
	Flexible Manufacturing Cell (FMC) – Flexible Turning Cell (FTC) – Flexible	
	Transfer Line (FTL) – Flexible Machining System (FMS) – benefits of FMS	
	- introduction to intelligent manufacturing system.	
	Material handling in CIM environment: Types – AGV: Introduction – AGV -	3
	working principle – types – benefits. AS/RS – working principle –types –	
	benefits.	
	Robotics: Definition – robot configurations – basic robot motion – robot	6
	programming method - robotic sensors - end effectors - mechanical	
	grippers - vacuum grippers - robot programming concepts - Industrial	
	applications of Robot: Characteristics - material transfer and loading -	
	welding - spray coating - assembly and inspection.	

V	Advanced Concepts Of CIM	14
	Concurrent Engineering: Definition – Sequential Vs Concurrent engineering	
	- need of CE - benefits of CE. Quality Function Deployment (QFD):	
	Definition – House of Quality (HOQ) – advantages – disadvantages. Steps	
	in Failure Modes and Effects Analysis (FMEA) – Value Engineering (VE) –	
	types of values – identification of poor value areas – techniques – benefits.	
	Guide lines of Design for Manufacture and Assembly (DFMA). Product	
	Development Cycle: Product Life Cycle - New product development	
	processes. Augmented Reality (AR) – Introduction - concept –	
	Applications.	

REFERENCES BOOKS:

- 1. R.Radhakrishnan, and S.Subramanian, "CAD/CAM/CIM", New Age International Pvt. Ltd.
- Mikell P.Groover, and Emory Zimmers, "CAD/CAM", Jr.Prentice Hall of India Pvt., Ltd.
- Dr.P.N.Rao, "CAD/CAM Principles and Applications,", Tata Mc Graw Hill Publishing Company Ltd.
- 4. Ibrahim Zeid, "Mastering CAD/CAM", Tata McGraw-Hill Publishing Company Ltd., New Delhi.
- 5. Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", Pearson Education Asia.
- Yoram Koren, "Computer control of manufacturing systems,", McGraw Hill Book.
- Chris Mcmahon and Jimmie Browne, "CAD/CAM Principle Practice and Manufacturing Management", Addision Wesley England, Second Edition,2000.
- Dr.Sadhu Singh, "Computer Aided Design and Manufacturing,", Khanna Publishers, NewDelhi, Second Edition, 2000.
- S.Kant Vajpayee, "Principles of Computer Integrated Manufacturing,", Prentice Hall of India, 1999.
- 10. David Bed worth, "Computer Integrated Design and Manufacturing,", TMH, 1998.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

ELECTIVE THEORY - I 4025532 – MECHANICAL INSTRUMENTATION

ANNEXURE-I

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

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025532
- Semester : V

Subject Title : MECHANICAL INSTRUMENTATION

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instructions		Examination			
Subject	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	Duration
MECHANICAL INSTRUMENTATION	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	Торіс	Hrs.
I	Introduction to Instruments and Measurement of Error	14
	Displacement Measurement and Pressure Measurement	15
	Temperature Measurement and Flow Measurements	15
IV	Miscellaneous Measurement	15
V	Control Systems	14
Test & Model Exam		7
	Total	80

RATIONALE:

Measurements are more important for the quality of the product. In this subject various methods of measurements are discussed.

OBJECTIVES:

- Study about the different instruments, errors.
- Impart knowledge on displacement measurements
- Understand about temperature measurement
- Study about miscellaneous measurement
- Understand the application of measurement system

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	INTRODUCTION TO INSTRUMENTS AND MEASUREMENT OF	
	ERROR	7
	Chapter: 1.1:	
	Introduction to Instruments: Introduction - classification of instruments -	
	Static terms and characteristics - Range and Span, Accuracy and	
	Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift,	
	Sensitivity, Threshold and Resolution, Repeatability and Reproducibility,	
	Linearity. Dynamic characteristics - Speed of response, Fidelity and	
	Dynamic errors, overshoot.	7
	Chapter: 1.2:	
	Measurement of error: Classification of errors, environmental errors,	
	signal transmission errors, observation errors, operational errors	
	Transducers: Classification of transducers, active and passive, resistive,	
	inductive, capacitive, piezo-resistive, Thermo resistive.	
II	DISPLACEMENT MEASUREMENT AND PRESSURE MEASUREMENT	
	Chapter: 2.1:	8
	Displacement Measurement: Capacitive transducer, Potentiometer,	
	LVDT, RVDT, Specification, Selection & application of displacement	
	transducer. Optical measurement scale and encoders.	

	Chapter: 2.2:	7
	Pressure Measurement: Low pressure gauges- McLeod Gauge, Thermal	
	conductivity gauge, Ionization gauge, Thermocouple vacuum gauge,	
	Pirani gauge. High Pressure gauge-Diaphragm, Bellows, Bourdon tube,	
	Electrical resistance type, Photoelectric pressure transducers,	
	piezoelectric type, Variable capacitor type.	
	TEMPERATURE MEASUREMENT AND FLOW MEASUREMENTS	
	Chapter: 3.1:	8
	Temperature Measurement: Non-electrical methods - Bimetal, Liquid in	
	glass thermometer and Pressure thermometer. Electrical methods - RTD,	
	Platinum resistance thermometer, Thermistor, Thermoelectric methods -	
	elements of thermocouple, Seebeck series, law of Intermediate metals,	
	thermo emf measurement.	
	Chapter: 3.2:	7
	Flow Measurements: Variable area meter - Rota meter, Variable velocity	
	meter – Anemometer, Special flow meter - Hot wire anemometer,	
	Electromagnetic flow meter, Ultrasonic flow meter ,Turbine meter ,Vortex	
	shedding flow meter.	
IV	MISCELLANEOUS MEASUREMENT	
	Chapter: 4.1:	7
	Introduction	
	Introduction to sound measurement and study of Electro dynamic	
	microphone and Carbon microphone. Humidity measurement -Hair	
	hygrometer, Sling psychrometer, Liquid level measurement - direct and	
	indirect methods.	
	Chapter: 4.2:	8
	Force & Shaft power measurement : Tool Dynamometer (Mechanical	
	Type), Eddy Current Dynamometer, Strain Gauge Transmission	
	Dynamometer. Speed measurement -Eddy current generation type	
	tachometer, incremental and absolute type, Mechanical Tachometers,	
	Revolution counter & timer, Slipping Clutch Tachometer, Electrical	
	Tachometers, Contact less Electrical tachometer, Inductive Pick Up,	

	Capacitive Pick Up, Stroboscope, Strain Measurement - Stress-strain	
	relation, types of strain gauges, strain gauge materials, resistance strain	
	gauge- bonded and unbonded, types (foil, semiconductor, wire wound	
	gauges), selection and installation of strain gauges load cells, rosettes.	
V	CONTROL SYSTEMS	
	Chapter: 5.1:	7
	Introduction: Block diagram of automatic control system, closed loop	
	system, open loop system, feedback control system, feed forward control	
	system, servomotor mechanism.	
	Chapter: 5.2:	7
	Comparison of Control Systems: Comparison of hydraulic, pneumatic,	
	electronic control systems, Control action: Proportional, Integral,	
	derivative, PI, PD, PID. Applications of measurements and control for	
	setup for boilers, air conditioners, motor speed control.	

Reference Books

- 1. Mechanical Measurements & Control-D.S.Kumar-Metropolitan Publications, New Delhi.
- 2. Mechanical & Industrial Measurements-R.K.Jain-Khanna Publications, New Delhi,
- 3. Mechanical Measurements &Instrumentation-A.K.Sawhney-Dhanpat Rai & Sons, New Delhi.
- 4. Measurement Systems-E. O. Doebelin-Tata McGraw Hill Publications.
- Mechanical Measurement &Control-R.V. Jalgaonkar-Everest Publishing House, Pune



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

ELECTIVE THEORY - I 4020533 – MECHATRONICS

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 : 4020533
- Semester : V
- Subject Title : Mechatronics

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Inst	ructions		Examination		
	Hours	Hours /		Marks		
4020533 Mechatronics	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
	5	80	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	Introduction, Sensors & Transducers	15	
II	Actuation systems	14	
	Basic system models, Input / Output systems	14	
IV	Programmable Logic Controller	14	
V	Design examples & advanced applications In Mechatronics	16	
Test and Model Exam			
	Total	80	

RATIONALE:

As per the latest requirements in the automation industries this enables to learn the various concepts of automation components. They are able to write program, and operate PLCs. They are able to select the electronic components for various industry applications.

OBJECTIVES:

- Explain the working of sensors and transducers
- Acquire knowledge about actuation systems
- Explain the system models and I/O systems
- Write program and operate PLCs
- Explain the applications of mechatronics

