DIPLOMA IN ENGINEERING AND TECHNOLOGY

1021

DEPARTMENT OF AUTOMOBILE ENGINEERING

SEMESTER PATTERN

N – SCHEME

TO BE IMPLEMENTED FOR STUDENTS ADMITTED FROM 2020 – 2021 ONWARDS

CURRICULUM DEVELOPMENT CENTRE

DIRECTORATE OF TECHNICAL EDUCATION
CHENNAI-600 025, TAMIL NADU

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

N SCHEME

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

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1021 DIPLOMA IN AUTOMOBILE ENGINEERING

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DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY

(SEMESTER SYSTEM)

(Implemented from 2020 - 2021)

N – SCHEME

R E G U L A T I O N S*

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

1. Description of the Course:

a. Full Time (3 years)

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

b. Sandwich (3½ years)

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

During 4^{th} and/or during 7^{th}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 Course and 18 hrs. / Week for Part-Time Diploma Course.***

The Curriculum for all the 6 Semesters of Diploma courses (Engineering & Special Diploma Courses viz. Textile Technology, Leather Technology, Printing Technology, Chemical Technology etc.) have been revised and revised curriculum is applicable for the candidates admitted from 2020 – 2021 academic year onwards.

2. Condition for Admission:

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

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

The Matriculation Examination of Tamil Nadu.(Or)

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

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

3. Admission to Second year (Lateral Entry):

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

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

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

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

4. Age Limit: No Age limit.

5. Medium of Instruction: English

6. Eligibility for the Award of Diploma:

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

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

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

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

7. Subjects of Study and Curriculum outline:

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

The curriculum outline is given in Annexure – I.

8. Examinations:

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

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

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

9. Continuous Internal Assessment:

A. For Theory Subjects:

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

i) Subject Attendance **5 Marks**

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

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

ii) Test **10 Marks**

2 Tests each of 2 hours duration for a total of 50 marks are to be conducted. Average of the these two test marks will be taken and the marks to be reduced to:	05 Marks
The Test – III is to be the Model Examination covering all the five units and the marks obtained will be reduced to:	05 Marks

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

From the Academic Year 2020 – 2021 onwards.

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

Without Choice:

Part A Type questions:	6 Questions × 1 mark	06 marks
Part B Type questions:	7 Questions × 2 marks	14 marks
Part C Type questions:	2 Questions × 15 marks	30 marks
	Total	**50 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. <u>For Practical Subjects:</u>

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:

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:

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

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

c) Internship Report:

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

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

12. Scheme of Examinations:

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

13. Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.
2. A candidate shall be declared to have passed the examination in a subject if he/she secures not less than *40% in theory subjects* and *50% in practical subjects* out of the total prescribed maximum marks including both the Internal Assessment and the Board Examinations marks put together, subject to the condition that he/she secures at least a minimum of 4*0 marks out of 100 marks in the Board Theory Examinations and a minimum of 50 marks out of 100 marks in the Board Practical Examinations.*

14. **Classification of successful candidates:**

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

First Class with Superlative Distinction:

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

First Class with Distinction:

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

First Class:

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

Second Class:

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

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

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

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

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ANNEXURE I

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN AUTOMOBILE ENGINEERING SYLLABUS

N-SCHEME

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

CURRICULUM OUTLINE

THIRD SEMESTER

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Drawing	Practical	Total
1	4021310	Mechanics of Materials and Material Science	5	-	-	5
2	4021320	Production Technology	5	-	-	5
3	4020330	Measurements and Metrology *	5	-	-	5
4	4021340	Fluid Mechanics and Pneumatics	5	-	-	5
5	4021350	Material Testing and Fluids Mechanics & Pneumatics Practical	-	-	4	4
6	4021360	Production Technology Practical	-	-	4	4
7	4020370	Measurements and Metrology Practical *	-	-	4	4
			20	-	12	32
Extra / Co-Curricular activities		Physical Education	-	-	-	2
		Library	-	-	-	1
Total						35

* Common with Mechanical Engineering

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FOURTH SEMESTER

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Drawing	Practical	Total
1	4021410	Heat Power Engineering	5	-	-	5
2	4021420	Vehicle Body Engineering	5	-	-	5
3	4021430	Automotive Electrical and Electronics Systems	5	-	-	5
4	4021440	Automotive Engines	5	-	-	5
5	4020350	Machine Drawing and CAD Practical *	-	2	2	4
6	4021460	Automotive Electrical and Electronics Systems Practical	-	-	4	4
7	4021470	Automotive Engines Practical	-	-	4	4
			20	2	10	32
Extra / Co-Curricular activities		Physical Education	-	-	-	2
		Library	-	-	-	1
Total						35

* Common with Mechanical Engineering

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FIFTH SEMESTER

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Drawing	Practical	Total
1	4021510	Fuels, Combustion and Emission Control	6	-	-	6
2	4021520	Power units and Transmission	5	-	-	5
Elective Theory - I						
3	4021531	Two-Wheeler and Three-Wheeler Technology	5	-	-	5
	4021532	Tractor and Farm Equipment	5	-	-	
	4021533	Industrial Automation	5	-	-	
4	4021540	Automobile Servicing Practical	-	-	4	4
5	4021550	Engine Testing and Emission Measurement Practical	-	-	4	4
Elective Practical - I						
6	4021561	Two-Wheeler and Three-Wheeler Technology Practical	-	-	4	4
	4021562	Tractor and Farm Equipment Practical	-	-	4	
	4021563	Industrial Automation Practical	-	-	4	
7	4020570	Entrepreneurship and Startup *	-	-	4	4
			16	-	16	32
Extra / Co-Curricular activities		Physical Education	-	-	-	2
		Library	-	-	-	1
Total						35

* Common with Mechanical Engineering

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SIXTH SEMESTER

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Drawing	Practical	Total
1	4021610	Hybrid Electrical Vehicle and Policies	6	-	-	6
2	4021620	Industrial Management and Transport Engineering	5	-	-	5
Elective Theory - II						
3	4020531	Computer Integrated Manufacturing *	5	-	-	5
	4021632	Heavy Vehicle Engineering	5	-	-	
	4021633	Heating Ventilation and Air Conditioning Systems	5	-	-	
4	4021640	Hybrid Electrical Vehicle Practical	-	-	5	5
Elective Practical - II						
5	4020561	Computer Integrated Manufacturing Practical *	-	-	5	5
	4021652	Heavy Vehicle Engineering Practical	-	-	5	
	4021653	Heating Ventilation and Air Conditioning Systems Practical	-	-	5	
6	4021660	Project work & Internship	-	-	6	6
			16	-	16	32
Extra / Co-Curricular activities		Physical Education	-	-	-	2
		Library	-	-	-	1
Total						35

* Common with Mechanical Engineering

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ANNEXURE II

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN AUTOMOBILE ENGINEERING SYLLABUS