4020533 MECHATRONICS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	Introduction, Sensors & Transducers	15
	Introduction – Systems – Measurement Systems – Control Systems –	
	Microprocessor Based Controllers. Examples – Mechatronics	
	approach. Measurement System terminology – Displacement, Position	
	& Proximity Sensors – Velocity and Motion Sensors – Force Sensors –	
	Fluid Pressure Sensors – Flow Sensors – Liquid Level Sensors –	
	Temperature Sensors – Light Sensors – Selection of Sensors –	
	Calibration of sensors.	
II	Actuation Systems	
	Mechanical Actuation Systems - Types of motion - Freedom and	7
	constraints – Loading – Gear Trains – Pawl & Ratchet – Belt & Chain	
	drive - Bearing - Selection - Ball & Roller bearings - Mechanical	
	aspects of motor selection.	
	Electrical Actuation Systems – Switches & Relays – Solenoids – D.C	7
	Motors – A.C. Motors – Stepper Motors – Specification and control of	

	stepper motors – Servomotors: D.C Servomotor and A.C Servomotor.	
	Pneumatic & Hydraulic Systems – Power supplies – DCV – PCV –	
	Cylinders – Rotary actuators.	
III	Basic System Models, Input/Output Systems	14
	Mathematical Model – Introduction to mathematical model –	
	Mechanical System building blocks – Electrical System building blocks	
	- Fluid System building blocks - Thermal System building blocks.	
	System Model – Engineering Systems – Rotational – Translational	
	Systems – Electro-Mechanical System – Hydro- Mechanical System.	
	Interfacing – Input/Output ports – Interface requirements: Buffers,	
	Handshaking, Polling and interrupts, Serial interfacing – Introduction to	
	PIA – Serial communications interface – Example of interfacing of a	
	seven-segment display with a decoder.	
IV	Programmable Logic Controller	14
	Definition – Basic block diagram and structure of PLC – Input/Output	
	processing – PLC Programming: Ladder diagram, logic functions,	
	latching and sequencing – PLC mnemonics – Timers, internal relays	
	and counters – Shift registers – Master and jump controls – Data	
	handling – Analog input/output – Selection of PLC – sample ladder	
	programs.	
V	Design Examples & Advanced Applications In Mechatronics	16
	Design process stages – Traditional Vs Mechatronics designs –	
	Possible design solutions: Timed switch, Wind- screen wiper motion,	
	Bath room scale – Case studies of mechatronics systems: A pick-and-	
	place robot, Car park barrier, Car engine management system,	
	Automatic Camera and Automatic Washing Machine. Sensors for	
	condition monitoring systems of production systems - Examples of	
	monitoring methods: Vibration monitoring, Temperature monitoring,	
	Wear behavior monitoring – Mechatronics control in automated	
	manufacturing: Monitoring of manufacturing processes, On-line quality	
	monitoring, Model-based systems, Hardware-in-the-loop simulation,	
	Supervisory control in manufacturing inspection, Integration of	
	heterogeneous systems.	

REFERENCES BOOKS:

- 1. W.Bolton, "Mechatronics", 2nd Edition 2001, Pearson Education, New Delhi.
- R.K.Rajput, A Text Book of Mechatronics, 1st Edition 2007, S.Chand & Co. Ltd., New Delhi.
- 3. HMT, "Mechatronics", 1st Edition 1998, Tata McGraw Hill, New Delhi.
- Devdas Shetty & Kolk, "Mechatronics System Design", 1st Reprint, 2001, PWS Publishing Co., Boston.
- James H.Harter, "Electromechanics", 1st Edition 2003, Prentice-Hall of India, New Delhi.
- M.D.Singh & J.G.Joshi, "Mechatronics", 1st Edition 2006, Prentice-Hall of India, New Delhi.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

4020540 – PROCESS AUTOMATION PRACTICAL

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 : 4020540
- Semester : V
- Subject Title : Process Automation Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
4020540	Hours	Hours /		Marks		
Process Automation	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
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:

- Design and operate pneumatic circuits.
- Design and operate fluid power circuits
- Use PLC system and its elements for process control
- Familiarize the working of function blocks in PLC
- Use ON-Delay timer to control a motor
- Use OFF-Delay timer to control a motor
- Use counter function block (Up counter and Down counter)
- Control the automatic operation of pneumatic cylinder using PLC
- Record of work to be prepared.

Exercises

PART A

Pneumatics Lab.

- 1. Direct operation of single and double acting cylinder.
- 2. Operation of double acting cylinder with quick exhaust valve.
- 3. Speed control of double acting cylinder using metering-in and metering-out circuits.
- 4. Automatic operation of double acting cylinder in single cycle using limit switch.

Hydraulics Lab.

- 5. Direct operation of double acting cylinder.
- 6. Direct operation of hydraulic motor.
- 7. Speed control of double acting cylinder metering-in and metering-out control.

PART B

PLC Lab.

- 1. Direct operation of a motor using latching circuit.
- 2. Operation of a motor using 'AND' logic control.
- 3. Operation of a motor using 'OR' 'control.
- 4. On-Delay control of a motor and Off –Delay control of a motor.
- 5. Automatic operation of a Double acting cylinder-single cycle forward, time delay, return.
- 6. Automatic operation of Double acting cylinder-Multi cycle.
- 7. Sequential operation of double acting cylinder and a motor.

BOARD EXAMINATION

Note:

- All the experiments in both sections should be completed. Two experiments will be given for examination by selecting one exercise from PART A and one exercise 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.

Detailled Allocation of Marks

	45
10	
15	
20	
	45
10	
25	
10	
	10
	100
	10 15 20 10 25 10

LIST OF EQUIPMENTS

(To accommodate a batch of 30 students in Practice / Board Examinations)

 Pneumatic Trainer Kit – 3 Nos (All Cylinders, Control Valves, Limit switches and other accessories)
 Hydraulics Trainer Kit – 2 No. (All Cylinders, Control Valves, Limit switches and other accessories)
 PLC kit – 3 Nos.
 Computer with software – 10 Nos.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

4025550 – THERMAL ENGINEERING AND IC ENGINES PRACTICAL

ANNEXURE- I

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

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025550
- Semester : V
- Subject Title : THERMAL ENGINEERING AND IC ENGINES PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instructions		Examination			
Subject	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	Duration
THERMAL						
ENGINEERING	1	64	25	100*	100	2 Uro
AND IC ENGINES	4	04	25	100	100	5 115.
PRACTICAL						

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

RATIONALE:

Now a days, the application of thermal engineering play a vital role in various field and get knowledge about IC Engines Parts and Operation of Engines. It is also improve the various advanced systems used in automobiles.

OBJECTIVES:

- Identify the various lubricating oils
- Identify the various Components used in automobile
- To conduct test on Petrol and Diesel Engine
- To dismantling and assembling the various Engine components.
- To measure the valve and port diagrams

DETAILED SYLLABUS

Contents: Practical

Exercise

PART A (THERMAL LAB)

- 1. Draw Port timing diagram
- 2. Draw Valve timing diagram
- 3. Find Flash and Fire point open cup and closed cup
- 4. Find Viscosity of lubricating oil Say bolt viscometer / Red wood viscometer
- 5. Find Calorific Value of liquid fuels.
- 6. Conduct the performance test on Petrol / Diesel engine and draw the performance curves.
- 7. Morse test on multi cylinder Petrol engine.
- 8. Find the percentage of CO, CO₂, O₂ and amount of HC, NO_x & smoke using exhaust gas analyzer.

PART B (IC ENGINES LAB)

- 1. Dismantling and assembling of the parts of a two stroke petrol engine.
- 2. Dismantling and assembling of the parts of a four stroke petrol and diesel engines.
- 3. Removing cam shaft, replacing timing gear, removing valves and adjusting valve Clearance.
- 4. Removing, servicing and replacing oil pump and water pump.
- 5. Removing, servicing and replacing of A.C mechanical fuel pump / S.U. electrical fuelpump.
- 6. Removing, servicing of SOLEX, SU carburetors and study the components in MPFI.
- 7. Dismantling and assembling of Diesel feed pump and study of components in CRDI.
- 8. Dismantling and assembling of distributor pump and injectors

BOARD EXAMINATION

Note:

- 1. The students should be taught theory portion and proper training in all the exercises. All the portions should be completed before examinations.
- The students should maintain theory assignment, observation note book / manual and record notebook. The assignment and record note book should be submitted during the Board Practical Examinations.
- 3. 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. Two experiments will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- 4. All regular students appearing for first attempt should submit record notebook for the examination.
- 5. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- 6. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

Part - A (Thermal Lab)				
Aim & Procedure	10			
Tabulation / Reading	30			
Result / Graph	10			
Part – B (IC Engines Lab)				
Aim & Procedure	10			
Dismantling / Assembling	25			
Result	10			
Viva-voce	05			
TOTAL	100 Marks			

DETAILLED ALLOCATION OF MARKS

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.
MODEL QUESTION PAPER 4025550 – THERMAL AND IC ENGINES PRACTICAL

Max. Marks: 100

Duration: 3 Hrs.

PART - A

1. Conduct the performance test on Petrol / Diesel engine and draw the performance curves.

PART - B

2. Dismantling and assembling of the parts of a four stroke petrol and diesel engines.

LIST OF EQUIPMENTS

- 1. Basic and special tools of sufficient quantity.
- 2. Model for Port timing diagram / Valve timing diagram
- 3. Open cup apparatus and Closed cup apparatus
- 4. Say bolt viscometer
- 5. Red wood viscometer
- 6. Bomb Calorimeter
- 7. Petrol engine/ Diesel engine test rig to conduct load test
- 8. Diesel engine test rig to conduct load test
- 9. Multi cylinder Petrol engine test rig to conduct morse test.
- 10. Exhaust gas analyzer and smoke meter
- 11. Two stroke and Four stroke petrol and diesel engine.
- 12. Lubricating oil pump.
- 13. Water pump.
- 14. AC Mechanical fuel pump and S.U. electrical fuel pump.
- 15. SOLEX carburetor, SU carburetor, MPFI system and CRDIsystem.
- 16. Diesel fuel feed pump. (single acting / double acting)
- 17. Distributor pump.
- 18. Different types of Injectors.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

ELECTIVE PRACTICAL - I 4020561 – COMPUTER INTEGRATED MANUFACTURING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

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 : 4020561
- Semester : V

Subject Title : Computer Integrated Manufacturing Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Inst	Instructions Examination				
4020561				Marks		
Computer Integrated Manufacturing Practical	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
	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:

As per the latest requirements in the Industries this enables to learn the various concepts of Computer Integrated Manufacturing. They are able to write part program and able operate CNC lathe and Milling machines. They are able to understand the advanced concepts adopted in CIM.

OBJECTIVES:

- Acquire knowledge in the field of Computer Integrated Manufacturing
- Create 3D Solid models of machine components using modelling software
- Execute and perform machining operations in CNC Lathe and CNC Milling machines.

DETAILED SYLLABUS

Contents: Practical

PART A: SOLID MODELLING

Introduction to Part modelling - Datum Plane – constraint – sketch – dimensioning – extrude – revolve – sweep – blend – protrusion – extrusion – rib – shell – hole – round – chamfer – copy – mirror – assembly – align – orient – drawing and detailing –creating assembly views

Exercise No. 1. Geneva Wheel



Exercise No. 2. Bearing Block



Exercise No. 3. Bushed bearing



Exercise No. 4. Gib and Cotter joint





3. Gib and 4. cotter



Exercise No. 5. Screw Jack



Exercise No. 6. Universal Coupling



Note: Print the orthographic view and sectional view from the above assembled 3D drawing.