N-SCHEME

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

SCHEME OF EXAMINATION

1021 DIPLOMA IN AUTOMOBILE ENGINEERING (FULL TIME)

III Semester

Subject Code	Subject	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	Board Examination#	Total		
4021310	Mechanics of Materials and Material Science	25	100	100	40	3
4021320	Production Technology	25	100	100	40	3
4020330	Measurements and Metrology *	25	100	100	40	3
4021340	Fluid Mechanics and Pneumatics	25	100	100	40	3
4021350	Material Testing and Fluids Mechanics & Pneumatics Practical	25	100	100	50	3
4021360	Production Technology Practical	25	100	100	50	3
4020370	Measurements and Metrology Practical *	25	100	100	50	3

* Common with Mechanical Engineering

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

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IV Semester

Subject Code	Subject	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	Board Examination #	Total		
4021410	Heat Power Engineering	25	100	100	40	3
4021420	Vehicle Body Engineering	25	100	100	40	3
4021430	Automotive Electrical and Electronics Systems	25	100	100	40	3
4021440	Automotive Engines	25	100	100	40	3
4020350	Machine Drawing and CAD Practical *	25	100	100	50	3
4021460	Automotive Electrical and Electronics Systems Practical	25	100	100	50	3
4021470	Automotive Engines Practical	25	100	100	50	3

* Common with Mechanical Engineering

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

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V Semester

Subject Code	Subject	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	Board Examination #	Total		
4021510	Fuels, Combustion and Emission Control	25	100	100	40	3
4021520	Power units and Transmission	25	100	100	40	3
Elective Theory - I						
4021531	Two-Wheeler and Three-Wheeler Technology	25	100	100	40	3
4021532	Tractor and Farm Equipment	25	100	100		
4021533	Industrial Automation	25	100	100		
4021540	Automobile Servicing Practical	25	100	100	50	3
4021550	Engine Testing and Emission Measurement Practical	25	100	100	50	3
Elective Practical - I						
4021561	Two-Wheeler and Three-Wheeler Technology Practical	25	100	100	50	3
4021562	Tractor and Farm Equipment Practical	25	100	100		
4021563	Industrial Automation Practical	25	100	100		
4020570	Entrepreneurship and Startup *	25	100	100	50	3

* Common with Mechanical Engineering

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

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VI Semester

Subject Code	Subject	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	Board Examination #	Total		
4021610	Hybrid Electrical Vehicle and Policies	25	100	100	40	3
4021620	Industrial Management and Transport Engineering	25	100	100	40	3
Elective Theory - II						
4020531	Computer Integrated Manufacturing *	25	100	100	40	3
4021632	Heavy Vehicle Engineering	25	100	100		
4021633	Heating Ventilation and Air Conditioning Systems	25	100	100		
4021640	Hybrid Electrical Vehicle Practical	25	100	100	50	3
Elective Practical - II						
4020561	Computer Integrated Manufacturing Practical *	25	100	100	50	3
4021652	Heavy Vehicle Engineering Practical	25	100	100		
4021653	Heating Ventilation and Air Conditioning Systems Practical	25	100	100		
4021660	Project Work & Internship	25	100	100	50	3

* Common with Mechanical Engineering

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

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1021 Diploma in Automobile Engineering (Full Time)
N – Scheme
(To be implemented for the students admitted from the year 2020-2021 onwards)

List of Equivalent Subjects for M- Scheme to N - Scheme

III Semester

Subject Code	M SCHEME	Subject Code	N SCHEME
32031	Strength of Materials	4020310	Strength of Materials
32032	Manufacturing Processes	4020320	Manufacturing Technology - I
32033	Machine Drawing		No Equivalent
32034	Computer Applications and CAD Practical		No Equivalent
32035	Foundry and Welding Practical		No Equivalent
32036	Lathe and Drilling Practical		No Equivalent
32137	Strength of Materials and Metrology Practical		No Equivalent

IV Semester

Subject Code	M SCHEME	Subject Code	N SCHEME
32141	Thermal Engineering	4021410	Heat Power Engineering
32042	Special Machines	4020420	Manufacturing Technology - II
32143	Automobile Engines	4021440	Automotive Engines
32144	Autotronics	4021430	Automotive Electrical and Electronics Systems
32145	Thermal Engineering and IC Engines Practical	4021470	Automotive Engines Practical
32046	Special Machines Practical	4020460	Manufacturing Technology - II Practical
32147	Autotronics Practical	4021460	Automotive Electrical and Electronics Systems Practical

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V Semester

Subject Code	M SCHEME	Subject Code	N SCHEME
32151	Industrial Management and Road Transport organization	4021620	Industrial Management and Transport Engineering
32152	Industrial Automation		No Equivalent
32153	Automobile Chassis and Transmission	4021520	Power units and Transmission
ELECTIVETHEORY-I			
32071	Total Quality Management		No Equivalent
32172	Alternative fuels and Energy Systems		No Equivalent
32173	Automobile Maintenance & Emission Control		No Equivalent
32055	Process Automation Practical		No Equivalent
32156	Automobile Chassis and Transmission Practical		No Equivalent
30002	Life and Employability Skills Practical.	40001	Communication Skill Practical

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VI Semester

Subject Code	M SCHEME	Subject Code	N SCHEME
32161	Automobile Body Building Engineering	4021420	Vehicle Body Engineering
32062	Computer Aided Design and Manufacturing	4020531	Computer Integrated Manufacturing
ELECTIVE THEORY- II			
32181	Two and Three Wheeler Technology	4021531	Two-Wheeler and Three-Wheeler Technology
32182	Tractor and Farm Equipments	4021532	Tractor and Farm Equipment
32183	Automobile Air-Conditioning System	4021633	Heating Ventilation and Air Conditioning Systems
32064	Computer Aided Design and Manufacturing Practical	4020561	Computer Integrated Manufacturing Practical
32165	Automobile Workshop Practical		No Equivalent
ELECTIVE PRACTICAL - II			
32184	Two and Three WheelerTechnology Practical	4021561	Two-Wheeler and Three-Wheeler Technology Practical
32185	Tractor and Farm Equipments Practical	4021562	Tractor and Farm Equipment Practical
32186	Automobile Air-Conditioning System Practical	4021653	Heating Ventilation and Air Conditioning Systems Practical
32167	Project Work		No Equivalent

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021310

Semester : III

Subject Title : Mechanics of Materials and Material Science

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021310 Mechanics of Materials and Material Science	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	Topics	Hours
I	Properties of Materials and Heat Treatment of Metals	13
II	Materials Processes, Ferrous, Non Ferrous Metals, Non-Metallic Materials and Special Materials.	13
III	Direct Stresses and Strains, Geometrical Properties of Sections	16
IV	Shear Force and Bending Moments, Friction	16
V	Torsion of Shaft and springs	15
Test & Revision		7
Total		80

RATIONALE:

Mechanics of Materials and Material Science is a core subject which aims at enabling the student to understand and analyze various materials used in automobile industry and types of load, stress and strain along with main causes of change in physical properties. All Automobile parts are subjected to different loading and behave in specific way. The subject is pre-requisite for understanding principle of machine design and strengths of various materials used in automobile industries. Understanding the mechanical properties of materials will help in selecting the suitable materials for automobile engineering applications.

OBJECTIVES:

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

- Determine the simple stress and strain for the engineering materials subject to tension, compression and shear load
- Determine the moment of Inertia of various sections used in industries.
- Define and explain the law of forces and friction.
- Draw the shear force and bending moments diagram of the beam for different loading
- Assess the effect of load on the torsion of shaft and spring.
- State various mechanical properties of materials.
- Describe the plastic deformation of the metals
- Describe the various heat treatment process for engineering materials
- Explain the processing of materials and non-metallic materials.
- Explain the various materials used in automobile components

4021310 - MECHANICS OF MATERIALS AND MATERIAL SCIENCE

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**PROPERTIES OF MATERIAL AND HEAT TREATMENT OF METALS**	
	1.1: Properties of material	**7**
	Definition of mechanical properties – Compressive strength, tensile strength, ductility, brittleness, hardness, toughness, malleability, impact strength, stiffness, fatigue, creep, Endurance limit, cyclic loading, repeated loading and fatigue loading. Atomic structure – Bonds – Primary bond and Secondary bonds – Crystals – Cubic structure – Simple Cubic structure, body centred Cubic structure – face centred Cubic structure Hexagonal closed packed structure –deformation of metal – Elastic and plastic deformation – Stress-strain diagram of ductile and brittle material – Slip and Twinning – Strain Hardening.	
	1.2: Heat Treatment of Metals:	**6**
	Heat treatment of metals –Cooling curve for solidification of pure metal – Phase diagram –Iron-carbon phase diagram – critical temperature on heating and cooling – cooling curve for pure iron –Normalizing, annealing hardening – Nitriding, cyaniding, carbonitriding, age hardening, flame and induction hardening. Description only	
II	**MATERIALS PROCESSES, FERROUS, NON FERROUS METALS, NON METALLIC MATERIALS AND SPECIAL MATERIALS.**	
	2.1: Materials processes	**3**
	Introduction - approaches to material processes – materials process steps - process of metals – process of glass - process of polymers.	
	2.2 : Ferrous and Non Ferrous metals	**6**
	Properties and automobile applications of Cast iron, Plain carbon steel, High Strength steel and Stainless steel.	
	Alloy steel - need of alloying, alloying elements, effect of alloying on properties, automobile application - Aluminium alloy - Copper alloy	
	2.3 : Non metallic materials and Special materials:	**4**
	Non metallic materials – composition, characteristics and automobile application of plastics, Polymer matrix composites and glass.	

	Introduction and automotive applications of Smart materials & Nanomaterials.	
III	**DIRECT STRESSES AND STRAINS, GEOMETRICAL PROPERTIES OF SECTIONS** **3.1: Direct Stresses and Strains** Introduction - Definition and explanation of tensile, compressive, shear, stress and strain - behaviour of ductile material under tension– limit of proportionality, elastic limit, yield point, breaking point, ultimate stress, percentage elongation and percentage reduction in area - problems – Hooke's law – Young's modulus – working stress – factor of safety - bars of varying section – shear stress and shear strain – modulus of rigidity – problems in tension, compression and shear. Lateral strain – Poisson's ratio – volumetric strain – bulk modulus – elastic constants and their relationship – problems connecting lateral, linear and volumetric deformation – problems on elastic constants. **3.2: Geometrical properties of sections** Introduction - centre of gravity – centroid – position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium – determination of centroid of angles, channels, I and T sections – problems – moment of inertia – definition – parallel axes theorem – perpendicular axes theorem - M.I of angle, channel, I and T sections - no derivations required – polar moment of inertia – radius of gyration – problems.	**8** **8**
IV	**SHEAR FORCE AND BENDING MOMENTS, THEORY OF BENDING AND FRICTION** **4.1: Shear Force and Bending Moments:** Introduction – classification of beams – definition - shear force - bending moment – sign convention – types of loads – relation between load, shear force and bending moment – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to concentrated load and uniform distributed load only – maximum Bending moment - problems on shear force diagram and bending moment diagram for cantilever and simply supported beam only.	**9**

	4.2: Theory of Bending Theory of simple bending – derivation of bending equation $\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$, and assumptions used – neutral axis - bending stress distribution – moment of resistance – simple problem. **4.3 : Friction** Friction – force of friction – limiting friction – static friction – dynamic friction – laws of static and dynamic friction – angle of friction – co-efficient of friction.	**5** **2**
V	**TORSION OF SHAFT AND SPRINGS** **5.1: Torsion of Shaft:** Theory of torsion – Assumptions – torsion equation $\frac{T}{J} = \frac{f_s}{R} = \frac{C\theta}{l}$ – 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. **5.2: Springs:** Types of springs – Laminated and coiled springs and applications – Types of coiled springs – 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	**8** **7**

Reference Books

1. R. S. Khurmi," Strength of Materials" S.Chand Publication, Ram Nagar, New Delhi
2. R.K.Rajput," Strength of Materials" S.Chand Publication, Ram Nagar, New Delhi
3. S.S.Rattan, "Strength of materials", Tata McGraw hill, New Delhi
4. R.K. Bansal, "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi
5. N. Khurmi & R S Khurmi, "Applied Mechanics" S.Chand Publication ,Ram Nagar, New Delhi.
6. William F Smith, Javad Hashemi and Ravi Prakash, "Material Science and Engineering", McGraw Hill Education, Noida

7. Jason Rowe “Advanced Materials in Automotive Engineering” Woodhead Publishing
8. Brain Cantor, Patric Grant and Colin Johnston, “ Automobile Engineering -Light weight, Functional and novel material, Taylor & Francis Group, New York and London
9. James Maxwell, “Plastics in the Automotive Industry”, Woodhead Publishing
10. Lorraine F. Francis, “Materials Processing - A Unified Approach to Processing of Metals, Ceramics and Polymers” Academic Press is an imprint of Elsevier.
11. S Sedha and R.SKhurmi, “Material science”, S.Chand & Co ,Ram Nagar, New Delhi

Reference Web Link / Video

Topic	Website	Link
Strength of Materials	Dote E-Lecture	https://www.youtube.com/watch?v=lT-3In1szHY&list=PL1b9Ht9ISqIFInLTS7xxQ6dRdIp4Jc8Vh
Strength of Materials	NPTEL	https://nptel.ac.in/noc/courses/noc21/SEM2/noc21-ce38/
Basics of Materials Engineering	NPTEL	https://nptel.ac.in/noc/courses/noc21/SEM2/noc21-me113/
Materials Science	NPTEL	https://nptel.ac.in/courses/112/108/112108150/

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021320

Semester : III

Subject Title : Production Technology

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021320 Production Technology	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	Topics	Hours
I	Foundry Technology, Forging	14
II	Welding Technology	14
III	Theory of metal cutting and Centre Lathe, Shaper	15
IV	Milling Machines and Drilling Machines	15
V	Grinding and CNC Machines	15
Test & Revision		7
Total		80

RATIONALE

Production Technology is a core subject. A diploma holder of Automobile engineering should be proficient in the use of manufacturing processes available. 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 in this subject aims the skills of metal cutting, milling, grinding, and other machining processes which are very much essential for a technician. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJECTIVES

Students must be able to:

- 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 forging technologies.
- Acquire knowledge about theory of metal cutting.
- Knowledge about the lathe and its working parts.
- Study the working of various machine tools: Shaper and milling.
- Study the milling procedure for spur helical and bevel gears.
- Study the various types of gear generating processes
- Study about the drilling process.
- Study the different types of grinders and grinding wheels.
- Study about the components and working CNC Turning and Milling machines.