PART B: CNC Programming and Machining

Introduction: 1. Study of CNC lathe, milling. 2. Study of international standard codes: G-Codes and M-Codes 3. Format – Dimensioning methods. 4. Program writing – Turning simulator – Milling simulator, IS practice – commands menus. 5. Editing the program in the CNC machines. 6. Set the machine and execute the program in the CNC machines.

Note: Create and edit the part program in the simulation software for verification of the part program. Enter / tranfer the program to make the component in the CNC machine.

CNC Turning Machine Material: M.S / Aluminium / Acrylic fibre / Plastic
1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.



2. Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine.





3. Using canned cycle - Create a part program for thread cutting, grooving and

CNC Milling Machine Material: M.S / Aluminum / acrylic fibre / plastic

4. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.



5. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine.



6. Using subprogram - Create a part program and produce component in the Machine.



BOARD EXAMINATION

Note:

- All the exercises in both sections should be completed. Two exercises will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the exercises 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.

Note: Part A: The given component drawing should be created and solid modelling after assembly should be printed and submitted along with the answer paper for evaluation by the external examiner.

Part B: The program for the given component should be written in the answer paper. The program should be entered in the CNC machine and the component should be submitted for evaluation by the external examiner. The machined component should be kept under the custody of examiner.

Allocation of marks for Board Examination

PART A: Solid Modelling

Creation of sketch	:	15
Modelling	:	25
Accuracy	:	5
PART B: CNC Programming		
Program writing	:	15
Setting	:	10
Editing and Machining	:	20
Viva voce		10

Total Marks

: 100

LIST OF EQUIPMENTS

(To accommodate a batch of 30 students in Practice / Board Examinations)

- 1. Personal computer 30 Nos.
- 2. 3D Solid Modelling and Simulation software Sufficient to the strength
- 3. CNC Lathe -2 Nos.
- 4. CNC Mill -2 Nos.
- 5. Consumables Sufficient quantity
- 6. Laser / Inkjet Printer 1 No.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

ELECTIVE PRACTICAL - I 4025562 – MECHANICAL INSTRUMENTATION PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

ANNEXURE- I

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

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025562
- Semester : V
- Subject Title : EP I MECHANICAL INSTRUMENTATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instructions		Examination			
Subject	Hours / Hours					
	Week	Semester	Internal Assessment	Board Examinations	Total	Duration
EP – I MECHANICAL						
INSTRUMENTATION	4	64	25	100*	100	3 Hrs.
PRACTICAL						

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

RATIONALE:

The aim is to provide the knowledge about the Various Mechanical Instruments. The knowledge about the sensor based instruments is important and using more sensor based instruments widely in this world.

OBJECTIVES:

- Handle various instruments
- Analyze the result of calibration of thermistor
- Interpret calibration curve of a rotameter
- Evaluate the stress induced in a strain gauge

- Test and calibration of a thermocouple
- Draw the calibration curves of rotameter and thermistor
- Measure various parameters using instruments
- Study of control system with the help of suitable practical application by
- arranging
- Know the measurement and control laboratory and study the specifications of measuring Instruments /devices.

DETAILED SYLLABUS

Contents: Practical

Exercise

- 1. Find the static characteristics of instruments with demonstration of any one measuring instrument.
- 2. Measure displacement by using inductive transducer. (Linear variable displacement transducer i.e. LVDT) and verify its characteristics.
- 3. Measure negative pressure or vacuum using McLeod gauge / Bourdon tube pressure gauge.
- 4. Measure temperature by thermocouple and verifying by thermometer.
- 5. Measure flow of liquid by rotameter.
- 6. Measure liquid level by capacitive transducer system.
- 7. Measure speed of rotating shaft by stroboscope / magnetic / inductive pick up.
- 8. Measure force or weight by load cell.
- 9. Measure strain by using basic strain gauge and verify the stress induced.
- 10. Measurement of Torque.

BOARD EXAMINATION

Note:

- 1. The students should be taught theory portion and proper training in all the exercises. All the portions should be completed before examinations.
- The students should maintain theory assignment, observation note book / manual and record notebook. The assignment and record note book should be submitted during the Board Practical Examinations.
- 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.
- 4. All regular students appearing for first attempt should submit record notebook for the examination.
- 5. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- 6. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

Aim & Procedure	15
Block Diagram	35
Reading and graph	15
Execution of circuit	25
Viva-voce	10
TOTAL	100 Marks

DETAILLED ALLOCATION OF MARKS

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

MODEL QUESTION PAPER

4025562 – MECHANICAL INSTRUMENTATION PRACTICAL

Max. Marks: 100

Duration: 3 Hrs.

Answer the given Question

1. Measure negative pressure or vacuum using McLeod gauge / Bourdon tube pressure gauge.

LIST OF EQUIPMENTS

1.	Thermometer	-	2 Nos
2.	Temperature gauge / Temperature transducer	-	2 Nos
3.	Pressure measuring setup using McLeod gauge / Bourdon	n-	2 Nos.
tu	be pressure gauge.		
4.	Strain measurement module using Strain gauge	-	2 Nos
5.	Displacement measurement module using LVDT	-	2 Nos
6.	3 wire RTD (PT-50 / PT-100) with industrial standard	-	2 Nos
7.	Thermocouple (J-type / K-type) with industrial standard	-	2 Nos
8.	Water bath with heater arrangement	-	3 Nos
9.	Furnace with blower arrangement	-	1 No.
10.	Load cell instruments and measurement setup	-	2 Nos
11.	Torsion meter/strain gauge torque transducers	-	2 Nos
12.	Capacitance transducers, water level trainer kit	-	2 Nos
13.	Multi meter	-	2 Nos
14.	DC Motor, photoelectric pick up kit, CRO connecting	-	2 Nos
15.	Stroboscope	-	2 Nos



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

ELECTIVE PRACTICAL - I 4020563 – MECHATRONICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

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 : 4020563
- Semester : V
- Subject Title : Mechatronics Practical

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: To weeks						eeks
Subject	Instructions		Examination			
	Hours/	Hours/	Marks			
	Week Semest	Semester	Internal Assessment	Board Examination	Total	Duration
4020563 Mechatronics Practical	4	64	25	100*	100	3Hrs.

No. of Mooles non Compository 40 Mooles

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

RATIONALE:

As per the latest requirements in the Industries this enables to learn the various concepts of industrial automation. They are able to write ladder logic program and able operate PLCs. They are able to understand the advanced concepts adopted in industrial automation.

OBJECTIVES:

- Acquire knowledge in the field of mechatronics
- Explain the various components of electro pneumatics and electro hydraulics
- Handle PLC, HMI, SCADA and DCS components

4020563 MECHATRONICS PRACTICAL

DETAILED SYLLABUS

ELECTRO PNEUMATICS: Introduction to Electro Pneumatics - Applications of pneumatics - Pneumatic and electro pneumatic controllers - Components and assemblies in the electrical signal control section: Power supply unit - Push button and control switches - Sensors for measuring displacement and pressure - Relays and contactors. Electrically actuated directional control valves - Construction and mode of operation - Functions - Electrical connection of solenoid coils. Procedure for developing a control system.

ELECTRO HYDRAULICS: Basic principles of electro hydraulics - Function and use of electrohydraulic components - Production and interpretation of standard hydraulic and electrical circuit diagrams

PROCESS CONTROL INSTRUMENTATION: Process control - Types of processes – Structure of control system – Controllers - Digital controllers – Types of process control – ON/OFF Control – Analog control – Digital control. Data Acquisition System - Objectives of DAS - Types of DAS: Single channel DAS – Multichannel DAS – Computer based DAS. Data Loggers - Block diagram of Data Loggers – Control facilities in Data Logger – Uses of Data Logger - Different stages of Direct Digital Control.

SCADA - Fundamental principles of modern SCADA systems - SCADA hardware -SCADA software - Landlines for SCADA - SCADA and local area networks - Modem used in SCADA systems - Remote terminal units. Human Machine Interface – components of HMI.

Distributed Control System - Parts of DCS – Layered structure of DCS – Communication options in DCS.Variable Frequency Drives - Construction, Working, Operation, Applications and Specifications

Experiments

PART A

(ELECTRO PNEUMATICS)

- Direct control of a 3/2 NC Single solenoid valve and a 3/2 NO Single solenoid valve
- 2. Direct control of a 5/2 single solenoid valve and a 5/2 double solenoid valve
- 3. Simple circuit using OR Logic and AND Logic
- 4. Limit switch and proximity switch application circuits

(ELECTRO HYDRAULICS)

- 1. Sorting device using double acting cylinder, directly actuated, manually
- 2. Component selection on conveyor belt using double acting cylinder and directly actuated, manually
- 3. Lifting station using single acting cylinder and directly actuated, manually
- 4. Door control using double acting cylinder and interlocking

PART B

PROCESS CONTROL INSTRUMENTATION

- 1. Wiring practice of HMI
- 2. Design of HMI screen
- 3. HMI Configuration and Interfacing with PLC and PC
- 4. Configuring Alarms in SCADA
- 5. Real time project development and interfacing with PLC
- 6. Monitoring & Control of Pneumatic System using HMI

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.

- 3. All regular students appearing for first attempt should submit record notebook for the examination.
- 4. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- 5. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

ALLOCATION OF MARKS

PART A: Electro Pneumatic circuit / Electro Hydraulic circuit (by lot):

Circuit diagram	:	15
Components connections & execution	:	20
Output	:	10

PART B: Process Control Instrumentation

Circuit diagram	:	15
Execution & Programming	:	20
Output	:	10
Vivavoce	:	10
Total Marks	:	100

List of Equipments

(To accommodate a batch of 30 students in Practice / Board Examinations) Electro Pneumatics:

- Basic Pneumatic Trainer Kit with FRL Unit, Compressor and Accessories 2 Nos
 - 3/2 NC Single Solenoid Valve 2Nos
 - 3/2 NO Single Solenoid Valve 2Nos
 - 5/2 Single Solenoid Valve 2Nos
 - 5/2 Double Solenoid Valve 2Nos
 - Limit Switch 6 Nos
 - Proximity Sensor (Inductive, Capacitive & Optical) Each 2 Nos
 - Single Acting Pneumatic Cylinder 4 Nos
 - Double Acting Pneumatic Cylinder 2 Nos
 - Power Supply Unit, Connecting Leads and Hoses As per Requirements

Electro Hydraulics:

- 1. Basic Hydraulics Trainer Kit with Hydraulic Pump, Regulator and Hoses Accessories – 2 Nos
 - Double Acting Cylinder 2 Nos
 - Single Acting Cylinder 2 No
 - Manual Actuator Switch 4 Nos
 - Material Sorting assembly set up 1 No
 - Conveyor Assembly set up 1 No
 - Lifting Station Assembly Set up 1 No
 - Limit Switch 4 Nos

Process Control Instrumentation:

- Programmable Logic Controller (PLC) with Software 3 Nos
- o Human Machine Interface (HMI) with Software 3 Nos
- SCADA Software 1 No or Integrated Software for PLC, HMI and SCADA)
- Personnel Computer 3 Nos
- Water Tank Assembly set up with Level Sensor and Flow Controller (Actuator) to interface with PLC and HMI – 1 No



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR V SEMESTER

4020570 – ENTREPRENEURSHIP & STARTUP

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 : 4020570

Semester : V

Subject Title : Entrepreneurship & Startups

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

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

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

UNIT	Торіс	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
	Field visit and Preparation of case study report	14
	Total	64

Topics and Allocation of Hours

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 5th semester the students will be able to

- o To excite the students about entrepreneurship
- o Acquiring Entrepreneurial spirit and resourcefulness
- Understanding the concept and process of entrepreneurship
- o 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
- o Survey and analyze the market to understand customer needs
- Understand the importance of generation of ideas and product selection
- o Learn the preparation of project feasibility report
- o Understand the importance of sales and turnover
- o Familiarization of various financial and non financial schemes
- o Aware the concept of incubation and starts ups

Unit	Name of the Topics	Hours
1	ENTREPRENEURSHIP – INTRODUCTION AND PROCESS	10
	Concept, Functions and Importance	
	Myths about Entrepreneurship	
	Pros and Cons of Entrepreneurship	
	Process of Entrepreneurship	
	Benefits of Entrepreneur	
	Competencies and Characteristics	
	Ethical Entropropourship	
	Entrepreneurial Values and Attitudes	
	Motivation	
	Entropropouro, co problem colvero	
	Entrepreneurs - as problem solvers	
	Mindset of an employee and an entrepreneur	
	Business Failure – causes and remedies	
2		10
2	BUSINESS IDEA AND BANKING	10
	 Types of Business: Manufacturing, Trading and Services 	
	 Stakeholders: Sellers, Vendors and Consumers 	
	E- Commerce Business Models	
	 Types of Resources - Human, Capital and Entrepreneurial 	
	tools	
	 Goals of Business and Goal Setting 	
	 Patent, copyright and Intellectual Property Rights 	
	 Negotiations - Importance and methods 	
	 Customer Relations and Vendor Management 	
	Size and Capital based classification of business enterprises	
	Role of Financial Institutions	
	Role of Government policy	

DETAILED SYLLABUS

	•	Entrepreneurial support systems	
	•	Incentive schemes for State Government	
	•	Incentive schemes for Central Government	
3	STAF	TUPS, E-CELL AND SUCCESS STORIES	10
	•	Concept of Incubation centre's	
	•	Activities of DIC financial institutions and other relevance	
		institutions	
	•	Success stories of Indian and global business legends	
	•	Field Visit to MSME's	
	•	Various sources of Information	
	•	Learn to earn	
	•	Startup and its stages	
	•	Role of Technology – E-commerce and Social Media	
	•	Role of E-Cell	
	•	E-Cell to Entrepreneurship	
4	PRIC	ING AND COST ANALYSIS	10
		Oplandsting of their of Oplanthait Dring and their Opat	
	•	Calculation of Unit of Sale, Unit Price and Unit Cost	
	•	Types of Costs - Variable and Fixed, Operational Costs	
	•	Break Even Analysis	
	•	Inderstand the meaning and concept of the term Cash	
		Propago a Cash Elow Projection	
	•	Pricing and Eactors affecting pricing	
	•	Linderstand the importance and preparation of Income	
	•	Statement	
	•	Launch Strategies after pricing and proof of concept	
		Branding - Business name logo tag line	
	•	Promotion strategy	
5	BUSI	NESS PLAN PREPARATION	10
	•	Generation of Ideas,	
	•	Business Ideas vs. Business Opportunities	

٠	Selecting the Right Opportunity
•	Product selection
•	New product development and analysis
•	Feasibility Study Report – Technical analysis, financial
	analysis and commercial analysis
•	Market Research - Concept, Importance and Process
•	Marketing and Sales strategy
•	Digital marketing
•	Social Entrepreneurship
•	Risk Taking-Concept
٠	Types of business risks

REFERNCE BOOKS:

- Dr. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra - 282002
- Dr. G.K. Varshney, Business Regulatory Framework , Sahitya Bhawan Publications, Agra - 282002
- 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
- Charantimath Poornima M. Entrepreneurship Development and Small Business Enterprises, Pearson Education, Noida - 201301
- Trott, Innovation Management and New Product Development, Pearson Education, Noida - 201301
- 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
- I. V. Trivedi, Renu Jatana, Indian Banking System, RBSA Publishers, Rajasthan
- 10. Simon Daniel, HOW TO START A BUSINESS IN INDIA, BUUKS, Chennai 600018

 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

Total	-	25
Attendance	-	5
Seminar Presentation	-	10
Assignment (Theory portion)*	-	10

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

- The students should be taught all units and proper exposure and field visit also arranged. All the portions should be completed before examinations.
- 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.
- 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).

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

DETAILED ALLOCATION OF MARKS



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

4020610 - INDUSTRIAL ENGINEERING & MANAGEMENT

CURRICULUM DEVELOPMENT CENTRE

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	Instr	uctions		Examinatio	n	
4020610	Hours	Hours /		Marks		
Industrial Engineering and	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
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 WorkMeasurement	18
	Principles, Personnel Management and Organizatioal Behavior:	19
IV	Financial and Material Management	18
V	Engineering Ethics and Human Values	16
Test and Model Exam		
Total		

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
I	Plant Engineering and Plant Safety	
	Chapter: 1.1: Plant Engineering : Plant – Selection of site of industry	9
	- 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.	
	Chapter: 1.2: Plant Safety: Importance - accident - causes and	9
	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.	

П	Work Study, Method Study and Work Measurement	
	Chapter: 2.1: Work Study: Productivity – Standard of living – method	4
	of improving productivity - Objectives - Importance of good working	
	conditions.	
	Chapter: 2.2: Method Study: Definition - Objectives - Selection of	6
	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.	
	Chapter: 2.3: Work Measurement: Definition - Basic procedure in	8
	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).	
III	Principles, Personnel Management and Organizational Behavior:	
	Chapter: 3.1: Principles of Management: Definition of management –	7
	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.	
	Chapter: 3.2: Personnel Management: Responsibility of human	7
	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.	
	Chapter: 3.3: Organizational behavior: Definition – organization	5
	- 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.	
IV	Financial and Material Management	
	Chapter: 4.1: Financial Management: Fixed and working capital -	9
	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.	
	Chapter: 4.2: Material Management: Objectives of good stock control	9
	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.	
V	Engineering Ethics and Human Values	
	Chapter: 5.1: Engineering Ethics: Definition - engineering ethics -	9
	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	
	(IPRs).	
	Chapter: 5.2: Human values : Morals - values - integrity - service	7
	learning - civic virtue - respect for others - living peacefully - caring -	
	sharing – honesty - courage - valuing time cooperation - commitments	
	 empathy - selfconfidence – character - stress management. 	

Reference Books :

- Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications (P) Ltd – 2004, 67/4 Madras House, Daryaganj, New Delhi– 110002.
- Engineering Economics and Management, T.R. Banga& S.C. Sharma, McGraw Hill Editiion. 2 – 2001, New Delhi.
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- 4. Govindarajan .M, Natarajan. S, Senthilkumar V.V, Engineering ethics, prentice hall of India New Delhi, 2004.
- 5. Management, Aglobal perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition. Latest.
- Essentials of Management,4th Edition, Joseph L. Massie, Prentice Hall of India, New Delhi 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. New Delhi. Latest.
- 9. Charles B. Fledderman, Engineering ethics, pearson prentice hall, New Jersey, 2004.


DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

4020620 – E - VEHICLE TECHNOLOGY AND POLICY

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 : 4020620
- Semester : VI
- Subject Title : E Vehicle Technology & Policy

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions			Examination			
4020620	Hours	Hours /					
E Vehicle Technology &	/ Week	Veek Semester	Internal Assessment	Board Examinations	Total	Duration	
Policy	4	64	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			
	Environmental impact and history, Types of Electric vehicles	12			
II	Electric vehicle, Electrical Propulsion System	12			
III	Energy Storages, Charging System, Effects and Impacts	11			
IV	Electric Mobility Policy Frame Work	11			
V	Tamilnadu E-Vehicle Policy 2019	11			
Test and Model Exam					
Total					

RATIONALE:

The world is transitioning to cleaner mobility options with the aim at improving air quality and reducing dependency on fossil fuels. Electric Vehicles (EVs) have emerged a popular clean mobility choice to reduce emissions. EVs are powered fully or partially by batteries, they can help to reduce dependence on fossil fuels also air quality. Tamil Nadu is one of the most advanced states in India. Tamil Nadu has a highly developed industrial eco-system and is very strong in sectors like automobiles and auto-components. Many globally renowned companies have setup their manufacturing facilities in Tamil Nadu. Due the rapid depletion of fossil fuel and increase in fuel cost, environmental pollution, the shift to clean transport is necessary. This subject introduced by keeping all the above factors.