4021320 PRODUCTION TECHNOLOGY
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**Foundry Technology:** Introduction – Pattern: Definition – types of patterns: Solid, Split, Loose piece, Skeleton. Pattern materials – pattern allowances. Properties of moulding sand – List the major moulding tools and its description. Green sand moulding process. Moulding machines: construction and working principle of Jolt machine, Squeezer, Sand slinger. Core – core sand – properties. CO_2 process core making. Construction and working principle of Cupola furnace, Electric arc furnace and induction furnace. Casting: Introduction - Working principle of centrifugal casting – continuous casting. Defects in casting – causes and remedies.	11
	Forging: Hot working, cold working – comparison and advantages. Description of rolling, drawing, bending, coining, embossing, extrusion, drop forging, upset forging, press forging.	3
II	**Welding Technology: Arc Welding:** Introduction – electrode -filler and flux materials –types of welding - Working principle, applications, advantages and disadvantages of Metal arc welding, Metal Inert gas (MIG) welding, Tungsten inert gas (TIG) welding, Submerged arc welding, Electro slag welding.	7
	Gas welding: Gas welding equipment - Types of flames – welding techniques – filler rods - Flame cutting. Working principle of Oxy-acetylene welding – advantages – limitations. Inspection and testing of welded joints – destructive and non-destructive types of tests – magnetic particle test – radiographic and ultrasonic test - defects in welding – causes and remedies.	7
III	**Theory of metal cutting:** Introduction – orthogonal cutting – oblique cutting - single point cutting tool – nomenclature – cutting tool materials – properties – tool wears – factors affecting tool life – cutting fluids.	3
	Centre Lathe: Introduction - specifications – simple sketch with	9

	principal parts. Construction and working of head stock – back geared type – all geared type. Feed mechanism - tumbler gear mechanism – quick change gear box – apron mechanism. Machining operations: straight turning – step turning - taper turning by different methods - thread cutting – boring – eccentric turning. Description of cutting speed – feed - depth of cut - metal removal rate. Work holding devices. **Shaper:** Introduction – specifications – principles of operations standard shaper – quick return mechanism - crank and slotted link – hydraulic shaper - feed mechanism.	**3**
IV	**Milling Machines:** Types - column and knee type – universal milling machine - principles of operation - specification of milling machines. work holding devices - tool holding devices - arbor - stub arbor - spring collet – adapter. Milling cutters: cylindrical milling cutter - slitting cutter -side milling cutter - angle milling cutter - T-slot milling cutter. Nomenclature of cylindrical milling cutter. Milling operations: straddle milling - gang milling - vertical milling attachment. Dividing head - indexing plate - linear indexing – simple indexing -compound indexing. Procedure for spur, helical and bevel gears. Generating Process: Gear shaper - gear hobbing - principle of operation only. Gear finishing processes: burnishing – shaving - grinding and lapping. **Drilling Machines:** Drilling machine: bench type - floor type - radial type - gang drill – multi spindle type –Working principle of upright drilling machine and radial drilling machine. Drills - flat drills - twist drills – nomenclature of twist drill. Tool holding devices: drill chucks - socket and sleeve. Operation: Drilling - reaming - counter sinking - counter boring - spot facing – tapping - deep hole drilling.	**10** **5**
V	**Grinding:** Types and classification – working principle of pedestal grinders- cylindrical grinder - centerless grinders – surface grinder - tool and cutter grinder. Grinding wheels – abrasives - natural and artificial diamond wheels - 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 -	**8**

	Dressing and Truing of wheels - Balancing of grinding wheels. **CNC machines:** Introduction – CNC turning machines – working principles of CNC slant bed turning centre. Tool holders – wok holding collets. CNC milling machines: Working principles of vertical machining centre – Tool holders – Work holder – Automatic tool changer. Coordinate Measuring Machine – Principle of operation.	**7**

Reference Books

1. Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya - IIth Edition - Media Promoters & Publishers Pvt. Ltd.
2. Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers
3. Manufacturing process – Begeman - 5th Edition -McGraw Hill.
4. Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd.
5. Workshop Technology – Raghuwanshi - Khanna Publishers.
6. Production Technology, Edn. XII, Khanna Publishers.
7. Production Technology - P. C. SHARMA - Edn. X - S.Chand& Co. Ltd.
8. Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd

Reference Web Link / Video

Topic	Website	Link
Fundamentals of manufacturing processes	NPTEL	https://nptel.ac.in/courses/112/107/112107219/
Manufacturing Processes I	NPTEL	https://nptel.ac.in/courses/112/107/112107144/
Manufacturing Processes II	NPTEL	https://nptel.ac.in/courses/112/105/112105127/

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4020330

Semester : III

Subject Title : Measurements and Metrology

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020330 Measurements and Metrology	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	Basic Concepts of Measurements	15
II	Linear and Angular Measurements	15
III	Form Measurement	15
IV	Advances in Metrology	14
V	Measurement of Mechanical Parameters	14
Test and Model Exam		7
Total		**80**

RATIONALE:

Measurements and metrology are the basic and prominent tools in all the industries in the present scenario. The students should be trained not only in manufacturing also they should have knowledge about the various measuring instruments which is used in industries. This will provide the students an opportunity to skill themselves for how to handle the various metrological equipment available to measure the dimensions of the components.

OBJECTIVES

- Study about the basic concepts of measurements.
- Acquire knowledge about precision and accuracy.
- Describe about the various linear and angular measurements.
- Acquire knowledge about the measurement of screw threads and gears.
- Study about the laser metrology and computer in metrology.
- Describe the measurement of mechanical parameters force, power and flow.

4020330 MEASUREMENTS AND METROLOGY

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**BASIC CONCEPTS OF MEASUREMENTS** **Chapter: 1.1: Introduction** Basic units - system concepts used in measuring technology - measuring instruments - length, angles and surface - scope of Metrology - standardization - international standardization, the bureau of Indian standards - legal Metrology - definition - applications - important elements of measurements - methods of measurements - needs for inspection - need for measurement - important terminology. **Chapter: 1.2: Precision and accuracy** Precision - definition - accuracy - definition - difference between precision and accuracy - factors affecting the accuracy of the	7 8

	measuring system - general rules for accurate measurements - precautions for use of instruments so as to avoid in accuracy in measurements - reliability - definition - error - definition - sources of errors - classification of error - compare systematic error and random error - selection of measuring instruments - symbols for metallurgical terms (ASME and ISO).	
II	**LINEAR AND ANGULAR MEASUREMENTS** **Chapter: 2.1: Linear measurements** Classification of linear measurement instrument - construction and the principles only - Steel rule - callipers - outside calliper, inside calliper, Jenny caliper - combination set - feeler gauge - pitch screw gauge - Vernier caliper - digital caliper - Vernier height gauge- micrometer - inside micrometer - thread micrometer - optical micrometer - light wave micrometer - possible sources of errors in micrometers - slip gauges - requirements - Indian standard - care and use. **Chapter: 2.2: Angular measurements** Introduction - vernier bevel protractor - universal bevel protractor - optical bevel protractor. Sine bar - types - uses and limitations - working principle of clinometer, autocollimator, angle dekkor. Comparators - uses - application - classification of comparator - mechanical comparator, optical comparator, electrical comparator, pneumatic comparator - principles - advantages and disadvantages - compare comparator with measuring instruments - compare electrical and mechanical comparators.	7 8
III	**FORM MEASUREMENT** **Chapter: 3.1: Measurement of screw threads** Screw thread terminology - error in thread - measurement of various elements of thread (description only) - thread gauges - classification - plug screw gauges, ring screw gauges, caliper gauges - adjustable thread gauge - gauging of taps - function of various types of gauges - floating carriage micrometer.	5

	Chapter: 3.2: Measurement of gears Introduction - types of gear - gear terminology - gear errors - spur gear measurement - run out, tooth measurement, profile measurement, lead checking , backlash checking, tooth thickness measurement - vernier gear tooth caliper - David brown tangent comparator - constant chord method - measurement of concentricity, alignment checking - Parkinson gear tester - Rolling gear testing machine - radius measurement - radius of circle - surface finish measurement - classification of geometrical irregularities - elements of surface texture - methods of measuring surface finish - measuring surface roughness - tracer type profilogram - double microscope.	10
IV	**ADVANCES IN METROLOGY** **Chapter: 4.1: Laser Metrology** Basic concepts of lasers - types of lasers - uses, advantages and applications - laser telemetric system - laser and LED based distance measuring instruments - scanning laser gauge - photodiode array imaging - diffraction pattern technique - laser triangulation sensors - two frequency laser interferometer - gauging wire diameter from the diffraction pattern formed in laser - interferometry - use of laser in interferometry - interferometer - standard interferometer, single beam interferometer, AC interferometer, Michelson interferometer, dual frequency laser interferometer - Twyman green interferometer - applications. **Chapter: 4.2: Computer in Metrology** Coordinating measuring machine - introduction - types of measuring machines - types of CMM - futures of CMM - causes of errors in CMM - 3 co-ordinate measuring machine - performance of CMM - applications - advantages disadvantages - computer controlled coordinating measuring machine - mechanical system of computer controlled CMMs - trigger type probe system, measuring type prop system, features of CNC and CMM - features of CMM software - factors affecting CMM - digital devices - Computer based inspection - Computer aided inspection using robots.	7 7

V	**MEASUREMENT OF MECHANICAL PARAMETERS** **Chapter: 5.1: Force** Measurement of force - Direct methods - equal arm balance, unequal arm balance, multiple lever system, pendulum scale - indirect methods - electromagnetic balance - load cells - hydraulic load cell, pneumatic load cell, strain gauge load cell, shear type load cell, electronic weighing system. Torque measurement - torque measurement using strain gauge - laser optical torque measurement - stroboscope for torque measurement. **Chapter: 5.2: Measurement of power** Mechanical dynamometer - DC dynamometer - inductor dynamometer - hydraulic dynamometer - diaphragm pressure sensor - deform cage with LVDT - diaphragm gauge with strain gauges - piezoelectric sensors. **Chapter: 5.3: Measurement of flow** Types of flow metres - rotameter, electromagnetic flow metre, hot wire anemometer, ultrasonic flow metre, laser Doppler anemometer (LDA) - reference beam mode, interference French mode.	6 4 4

Reference Books:

1. Mechanical Measurements and Instrumentation, Rajput R K, S.K.Kataria and Sons.
2. Mechanical Measurement and Control, Jalgaonkar R.V, Everest Publishing House.
3. Mechanical and Industrial Measurements, Jain R K, Khanna Publications.
4. Instrumentation Devices and Systems, Narang C S, Tata McGraw Hill Publications.
5. Instrumentation, Measurement and Analysis, Nakra B.C, Chaudhary K.K, Tata McGraw Hill Publications.

Reference Web Link / Video

Topic	Website	Link
Engineering Metrology	NPTEL	https://nptel.ac.in/courses/112/104/112104250/
Metrology	NPTEL	https://nptel.ac.in/courses/112/106/112106179/

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021340

Semester : III

Subject Title : Fluid Mechanics and Pneumatics

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021340 Fluid Mechanics and Pneumatics	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	Topics	Hours
I	Properties of Fluid and Fluid Static	15
II	Fluid Dynamic, kinematics and Hydraulic Machinery's	15
III	Hydraulic systems and its components	14
IV	Hydraulic circuits and hydro-pneumatics	14
V	Pneumatic Systems, components and circuits	15
Test & Revision		7
Total		80

RATIONALE

Knowledge of fluid properties, fluid flow, hydraulic and pneumatic is essential in all fields of engineering. Fluid mechanics and pneumatics have important role in the automobile application like lubrication system, cooling system, combustion process etc., and also in most of the automated industry applications. This subject requires knowledge of basic engineering sciences, applied mechanics, mathematics etc.

OBJECTIVES

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

- Define various properties of fluids
- State and explain Pascal's law and its applications
- Explain the working of pressure measuring devices
- State continuity equation, Bernoulli's equation and its applications.
- Estimate various losses in flow through pipes.
- Draw the construction, working of hydraulic pumps and turbines.
- Explain the elements of pneumatics system
- Draw pneumatic circuits for industrial application
- Draw hydraulic circuits for industrial application
- State the important of hydro-pneumatic systems
- Compare pneumatic, hydraulic and hydro-pneumatic

4021340 FLUID MECHANICS AND PNEUMATICS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**PROPERTIES OF FLUID AND FLUID STATIC** **1.1 : Properties of fluid** Introduction –Fluid Mechanics –Definition of Fluid - Types of fluid. Properties of Fluid – Density, Specific Weight, Specific Volume, Specific gravity - Simple problem - Viscosity, Absolute Viscosity, Kinematics Viscosity, Compressibility, adhesion, Cohesion, surface tension, capillarity and Bulk Modulus. **1.2: Fluid Static** Fluid pressure at a point - Pascal's Law - Proof – Application – Hand operated Hydraulic Jack and Hydraulic Press. Pressure head-atmospheric, gauge, vacuum and absolute pressures – simple problems - Pressure measurements by piezometer tube, simple manometer, differential manometer and inverted differential manometer – problems – Mechanical pressure gauges - bourdon tube pressure gauge, diaphragm pressure gauge and Dead weight pressure gauge.	**6** **9**
II	**FLUID DYNAMIC AND KINEMATICS, HYDRAULIC MACHINERY'S** **2.1: Fluid Dynamic and kinematics** Introduction **-** Types of fluid flow – steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, compressible and incompressible flow, rotational and irrotational flow - Reynolds number - Rate of flow-Continuity equations - energies of fluid-simple problems. Bernoulli's equations - statement, assumptions and proof – applications of Bernoulli's -pitot tube, venturimeter, and orificemeter – Simple Problems. Orifice – types of orifice – vena contracta – co-efficient of contraction – co-efficient of velocity – co-efficient discharge – simple problems. law of fluid friction - hydraulic gradient line – total energy line – wetted perimeter – hydraulic mean radius - loss of head in pipe - Major	**12**