OBJECTIVES:

- To learn the environmental impact and history of Electric Vehicles.
- To understand the concept of Electric Vehicle and its types.
- To study the configurations of Electric Vehicles
- To acquire knowledge about Energy Storages, Charging System, Effects and Impacts
- To appreciate the Electric Mobility Policy Frame work India and EV Policy Tamil Nadu 2019.

4020620 E Vehicle Technology & Policy DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	Environmental impact and history:	6
	Environmental impact of conventional vehicle - Air pollution - Petroleum	
	resources - History of Electric vehicles & Hybrid Electric Vehicles -	
	Conventional drive train system - Rear Wheel, Front Wheel and All	
	wheel - Parts of Drive train system	
	Types of Electric Vehicles:	6
	Introduction to Battery Electric Vehicle (BEV) - Definition BEV -	
	Necessity BEV - Different between BEV and Conventional Vehicle -	

	Advantages of BEV - Block diagram of BEV - Hybrid electric Vehicle	
	(HEV) - Plug-in Hybrid Electric Vehicle (PHEV) - Fuel Cell Electric	
	Vehicle (FCEV) – Description.	
II	Electric Vehicles:	6
	Configurations of Electric Vehicle - Performance of Electric Vehicles -	
	Tractive Effort in Normal Driving – energy consumption.	
	Hybrid Electric Vehicles: Concept of Hybrid electric drive trains -	
	Architecture of Hybrid Electric Drive trains – Series, Parallel and Series &	
	Parallel	
	Electric Propulsion Systems:	6
	Types of EV motors - DC motor drives- Permanent Magnetic Brush Less	
	DC Motor Drives (BLDC) – Principles, Construction and Working – Hub	
	motor Drive system - Merits and Demerits of DC motor drive, BLDC	
	motor drive	
	Energy Storages:	5
	Electrochemical Batteries - Battery Technologies - Construction and	
	working of Lead Acid Batteries, Nickel Based Batteries and Lithium	
	Based Batteries - Role of Battery Management System (BMS)- Battery	
	pack development Technology- Cell Series and Parallel connection to	
	develop battery pack.	
	Charging:	4
	Battery Charging techniques - Constant current and Constant voltage,	
	Trickle charging - Battery Swapping Techniques - DC charging -	
	Wireless charging - Maintenance of Battery pack - Latest development	
	in battery chemistry.	
	Effects and Impacts:	1
	Effects of EV - Impacts on Power grid - Impacts on Environment -	
	Impacts on Economy.	
IV	Electric Mobility Policy Frame Work	11
	Government of India Electric Mobility Policy Frame work - Global	
	Scenario of EV adoption - Electric mobility in India - National Electric	
	Mobility Mission Plan 2020 - Action led by Original Equipment	
	Manufacturers - Need of EV Policy - Advantage of EV Eco system -	

	Scope and Applicability of EV Policy – ARAI Standards for Electric	
	Vehicle – AIS 038, AIS 039 & AIS 123 - Key Performance Indicator -	
	Global impact – Trends and Future Developments	
V	Tamil Nadu E-Vehicle Policy 2019	11
	Tamil Nadu E-vehicle Policy 2019: Vehicle Population in Tamil Nadu -	
	Objectives of EV Policy – Policy Measures – Demand side incentives –	
	Supply side incentives to promote EV manufacturing - Revision of	
	Transport Regulation of EV – City building codes – Capacity Building and	
	Skilling – Charging structure – implementing agencies – Reasearch	
	&Development and Business Incubation – Recycling Ecosystem –	
	Battery and EVs	

Reference Books

- 1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi, CR Press, London, New York.
- Comparison of Electric and Conventional Vehicles in Indian Market: Total Cost of Ownership, Consumer Preference and Best Segment for Electric Vehicle (IJSR), Akshat Bansal, Akriti Agarwal
- A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development (MDPI), Fuad Un-Noor, Sanjeevikumar Padmanaban, Lucian Mihet-Popa, Mohammad Nurunnabi Mollah and Eklas Hossain.
- 4. Electric Vehicles: A future Projection CII October 2020 report.
- 5. Design and analysis of aluminum/air battery system for electric vehicles, Shaohua Yang, Harold Knickle, Elsevier.
- 6. Propelling Electric Vehicles in India, Technical study of Electric Vehicles and Charging Infrastructure
- ZERO EMISSION VEHICLES (ZEVs): TOWARDS A POLICY FRAMEWORK

 NTI Aayog.
- FASTER ADOPTION OF ELECTRIC VEHICLES IN INDIA: PERSPECTIVE OF CONSUMERS AND INDUSTRY, The Energy and Resources Institute, New Delhi.
- 9. India EV Story: Emerging Opportunities by Innovation Norway.
- 10. Automotive Industry Standards AIS 038, AIS 039 & AIS 123 Manual



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

ELECTIVE THEORY - II 4025631 – TOOL DESIGN

ANNEXURE-I

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

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025631
- Semester : VI
- Subject Title : ET II TOOL DESIGN

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instru	ictions	Examination			
Subject	Hours / Week	Hours / Semester	Marks			
•			Internal Assessment	Board Examinations	Total	Duration
ET – II TOOL DESIGN	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	Торіс	Hrs.			
I	Design of Single Point Cutting Tools and Milling Cutters	14			
II	Design of Taper Shank Twist Drill, Tap, Reamer and Broach	15			
III	Design of Blanking Dies, Piercing Dies and Bending Dies	15			
IV	Design of Drawing Dies and Forming Dies	15			
V	Design of Jigs and Fixtures	14			
	Test & Model Exam				
	Total				

RATIONALE:

The aim is to impart basics of the design procedure and manufacturing of cutting tools, jigs & fixtures, dies & molds, gauges and press tools.

OBJECTIVES:

At the end of the study of Semester the student will be able to

- Design and develop single point cutting tools, Multi point cutting tools.
- Select cutting tool materials for various tools.
- Calculate cutting forces during orthogonal cutting.
- Select milling cutters for various operations.
- Standardize tools & tools elements, components of jigs and fixtures.
- Design tools that would be safe and easy to operate.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	DESIGN OF SINGLE POINT CUTTING TOOLS AND MILLING	
	CUTTERS	
	Chapter: 1.1:	7
	Design of single point cutting tools: Nomenclature of Single Point	
	Cutting Tool - Tool signature - Functions of various tool angles	
	Optimum values of tool angles - Cutting tool materials - Orthogonal &	
	Oblique cutting — Problems - Chip formation — Merchant's theory of	
	mechanics of metal cutting - Permissible speed, feed& depth of cut -	
	Design of single of cutting tools - Design of parting-off tool - Chip	
	breaker - Types and uses — Simple Design problems.	
	Chapter: 1.2:	7
	Design of milling cutters: Nomenclature of milling cutter -types-uses-tool	
	materials - Angle of contacts – Forces analysis- Forces and power	
	consumption - Allowable feed and depth of cut - Tooth form and cutter	
	design — Simple Design problems on Plain Milling cutter. ISO designation	
	of Cutting Tools.	

II	DESIGN OF TAPER SHANK TWIST DRILL, TAP, REAMER AND	
	BROACH	
	Chapter: 2.1:	8
	Design of taper shank twist drill & taps: Nomenclature of Twist drill -	
	Design aspects - Cutting forces - Material selection - Simple Design	
	problems. Nomenclature of taps - Types- Tool materials - Design and	
	selection – Simple Design problems.	
	Chapter: 2.2:	7
	Design of reamer and broach tool: Nomenclature of reamer - Types -	
	Reamer design - Tool materials - Design problems Introduction - Design	
	considerations - Constructional detail of broach - Angles of tooth – Simple	
	Design problems.	
	DESIGN OF BLANKING DIES, PIERCING DIES AND BENDING	
	Chapter: 3.1:	8
	Blanking Dies: Fundamentals of die - Cutting operations - Power press	
	types - Cutting action in punch and die operation – Die clearance -	
	Cutting forces - Types of die construction - Die block design - Punch	
	Design - Description of other parts in a die and punch – Assembly -	
	Stock feed mechanism – Simple Design problems.	
	Chapter: 3.2:	7
	Bending Dies: Design of bending dies - Bending terminology - Bending	
	methods - Design principles - Blank length - Bend radius - Bend	
	allowances - Spring back - Bending pressure – Simple Design problems.	
IV	DESIGN OF DRAWING DIES AND FORMING DIES	
	Chapter: 4.1:	8
	Drawing Dies Design of drawing dies : Drawing operations - Deep	
	drawing and materials for deep drawing - Drawing die - Design	
	consideration - Calculation of blank diameter, number of draws – Pressure	
	- Clearance - Allowance - Radius of draw dies - Punch radius - Drawing	
	speed and single and double action draw dies – Simple Design problems.	
	Chapter: 4.2:	7
	Forming dies: principles of forming-types-gauges-types-simple design	
	problems on plug gauge and ring gauge - Twisting operations - Coining	

	dies - Swaging dies (Descriptions only).	
V	DESIGN OF JIGS AND FIXTURES	
	Chapter: 5.1:	7
	Design of jigs : Principles of locating and clamping - Definition of drill jig	
	- General considerations in the design of drill jigs - Drill bushings - Jig feet	
	- Types of drill jigs - Methods of constructions - Design of universal jig -	
	trunnion jig, leaf jig, plate jig and indexing jig.	
	Chapter: 5.2:	7
	Design of fixtures : Definition of fixture - Design of Milling fixtures, lathes	
	fixtures, welding fixtures and grinding fixtures	

Reference Books

- 1. Tool Design, Donaldson TMH, New Delhi.
- 2. Fundamentals of Tool Design, ASTME, PHI, New Delhi.
- 3. Production Engg. Science, P.C.Pandey & Singh, Charator Publishing., Anand.
- 4. Production Engg. Design (Tool Design), Surender K. & UmeshChander, Satyaprakashan, New Delhi.
- 5. Tool Design, Herman Pollack, ELBS, UK.
- 6. Fundamentals of Tool Design, S.R.Basu & M.Mukerjee, Oxford & IBH Publishing, New Delhi.
- 7. Design of Jigs, Fixtures and Press tools, K.Venkataraman, TMH, New Delhi.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

ELECTIVE THEORY - II 4020632 – REFRIGERATION AND AIR CONDITIONING

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 : 4020632
- Semester : VI

Subject Title : Refrigeration and Air-Conditioning

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions			Examination			
4020632	Harma	4020632 Marks		Marks			
Refrigeration and Air-Conditioning	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration	
	5	80	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	Refrigeration System And Refrigeration Equipments	15				
	Vapour Compression Refrigeration System And Vapour	15				
	Absorption Refrigeration System					
	Refrigerant Flow Controls, Refrigerants And					
	Lubricants, Applications Of Refrigeration					
IV	Psychrometry And Comfort Air Conditioning					
V	Air Conditioning Systems And Cooling Load Calculations					
	Test and Model Exam	7				
	TOTAL	80				

RATIONALE:

Requirement of human comfort, maintenance of machines and preserving Perishables through air conditioning is very essential. Hence learning the study of refrigeration principles, refrigeration system, Concept of air-conditioning and methods of facilitates quality design of air conditioners are essential.