	losses – loss of head due to friction Darcy - Weisbach equation and Chezy's equation – problems- Minor losses and its types **2.2: Hydraulic Machinery's:** Pelton wheel turbine – Francis turbine – single stage centrifugal pump – double acting reciprocating pump – submergible pump.	**3**
III	**HYDRAULIC SYSTEMS AND ITS COMPONENTS:** **3.1: Hydraulic pump and actuator** Fluid Power – Application of fluid power - service properties of hydraulic fluids- Hydraulic system Elements - Pump – Positive displacement Pump- External Gear Pump, Internal Gear Pump, Vane pump, Piston pump - Hydraulic actuator - Linear actuator - Single acting cylinder – Double acting cylinder – Telescopic cylinder –Rotary actuator - Hydraulic Motor – Gear type, vane type and piston type motor. **3.2: Hydraulic valves and accessories** Directional Control valve: Types – Seat valve and spool valve – operating method – Construction of 2,3 and 4way directional control valve. Pressure control valve: Pressure relief valve Compound relief valve. Flow control valve - Unloading valve – sequence valve – counterbalance valve – brake valve – pressure reducing valve –hydraulic intensifier. Hydraulic accumulators – Reservoirs and accumulators - Types – Dead weight, spring loaded and gas loaded type. Filters – Seals and its classification – Filters and its types– Filter location.	**7** **7**
IV	**HYDRAULIC CIRCUITS AND HYDRO-PNEUMATIC** **4.1: Hydraulic Circuits** ISO Symbol of hydraulic components - Direst operation of single acting cylinder, double acting cylinder and hydraulic motor. Speed Control of hydraulic cylinder and Speed Control of hydraulic Motor– Double pump. Hydraulic circuit: sequencing circuit – counterbalancing circuit – Regeneration circuit - Braking circuit – Intensifier circuit – Accumulator circuit – synchronizing circuit - Two hand safety circuit - Fail-safe control circuit by using emergency cut-off valve.	**11**

	Hydraulic circuit for operation of shaper machine, vertical milling machine and surface grinder **4.2: Hydro-pneumatic** Types – Air-oil reservoir, Air-oil cylinder, air-oil intensifier –Comparison of pneumatic, hydraulic and hydro-pneumatic.	**3**
V	**PNEUMATIC SYSTEMS, COMPONENTS AND PNEUMATIC CIRCUITS** **5.1: Pneumatic Systems, components** Pneumatic Systems –elements - Compressor – Piston type and Vane type compressor – filter – regulator - lubricator unit – mufflers. Pneumatic actuator – Single acting cylinder – Double acting cylinder – Air motors – Vane type and piston type. Pneumatic valves – Directional control valves - 2/2, 3/2, 4/2, 4/3 & 5/2 - Control methods - Pressure relief valves - Check Valve - Flow control Valve - shuttle valve – Twin pressure valve - Quick exhaust valve - Time delay valve. **5.2: Pneumatic circuits** ISO Symbol Pneumatic components - Controlling of single acting and Double acting cylinder - Speed control circuit, Quick exhaust valve circuit, Two step feed control circuit, Time delay circuit, Automatic cylinder reciprocating circuit, Deceleration air cushion of cylinder circuit - two hand safety control circuit.	**8** **7**

Reference Books

1. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, S.Chand& Co.
2. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, Dr.R.K.Bansal Laxmi Publication Pvt., Ltd.
3. Hydraulic Machines, Jagadishlal, Metropolitan Book Co. Pvt. Ltd.
4. Fluid Power, Anthony Esposito, Pearson Education.
5. Pneumatic System – Principles and Maintenance, S.R.Majumdar, McGraw Hill Education.

6. Oil Hydraulic System – Principles and Maintenance, S.R.Majumdar, McGraw Hill Education.
7. Fundamentals of pneumatic control Engineering -FESTO Manual

Reference Web Link / Video

Topic	Website	Link
Fluid Mechanics	NPTEL	https://nptel.ac.in/courses/112/104/112104118/
Fluid Mechanics and Fluid Power	Dote E-Lecture	https://www.youtube.com/watch?v=xmkh7M9R7nM&list=PL1b9Ht9ISqIHpYlanUmZMrVUnF_CABwRk
Oil Hydraulics and Pneumatics	NPTEL	https://nptel.ac.in/courses/112/106/112106300/

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021350

Semester : III

Subject Title : Material Testing and Fluid Mechanics & Pneumatics Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021350 Material Testing and Fluid Mechanics & Pneumatics 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:

This subject deals with the testing and behavior of metals at various testing condition and to create better understanding of the behavior of fluids under the condition of rest and motion. This subject deals with hydraulic and pneumatic operation.

OBJECTIVES:

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

- Acquire skills on different types of testing methods of metals.
- Conduct material testing on elasticity, hardness, shear strength
- Determine modulus of rigidity of open spring coil springs.
- Determine the co-efficient of discharge of venturimeter.
- Determine the co-efficient of friction in pipes.
- Design and operate pneumatic circuit and hydraulic circuit.

4021350 MATERIAL TESTING AND FLUID MECHANICS & PNEUMATICS PRACTICAL

DETAILED SYLLABUS

Experiments

PART A

1. Tension test on Ductile Materials- Finding Young's Modulus of Elasticity, Yield Points, Percentage Elongation and Percentage Reduction in Area, Stress Strain Diagram Plotting test on Mild Steel with the help of a Universal Testing machine.
2. Torsion test - Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress. Draw a graph between torque and angle of twist in radians.
3. Test on spring - Compression Tests on open coil spring - Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method. Draw a graph between load and deflection
4. Test on orifice - Determination of co-efficient of discharge of a orifice by variable head method and a graph between $\sqrt{H_1} - \sqrt{H_2}$ Vs time taken (t).
5. Test on venturimeter - Determination of co-efficient of discharge of the venturimeter and draw the following graphs between (i) head Loss (h_f) Vs Actual discharge (Q_a) and (ii) head loss (h_f) Vs co-efficient of discharge (C_d)
6. Test on pipe friction apparatus - Determine the friction factor of the given pipe and draw a graph between friction head (h_f) and Velocity (v).

PART B

Pneumatics Lab.

1. Direct operation of pilot control of single acting cylinder and double acting cylinder.
2. Speed control of double acting cylinder using metering-in and metering-out circuits.
3. Automatic operation of double acting cylinder in single cycle – using limit switch.

Hydraulics Lab.

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

BOARD EXAMINATION

Note:

- All the exercises / experiments in both sections should be completed. Two exercises / experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises / experiments should be given in the question paper and students are allowed to select by 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 / equipment before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
	Part- A	
1	Observation	10
2	Tabulation and Calculation	40
3	Result and Graph	5
	Part- B	
4	Circuit	10
5	Connection as per circuit	20
6	Execution of circuit	5
7	**Viva-voce**	10
	Total	100

LIST OF EQUIPMENT / TOOLS / MACHINERY REQUIRED

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1.	Universal Testing Machine (UTM)	01
2.	Torsion testing machine	01
3.	Spring testing machine	01
4.	Pipe friction Apparatus	01
5.	Venturimeter Apparatus	01
6.	Orifice testing kit setup	01
7.	Pneumatics Trainer Kit with all standard accessories	02
8.	Hydraulics Trainer Kit with all standard accessories	02
9.	Measuring instruments	Sufficient quantity
10.	Consumables	Sufficient quantity

Reference Web Link / Video

Topic	Website	Link
Strength of Materials Practical	Virtual Labs	https://sm-nitk.vlabs.ac.in/
Fluid Mechanics Practical	Virtual Labs	https://fm-nitk.vlabs.ac.in/
Fluid Mechanics Practical	Virtual Labs	https://fmc-nitk.vlabs.ac.in/
Pneumatic Components	Virtual Labs	http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/COEP_KNOWLEDGE_SEEKERS/labs/exp1/index.html

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021360

Semester : III

Subject Title : Production Technology Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021360 Production Technology 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:

In the process of manufacturing we should possess adequate and through knowledge about the working of metal forming as well as metal cutting processes. The topics included aim to inculcate the skills of metal cutting, milling, grinding, and other machining processes which are very much essential for a technician. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJECTIVES:

Students must be able to:

- Identify the tools used in foundry.
- Identify the tools and equipment used in welding
- Prepare sand moulds for different patterns.
- Perform welding operation to make different types of joints.
- Identify the parts of drilling machine.
- Perform the various drilling operations.

- Identify the parts of a lathe.
- Operate the lathe and machine a component using lathe.
- Study the working of various machine tools: Shaper.
- Study various types of milling operations.
- Perform the milling procedure for spur gear
- Study the different types of grinders and grinding wheels.

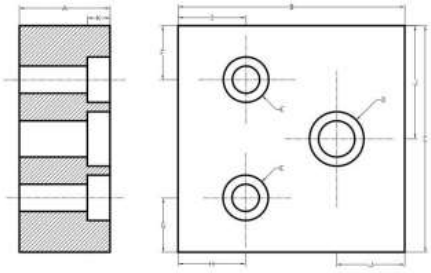
4021360 PRODUCTION TECHNOLOGY PRACTICAL

DETAILED SYLLABUS

EXERCISES

PART-A

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 specimen and make the T-joint by the Arc Welding (Both sidewelded). (Raw material 25mmX6mm MS flat)
4. Prepare the specimen and make the Butt joint by the Gas Welding. (Raw material 25mmX3mm MS sheet)
5. Prepare the specimen and make the drilling and counter boring as shown in figure using the upright drilling machine / Radial drilling machine.



Dimensions			
Sl.No	Part Name	Actual	Obtained

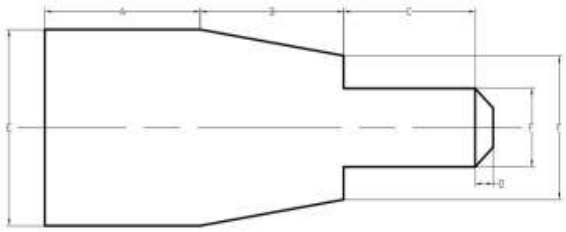
6. Prepare the specimen and make the plain surfaces as shown in figure using the surface Grinder.

Dimensions			
Sl.No	Part Name	Actual	Obtained

PART – B

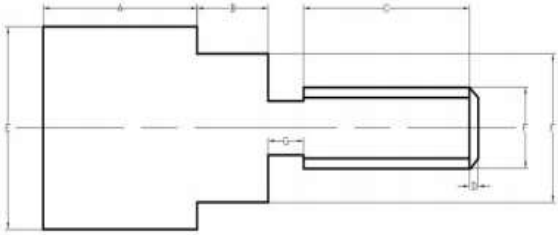
Exercise

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



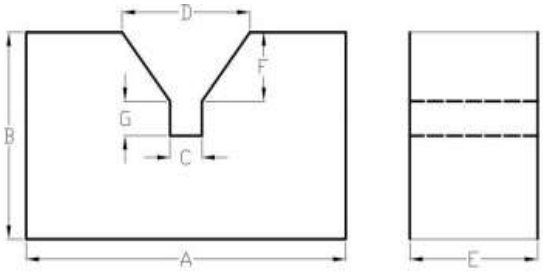
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Prepare the specimen and make the Step Turing & Thread cutting as shown in figure using the Lathe.



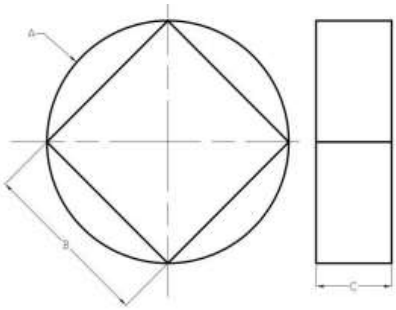
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Prepare the specimen and make 'V' Block as shown in figure using Shaping machine



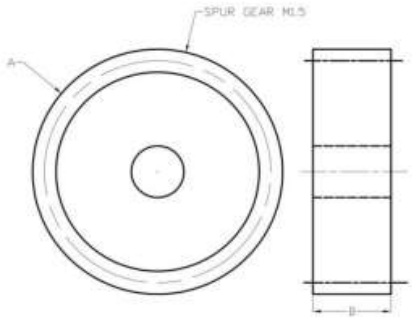
Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Prepare the specimen and make round to square as shown in figure using milling machine



Dimensions			
Sl.No	Part Name	Actual	Obtained

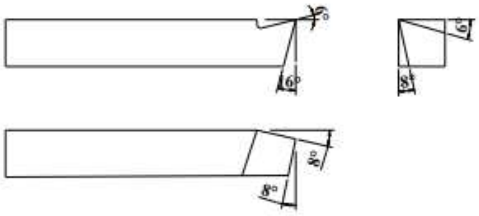
5. Prepare the specimen and make Spur Gear as shown in figure using milling machine by indexing method.



Dimensions			
Sl.No	Part Name	Actual	Obtained

.