OBJECTIVES:

- Explain the working of open and closed air system of refrigeration.
- Describe the working and construction of compressors used for airconditioning
- Explain the vapour compression refrigeration system.
- Explain the vapour absorption refrigeration system.
- Compare the properties and applications of various refrigerants.
- Define the parameters used for air conditioning.
- To Use the psychometric chart.
- Estimate the cooling load for the given requirement.
- Explain the industrial application of refrigeration.

4020632 REFRIGERATION AND AIR-CONDITIONING DETAILLED SYLLABUS

Unit	Name Of The Topic	Hours
I	REFRIGERATION SYSTEM	15
	Thermodynamic state of a pure substances - modes of heat	
	transfer – laws of heat transfer – mechanisms of production of cold	
	- unit of refrigeration - types of refrigeration - reversed Carnot	
	cycle-C.O.P of heat engine-heat pump- refrigerating machine -	
	principle of working of open and closed air system of refrigeration –	
	Advantages and disadvantages – problems.	
	REFRIGERATION EQUIPMENTS	
	Compressor - principle of working and constructional details of	
	reciprocating and rotary compressors, hermetically and	
	semihermetically sealed compressors - condensers - principle of	
	working and constructional details of air cooled and water cooled	

	Condensers, evaporative condensers - advantages and	
	disadvantages - natural and forced draught cooling towers.	
	Evaporators - natural circulation and forced circulation type -	
	principle of working constructional details.	
II	VAPOUR COMPRESSION REFRIGERATION SYSTEM	15
	Principle of working of vapour compression system - analysis of	
	vapour compression cycle using T-s diagram and p-H diagram-	
	refrigerating effect - compression work - C.O.P - effect	
	ofsuperheating and under cooling - problems - effect of	
	evaporative	
	pressure - condenser pressure - liquid - vapour refrigeration	
	heatexchangers – advantages and disadvantages of superheating	
	and Under cooling – use of flash chamber and accumulator.	
	VAPOUR ABSORPTION REFRIGERATION SYSTEM	
	Simple absorption system – Electrolux system – Solar absorption	
	system - absorption system comparison with Mechanical	
	(Compression) refrigeration system.	
	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION	15
	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic	15
111	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator –	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12,	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics.	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics. APPLICATIONS OF REFRIGERATION	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics. APPLICATIONS OF REFRIGERATION Slow freezing – quick freezing – cold storage – frozen storage	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics. APPLICATIONS OF REFRIGERATION Slow freezing – quick freezing – cold storage – frozen storage freeze drying – dairy refrigeration – ice cream cabinets – ice	15
III	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics. APPLICATIONS OF REFRIGERATION Slow freezing – quick freezing – cold storage – frozen storage freeze drying – dairy refrigeration – ice cream cabinets – ice making – Water cooler, milk cooler, bottle cooler – frost free	15
	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics. APPLICATIONS OF REFRIGERATION Slow freezing – quick freezing – cold storage – frozen storage freeze drying – dairy refrigeration – ice cream cabinets – ice making – Water cooler, milk cooler, bottle cooler – frost free refrigeration.	15
III IV	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics. APPLICATIONS OF REFRIGERATION Slow freezing – quick freezing – cold storage – frozen storage freeze drying – dairy refrigeration – ice cream cabinets – ice making – Water cooler, milk cooler, bottle cooler – frost free refrigeration. PSYCHROMETRY AND COMFORT AIR CONDITIONING	15
III IV	REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATION OF REFRIGERATION Capillary tube - automatic expansion valve – thermostatic expansion valve - solenoid valve - evaporator pressure regulator – suction pressure regulator - selection of a refrigerant - properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 – lubricants used in refrigeration and their applications, Cryogenics. APPLICATIONS OF REFRIGERATION Slow freezing – quick freezing – cold storage – frozen storage freeze drying – dairy refrigeration – ice cream cabinets – ice making – Water cooler, milk cooler, bottle cooler – frost free refrigeration. PSYCHROMETRY AND COMFORT AIR CONDITIONING Definitions of dry air, moist air, water vapour, Avogadro's law,	15

	dew point - humidity - specific and absolute - relative humidity -	
	degree of saturation – enthalpy of moist air - adiabatic saturation of	
	air by evaporation of water - psychometric chart and its uses -	
	psychometric processes - sensible heating and cooling -	
	humidifying and heating – dehumidifying and cooling – adiabatic	
	cooling with humidification – total heating or cooling processes –	
	sensible heat factor – by pass factor with simple problems –	
	Governing optimum effective temperature - comfort chart - design	
	consideration.	
V	AIR CONDITIONING SYSTEMS	14
	Equipment for air conditioning and insulation factors -	
	airpurification - temperature control - humidity control - dry and	
	wet filters - centrifugal dust collector – air washer humidifier –	
	dehumidifier – fans and blowers – grills and registers – summerand	
	winter air conditioning, window type air conditioner – split type air	
	conditioner system – properties of ideal insulator, types of	
	insulating materials – air distribution and duct systems – tools and	
	Installation, servicing and maintenance of R & AC systems.	
	COOLING LOAD CALCULATIONS	
	Different heat sources - conduction heat load - radiationLoad of	
	sun - occupants load - equipment load - infiltration air load-	
	miscellaneous heat sources – fresh air load – simple problems.	

Reference books:

- Refrigeration and air conditioning, P.L. Ballaney, Khanna Publishers, 2B,North Market, Naisarak, New Delhi 110 006.
- 2. Refrigeration and air conditioning, V.K. Jain,
- 3. Industrial Refrigeration Hand Book, Wilbert F. Steocker
- 4. A course in refrigeration and air conditioning, Domkundwar,
- 5. Principles of refrigeration, Dossat,
- Home refrigeration and air conditioning, Audels, Theo.Audel & Co. publisher,199 Edn.49, West 23rd Street, New York. – 1998
- 7. Refrigeration and air conditioning, C.P Arora,
- 8. Cryogenic systems Randell Fd Barron.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

ELECTIVE THEORY - II 4025633 – OIL HYDRAULICS AND PNEUMATICS

ANNEXURE-I

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

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025633
- Semester : VI

Subject Title : ET – II OIL HYDRAULICS AND PNEUMATICS

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instr	uctions	Examination				
Subiect	Hours /	Hours /	Marks				
	Week Semes	Semester	Internal Assessment	Board Examinations	Total	Duration	
ET – II OIL							
HYDRAULICS AND	5	80	25	100*	100	3 Hrs.	
PNEUMATICS							

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

Topics and Allocation of Hours

UNIT	Торіс	
I	Introduction, Hydraulic Pumps, Cylinder and Motors	14
II	Hydraulic Valves, Seals & Filters and Basic Circuits	15
	Design of Hydraulic Elements	14
IV	Basic Pneumatic System and Circuits	15
V	Design of Pneumatic Logic Circuits, Low Cost Automation, Installation & Maintenance of Fluid Power Systems	15
	Test & Model Exam	7
	Total	80

RATIONALE:

The units of this subject are useful for the students to learn about the various hydraulic and pneumatic circuits and it describes low cost automation, installation and maintenance of fluid power systems.

OBJECTIVES:

At the end of the study of Semester the student will be able to

- Design hydraulic and pneumatic systems for various applications.
- Select various types of hydraulic pumps, cylinders and motors.
- Design hydraulic circuits for automation.
- Design pneumatic logic circuits for low cost automation
- Handle installation and maintenance of fluid power systems

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
	INTRODUCTION, HYDRAULIC PUMPS, CYLINDER AND MOTORS	
	Chapter: 1.1:	6
	Introduction: Introduction to Fluid Power System and its basic	
	components – Basic law – Applications of fluid power – Advantages and	
	drawbacksof fluid power.	
	Chapter: 1.2:	8
	Hydraulic Pumps: Classification – Positive displacement Pumps:	
	Gearpump, Lobe pump, Vane pump, Piston pump – Pump performance	
	-Pump noise - Pump selection. Cylinder mountings and mechanical	
	linkages – Cylinder force, velocity and Power – Cylinder loads due to	
	moving of weights – Cylinder loading through mechanical linkages –	
	Hydraulic cylinder cushions and shock absorbers. Analysis of torque	
	capacity – Gear motor – Vane motor – Piston motor – Hydraulic motor	
	theoretical torque, power and flow rate – Hydraulicmotor performance.	
II	HYDRAULIC VALVES, SEALS & FILTERS AND BASIC CIRCUITS	
	Chapter: 2.1:	7
	Pressure Control Valves (PCV): Simple pressure relief valve, Compound	

	pressure relief valve, Pressure reducing valve, Unloading valve,	
	Sequence valve, Counter balance valve. Flow Control Valves (FCV):	
	Orifice as flow control valve, Needle valve, Pressure compensated and	
	Non-pressure compensated valve.	
	Chapter: 2.2:	8
	Direction Control Valves (DCV): Check valve, Pilot operated check	
	valve, three-way valve, four-way valve, Manual / Mechanical / Solenoid	
	operated valves. Servo valves: Definition – Mechanical-hydraulic	
	servo valve — Electro- hydraulic servo valves. Seals and its	
	classification – Filters and its types – Filter location. Accumulators:	
	Reservoirs and accumulators – Types of accumulators – Charging and	
	discharging of accumulators – Accumulator circuits. Deceleration	
	circuit — Intensifier circuit — Regenerative circuit — Synchronizing	
	circuit – Automatic cylinder reciprocating circuit – Sequencing circuit.	
	Safety Circuits: Two-hand safety control circuit –Fail-safe control circuit	
	by using emergency cut-off valve.	
	DESIGN OF HYDRAULIC ELEMENTS	
	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u>	4
	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder –	4
111	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads –	4
111	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems –	4
111	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems – Cylinder preferred sizes – Piston rod buckling and simple	4
111	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems – Cylinder preferred sizes – Piston rod buckling and simple problems.	4
111	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems — Cylinder preferred sizes — Piston rod buckling and simple problems. <u>Chapter: 3.2:</u>	4
111	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems — Cylinder preferred sizes — Piston rod buckling and simple problems. <u>Chapter: 3.2:</u> Selection of Hydraulic Motor: Hydro-static drives – Hydro-static drive	4
111	DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems — Cylinder preferred sizes — Piston rod buckling and simple problems. <u>Chapter: 3.2:</u> Selection of Hydraulic Motor: Hydro-static drives – Hydro-static drive characteristics – Braking of hydro-static drives – Matching motor to	4
111	DESIGN OF HYDRAULIC ELEMENTS Chapter: 3.1: Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems – Cylinder preferred sizes – Piston rod buckling and simple problems. Chapter: 3.2: Selection of Hydraulic Motor: Hydro-static drives – Hydro-static drive characteristics – Braking of hydro-static drives – Matching motor to load – Simple problems.	4
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111	 DESIGN OF HYDRAULIC ELEMENTS <u>Chapter: 3.1:</u> Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems — Cylinder preferred sizes — Piston rod buckling and simple problems. <u>Chapter: 3.2:</u> Selection of Hydraulic Motor: Hydro-static drives – Hydro-static drive characteristics – Braking of hydro-static drives – Matching motor to load – Simple problems. <u>Chapter: 3.3:</u> Selection of Control Valves: Relief valves – Flow control valves – Direction control valves. <u>Chapter: 3.4:</u> Selection of Other Devices: Selection of filters – Selection of 	4 4 3 3

	Reservoir and its design – Sizing of accumulator – Simple problems	
IV	BASIC PNEUMATIC SYSTEM AND CIRCUITS	
	Chapter: 4.1:	7
	Pneumatic System: Comparison of pneumatic system with hydraulic	
	system — Basic pneumatic system: Air filter, Pressure regulator,	
	Lubricator and Muffler — Pneumatic valves: Direction control valve,	
	Flow control valve, Shuttle valve (for .OR. operation), Two-pressure	
	valve (for .AND. operation), Quick exhaust valve and Time delay valve.	
	Cylinders – Air-motors and its types – Basic pneumatic circuits:	
	Simple circuit, Material-handling circuit.	
	Chapter: 4.2:	8
	Hydro-pneumatics: Air-oil reservoir — Air-oil cylinder — Air-oil	
	intensifier — Comparison of hydraulic, pneumatic and hydro-	
	pneumatic systems. Advantages - Pneumatic sensors - Position	
	sensors and its types - Pressure sensor - Switching elements.	
	Operation of single-acting cylinder - Operation of double-acting	
	cylinder – Air- pilot control of double- acting cylinder – Cylinder cycle	
	timing system - Two- step speed control system - Two-handed	
	safety control system - Control of air motor - Deceleration air cushion	
	of cylinder. Cylinder sequencing circuit - Control of pneumatic cylinder	
	using flip-flop.	
V	DESIGN OF PNEUMATIC LOGIC CIRCUITS, LOW COST	
	AUTOMATION, INSTALLATION & MAINTENANCE OF FLUIDPOWER	
	SYSTEMS	
	Chapter: 5.1:	5
	Methods of designing Pneumatic Logic Circuits: Classic method,	
	Cascade method, Step-counter methods, Karnaugh-Veitch mapping	
	method and Combinational circuit design. Concepts - Case studies:	
	Conveyor feed system, Car park barrier and Pick & Place robot.	
	Chapter: 5.2:	5
	Installation of hydraulic Systems : Pump, cylinder, valves - Installation	
	of tubing and Power pack, Filling systems – Maintenance of hydraulic	
	system - Trouble- shooting of hydraulic system - Fault finding	

procedure – Troubles, Possible causes and Remedies of pumps, relief	
valves, DCV and other valves, hydraulic motor, accumulators -	
General circuit problems.	
Chapter: 5.3:	5
Installation of pneumatic systems : - Maintenance of pneumatic	
system – Trouble-shooting of pneumatic system – Troubles, Possible	
causes and Remedies of compressor, FRL, air cylinder and motor,	
valves, air motor, pipe lines and hoses	

Reference Books

- 1. Introduction to Hydraulics & Pneumatics, S.Ilango & V.Soundararajan, Prentice Hall of India, New Delhi.
- Pneumatic Actuating Systems for Automatic Equipment Structure & Design, Igor L.Krivits & German V.Krejnin, CRC Press, Taylor & Francis Group, USA.
- 3. Pneumatic Conveying Design Guide, David Mills, Elseveir Butterworth- Heinemann, UK.
- 4. Principles of Hydraulic System Design, Peter J.Chapple, Cocxs Moore Publishing, UK.
- 5. Principle and Practice of Hydraulic System, S.R.Majumdar, TataMcGraw Hill, New Delhi.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

4020640 - SOLID MODELLING PRACTICAL

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 : 4020640
- Semester : VI
- Subject Title : Solid Modelling Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions			Examinatio	n	
	Houro	Hours /		Marks		
4020640 Solid Modelling Bractical	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
FIAULUAI	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:

A Mechanical Engineering Diploma Engineer is expected to possess a thorough understanding of drawing, which includes clear visualization and proficiency in reading and interpreting a wide variety of production drawing. The market driven economy demands frequent changes in product design to suit the customer requirements. The introduction of this subject is to provide hands on experience in sketching and modeling of the industrial components using any one of the Computer Aided Design and Modelling packages. The aim of this subject is to help the student to attain the industry identified competency through practice in CAD software.

OBJECTIVES:

- Prepare 2D Drawing using sketcher or part modelling of any parametric CAD software.
- Generate 3D Solid models from 2D sketch or part modelling of any parametric CAD software.
- Prepare assembly of part models using assembly of any parametric CAD software.
- Generate orthographic views of 3D solid models/assemblies using drafting of any parametric software.
- Plot a drawing for given part model/assembly.

DETAILED SYLLABUS

Contents: Practical

Introduction

Parametric CAD software – sketch – elements – entities: line – circle – arc – ellipse – polygon – text – dimensions – sketch tools – fillet – chamfer – offset – trim – extend – mirror – rotate – block. Partmodelling– reference planes – reference point – reference axes – co-ordinate system – extrude – revolve – swept – helix and spiral – lofts – dome – shell – draft – rib – wrap – intersect – holes – patterns. Assembly – approaches – mate – coincident – sub assembly –rebuild – isolate. Drawing views – Save – Plot – model view – exploded view – projected view – section view – import – export – Appearance – rendering.

Exercises

PART A: Draw the given 3D drawing using 3D modelling commands.

- 1. Model 1
- 2. Model 2
- 3. Model 3
- 4. Model 4
- 5. Model 5
- 6. Model 6

PART B: Draw the part models and assemble the components using 3D modelling.

1. Revolving Centre

- 2. Tail stock
- 3. Machine Vice
- 4. Crane hook
- 5. Petrol Engine Connecting Rod
- 6. Pipe Vice

Board Examination

Note: All the exercises should be completed All the exercises should be given for examination, the students are permitted to select by lot or the question paper from DOTE should be followed. Record note book should be submitted during examination.

Two exercises will be given for examination by selecting one exercise in each PART. The printout of exercises of the student work should be submitted with answer paper and the same have to be evaluated as per the allocation.

SI. No.	Performance Indicator	Marks
Part A –	3D Component Modelling	
1	Sketching	15
2	3D Modelling	15
Part B –	Assemble Drawing Modelling	
3	Sketching / Part modelling	20
4	Assembly	30
5	Solid Model / Views	10
6	Viva voce	10
	Total	100

DETAILLED ALLOCATION OF MARKS

Exercises



PART A: Draw the given 3D drawing using 3D modelling commands.

Model 5

Model 6

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LIST OF EQUIPMENTS

(To accommodate a batch of 30 students in Practice / Board Examinations)

Personal computer	:	30 Nos.
Laser Printer	:	1 No.
Software	:	GUI System Software
	:	Modelling package – Sufficient to the strength.



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

ELECTIVE PRACTICAL - II 4025651 – TOOL DESIGN PRACTICAL

ANNEXURE- I

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

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025651
- Semester : VI
- Subject Title : EP II TOOL DESIGN PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			
			Internal Assessment	Board Examinations	Total	Duration
EP – II TOOL						
DESIGN	4	64	25	100*	100	3 Hrs.
PRACTICAL						

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

RATIONALE:

The aim of this course is to provide enough practice in design of gauges (GO/NO GO),

Press tools, Jigs & Fixture, so that students would be capable of design and develop production tools required for manufacturing.

OBJECTIVES:

- Design and develop single point cutting tools, multi point cutting tools.
- Select cutting tool materials for various tools.
- Select milling cutters for various operations.
- Standardize tools & tools elements, components of jigs and fixtures.
- Design tools that would be safe and easy to operate.

DETAILED SYLLABUS

Contents: Practical

Exercise

I. Drill Jigs:

- 1. Design and draft a leaf jig to drill holes in the given component
- 2. Design and draft a plate jig to drill holes in the given component
- 3. Design and draft an indexing jig to drill holes in the given component

II. Fixtures:

- 1. Design and draft a plain milling fixture to machine the given component
- 2. Design and draft a string milling fixture to machine the given component
- 3. Design and draft a turning fixture to machine the given component

III. Press Tools:

- Design and draft a progressive die to make washer having 15 mm internal hole and 30 mm outside diameter is to be made from 1.5 mm thick strip of C20 steel.
- Design and draft a drawing die to make cup having 50 mm diameter and 75 mm deep is to be drawn from 2mm thick drawing steel with a tensile strength of 315 N / mm².

IV. Gauges:

- 1. Design and draft a plug gauge to check ø50H6 hole.
- 2. Design and draft a plain ring gauge to check ø35k7 shaft.

Note: Students should do all the above ten exercises in the drawing sheets and submit for internal evaluation. Students should do examination on drawing sheets

BOARD EXAMINATION

Note:

- 1. The students should be taught theory portion and proper training in all the exercises. All the portions should be completed before examinations.
- The students should maintain theory assignment, observation note book / manual and record notebook. The assignment and record note book should be submitted during the Board Practical Examinations.
- 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.
- 4. All regular students appearing for first attempt should submit record notebook for the examination.
- 5. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- 6. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

Part Drawing Preparation	25
Design Calculations	40
Assembly Drawing	25
Viva-voce	10
TOTAL	100 Marks

DETAILLED ALLOCATION OF MARKS

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

MODEL QUESTION PAPER 4025651 – TOOL DESIGN PRACTICAL

Max. Marks: 100

Duration: 3 Hrs.

1. Design and draft a progressive die to make washer having 15 mm internal hole and 30 mm outside diameter is to be made from 1.5 mm thick strip of C20 steel.

LIST OF EQUIPMENTS

1. Drawing Board with Table -

Sufficient Quantity



DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

ELECTIVE PRACTICAL - II 4020652 – REFRIGERATION AND AIR CONDITIONING PRACTICAL

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 : 4020652
- Semester : VI

Subject Title : Refrigeration and Air-Conditioning Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
4020652	Hours	Hours /		Marks		
Refrigeration and Air-Conditioning Practical	/ Week	Semester	Internal Assessment	Board Examinations	Total	Duration
	5	80	25	100*	100	3 Hrs.

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

OBJECTIVES:

- Identify the various tools used in R & AC
- Demonstrate the construction and working of window air conditioner
- Demonstrate the construction and working of split type air conditioner
- Set parameters for comfortable operation of an air conditioner.
- Determine the C.O.P of air conditioner.
- Determine the capacity of window air conditioner.
- Describe the wiring of refrigerator and coolers.
- Perform servicing on air conditioner.

Experiments:

PART A

- Determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with any one expansion device. (Thermostatic expansion valve / Capillary tube / Automatic Expansion Valve)
- 2. Determine the C.O.P of sealed system by using electrical measurements.
- 3. Determine the capacity of a window air conditioner.
- 4. Determine the efficiency of a cooling tower.
- 5. Conduct Leak tests in a split air conditioning system, detect the failures and suggest the remedies. Conduct the Refrigerant Charge Test.
- 6. Conduct the flush test to remove the contaminants of refrigeration system and recharge.

PART- B

- 1. Study the various sizes of copper and steel tubing. To study the various tools used for operations.
- 2. Study and carry out the various operations on copper and steel tubing– Flaring, Swaging and Soldering methods used in R& A.C.
- Study the methods to set and adjust the following a) Thermostats, b) Low pressure and high pressure cut-outs c) Thermostatic expansion valve d) Automatic Expansion Valve.
- 4. Conduct the service to change refrigerant into service cylinder from storage cylinder.
- 5. Conduct the service to pump down the system and to purge air from the system.
- 6. Conduct the service to check the oil level in the compressor and trace the common faults in R & A.C units and their remedies.

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.
- 3. All regular students appearing for first attempt should submit record notebook for the examination.
- 4. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- 5. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

Detailled Allocation of Marks

PART A

Procedur	e	-	10
Formulae	/ Observation	-	20
Calculatio	on / Result	-	20
PART B			
Descriptio	on / Procedure	-	15
Tool hand	dling	-	15
Conclusio	on / Report	-	10
Viva voce		-	10
TOTAL		-	100
LIST OF EQUIPMENTS

(To accommodate a batch of 30 students in Practice / Board Examinations) WORKING MODELS OF THE FOLLOWING WITH ARRANGEMENTS FOR CONDUCTING TESTS

- 1. Refrigerator with test rig
- 2. Water cooler
- 3. Window A/C with test rig
- 4. Split A/C
- 5. Cooling tower

WORKING MODEL OF THE FOLLOWING TO CONDUCT EXPERIMENTS

- 1. Thermostat units
- 2. Cut off units
- 3. Thermostatic expansion valve unit
- 4. Automatic expansion valve unit
- 5. Sealed compressor with experimental setup

TOOLS:

- 1. Mechanics tool set
- 2. Tube cutter
- 3. Tube bender type
- 4. Tube bender spring
- 5. Swaging tool
- 6. Flaring block
- 7. Flaring nut
- 8. Pinching tool
- 9. Capillary tube testing gauge
- 10. Blow Lamp

SERVICE TOOLS:

- 1. Gas cylinder with receiver valve and key
- 2. Charging System
- 3. Blow lamp
- 4. Stem key
- 5. Spring remover
- 6. Service valve
- 7. 't' connector
- 8. High pressure gauge
- 9. Compound gauge
- 10. Leak detector
- 11. Soldering and Brazing kit.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

ELECTIVE PRACTICAL - II 4025653 – OIL HYDRAULICS AND PNEUMATICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

ANNEXURE- I

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

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025653
- Semester : VI
- Subject Title : EP II OIL HYDRAULICS AND PNEUMATICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instructions		Examination			
Subject	Hours / Week	Hours / Semester	Marks			
-			Internal Assessment	Board Examinations	Total	Duration
EP – II OIL						
HYDRAULICS AND	1	64	25	100*	100	2 Hre
PNEUMATICS	4	04	25	100	100	5 115.
PRACTICAL						

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

RATIONALE:

The units of this subject are useful for the students to learn about the various hydraulic and pneumatic circuits and it describes low cost automation, installation and maintenance of fluid power systems.

OBJECTIVES:

At the end of the study of Semester the student will be able to

- Design hydraulic and pneumatic systems for various applications.
- Select various types of hydraulic pumps, cylinders and motors.

- Design hydraulic circuits for automation.
- Design pneumatic logic circuits for low cost automation
- Handle installation and maintenance of fluid power systems

DETAILED SYLLABUS

Contents: Practical

Exercise

PART-A

Develop suitable circuit and build circuit for the following (using hydraulic & pneumatic trainer kits):

- 1. Operating a Double acting cylinder (DAC)
- 2. Pilot operations of Single Acting Cylinder (SAC)
- 3. Operation of SAC controlled using shuttle valve
- 4. Operation of DAC controlled using exhaust valve
- 5. Automatic operation of DAC in single cycle
- 6. Control DAC speed using metering-in valve
- 7. Control DAC speed using metering-out valve.
- 8. Operation of DAC using unidirectional control
- 9. Operation of DAC using bidirectional control
- 10. Operation of DAC using magnetic reed switch
- 11. Operation of DAC using principle of AND Gate and return stroke control by manual switch
- 12. Operation of DAC using principle of AND Gate and return stroke control by magnetic reed switch
- 13. Operation of DAC in continuous mode

PART-B (Descriptive only)

 Sketch the circuit for the hydraulic operation of a planning machine and explain how table motion, cross rail motion and tool head motion are achieved.

- 2. Sketch the circuit for hydraulic control of a vertical milling machine and explain how various feed motions are achieved.
- 3. Sketch the circuit for hydraulic operation of a grinding machine and explain how table reciprocation and feed motion are achieved.
- 4. Sketch the circuit for hydraulic control of press and explain the same.
- 5. Draw the pneumatic circuit for automatic material handling.
- 6. Sketch and explain a two-hand safety control circuit.

BOARD EXAMINATION

Note:

- 1. The students should be taught theory portion and proper training in all the exercises. All the portions should be completed before examinations.
- The students should maintain theory assignment, observation note book / manual and record notebook. The assignment and record note book should be submitted during the Board Practical Examinations.
- 3. 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. Two Parts will be given for examination by selecting one from PART A and one from PART B.
- 4. All regular students appearing for first attempt should submit record notebook for the examination.
- 5. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- 6. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

Part A	50 Marks
Aim & Procedure	10
Circuit Diagram	15
Execution	20
Result	5
Part B	45 Marks
Answer Any One	45
Viva-voce	05
TOTAL	100 Marks

DETAILLED ALLOCATION OF MARKS

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

MODEL QUESTION PAPER 4025653 – OIL HYDRAULICS AND PNEUMATICS PRACTICAL

Max. Marks: 100

Duration: 3 Hrs.

Part - A

1. Operation of DAC using bidirectional control

Part - B

2. Sketch the circuit for hydraulic control of a vertical milling machine and explain how various feed motions are achieved.

LIST OF EQUIPMENTS

- 1. Hydraulic trainer kit 3 Nos.
- 2. Pneumatic trainer kit 3 Nos.



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

DIPLOMA IN PRODUCTION ENGINEERING

N SCHEME 2020 – 2021 ONWARDS

> III YEAR VI SEMESTER

4025660 – PROJECT WORK AND INTERNSHIP

CURRICULUM DEVELOPMENT CENTRE

ANNEXURE- I

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

N-SCHEME

(Implemented from the Academic year 2020 - 2021 onwards)

- Course Name : 1025 Diploma in Production Engineering
- Subject Code : 4025660
- Semester : VI

Subject Title : PROJECT WORK AND INTERNSHIP

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

	Instructions		Examination			
Subject Hour	Hours /	/ Hours /	Marks			
	Week	Semester	Internal Assessment	Board Examinations	Total	Duration
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.

RATIONALE:

This subject 'Project Work and Internship" is the continuation of the previuos 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 document 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 & INTERNSHIP:

Project Review I	 10 marks
Project Review II	 10 marks
Attendance	 05 marks (Award of marks same as
	theory subject pattern)
Total	 25 marks

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:

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

*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.