6. Prepare the specimen and make the turning tool as shown in figure using the Tool and Cutter Grinder.



Dimensions			
Sl.No	Part Name	Actual	Obtained

BOARD EXAMINATION

Note:

- All the exercises/experiments in both sections should be completed. Two exercises/experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises/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 machineries / equipments before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
	Part- A	
1	Procedure / Preparation	10
2	Machining / Dimensions	25
3	Finishing	5
	Part- B	
4	Procedure / Preparation	10
5	Machining / Dimensions	35
6	Finishing	5
7	**Viva-voce**	10
	Total	100

LIST OF EQUIPMENT / TOOLS / MACHINE REQUIRED

(for a batch of 30 students)

Sl. No.	Machines /Tools/ Equipments	Quantity
1	Moulding board	5 Nos.
2	Cope box	5 Nos.
3	Drag box	5 Nos.
4	Core box	5 Nos.
5	Shovel	2 Nos.
6	Rammer set	5 Nos.
7	Slick	5 Nos.
8	Strike-off bar	5 Nos.
9	Riddle	2 Nos.
10	Trowel	5Nos.
11	Lifter	5 Nos.
12	Cleaning Brush	5 Nos.
13	Vent rod	5 Nos.
14	Draw spike	5 Nos.
15	Gate cutter	5 Nos.
16	Runner & riser	5 Nos. each
17	Arc welding transformer	1 No
18	Gas welding unit	1 Set
19	Welding shield	5 Nos.

20	Gas welding goggles	5 Nos.
21	Chipping hammer	10 Nos.
22	Leather Glows 18''	10 Sets.
23	Upright drilling machine / Radial drilling machine	1 No.
24	Vernier Height Gauge	1 No.
25	Surface plate	1 No.
26	Lathe	4 Nos.
27	Vertical milling machine	1 No.
28	Universal Milling Machine	1 No.
29	Surface Grinding Machine	1 No.
30	Tool and Cutter Grinder	1 No.
31	Shaping Machine	1 No.
32	Tools and Measuring instruments	Sufficient quantity
33	Personal protective equipment	Sufficient quantity
34	Fire safety equipment	Sufficient quantity
35	Consumable	Sufficient quantity

Reference Book

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017

Reference Web Link / Video

Topic	Website	Link
Manufacturing Processes	Virtual Lab	http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/#

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4020370

Semester : III

Subject Title : Measurements and Metrology Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020370 Measurements and Metrology 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:

- Familiarize about measuring techniques of Metrology instruments.
- Select the range of measuring tools. Study of accuracy of instruments and calibration of instruments.
- Obtain accurate measurements.
- Determine the least count of measuring instruments.
- Acquire knowledge about linear measurement.
- Acquire knowledge about angular measurement.
- Acquire knowledge about geometric measurements.
- Study of Linear Measuring Instruments: Vernier Caliper, Micrometer, Inside Micrometer, Vernier Height gauge and Slip Gauge.
- Study of Angular Measuring Instruments–Universal Bevel Protractor, Sine Bar.
- Study of Geometric measurement - Gear tooth Vernier, Thread Vernier.

Exercises

PART A:

1. Measure the dimensions of ground MS flat / cylindrical bush using VernierCaliper 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 inside diameter of the bore of a bush cylindrical component using inside micrometer compare the result with digital micro meter.
5. Measure the height of gauge blocks or parallel bars using vernier height gauge.
6. Detect of cracks of the given two specimens using liquid penetrant test and magnetic particle test.

PART B:

1. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
2. Measure the angle of the machined surface using sine bar with slip gauges.
3. Measure the geometrical dimensions of V-Thread using thread micrometer.
4. Measure the geometrical dimensions of spur gear.
5. Find out the measurement of given component and compare with a standard component using mechanical comparator and slip gauge .
6. Prepare a specimen to examine and find the grain structure using the Metallurgical Microscope.

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.

DETAILED ALLOCATION OF MARKS

Part-A	**:**	**45 marks**
Procedure / Preparation	10	
Observation / Dimensions	25	
Finishing	10	
Part-B	**:**	**45 marks**
Procedure / Preparation	10	
Observation / Dimensions	25	
Finishing	10	
Viva-voce	**:**	**10 marks**
Total	**:**	**100Marks**

LIST OF EQUIPMENTS (For 30 students)

1. Vernier Caliper - 2 Nos.
2. Digital / Dial Vernier Caliper. - 2 Nos.
3. Outside micrometer - 2 Nos.
4. Inside 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. Digital inside micrometer - 2 Nos.
10. Surface plate - 2 Nos.
11. Vernier height gauge - 1No.
12. Thread Vernier - 1 No.
13. Thread micrometer – 1 No.
14. Gear tooth Vernier - 2 Nos.
15. Mechanical comparator - 2 Nos.
16. Dial indicator (0-10) - 2 Nos.
17. Abrasive grinder – 1 No.
18. Polishing Machine – 1 No.
19. Mounting machine – 1 No.
20. Metallurgical microscope – 2 Nos
21. Magnetic yoke - 1 No.
22. Liquid penetrant test kit – 1 set.
23. Consumable - Sufficient quantity

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021410

Semester : IV

Subject Title : Heat Power Engineering

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021410 Heat Power Engineering	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	TOPIC	TIME
I	Steam Generators and Steam Boiler	15
II	Steam Engine, Steam Turbine and Steam Condenser	15
III	Air Compressors Gas Turbines and Jet Propulsion	15
IV	Refrigeration and Air-Conditioning	14
V	Thermal Power Plant and Nuclear Power Plant	14
Test & Revision		7
Total		80

RATIONALE:

This subject is one of the core subjects. Diploma engineers have to work with various power producing and power absorbing devices. This subject will enable students to establish foundation required to design, operate and maintain the devices. This subject emphasizes on steam boilers and allied components that are used in industrial sectors. Thermal power plants are still contributing major share in electricity production in India. The students will be able to calculate various parameters required to determine the performance of these devices.

OBJECTIVES

- Explain the concepts and applications of steam
- Learn the construction and working of steam boilers, steam engines, steam turbines and steam condensers.
- Explain the concepts and applications of air compressor, gas turbines and jet propulsion
- Explain the concepts and applications of Refrigeration and Air-conditioning.
- Explain the concepts and applications of thermal and nuclear power plants.

4021410 HEAT POWER ENGINEERING

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**STEAM GENERATORS AND STEAM BOILER** **1.1: Steam Generators** Properties of steam - Formation of steam – dryness fraction – wetness fraction – types of steam – dry steam, wet steam and superheated steam - compare - advantages of superheated steam - enthalpy – entropy – specific volume – simple problems. **1.2: Steam Boiler** Introduction – Classifications – Essentials of good steam boiler – selection of a steam boiler – Compare water tube boiler and fire tube boiler – Working principle of BHEL boiler. Boiler act. Boiler Mountings: water level indicator - stop valve – feed check valve – blow of cock. Steam safety valves: Spring loaded safety vale – High steam and Low water safety valve. Boiler accessories: feed pump – injector – economizer – air preheater – super heater – steam separator. Performance of boilers: Evaporative capacity – Equivalent evaporation – Factor of evaporation – Boiler efficiency – Heat losses in a power plant – simple problems.	**5** **7** **3**
II	**STEAM ENGINE, STEAM TURBINE AND STEAM CONDENSER** **2.1: Steam Engine** Introduction - Classification – Reciprocating steam engine parts and their description – working principle – theoretical indicator diagram – actual indicator diagram – mean effective pressure – Indicated power – brake power. Efficiency: mechanical, relative and overall. Description only. **2.2: Steam Turbine** Introduction – classification – advantages – types – compounding: velocity, pressure and pressure velocity. Bleeding – energy losses - Description only.	**7** **3**

	2.3: Steam Condenser Introduction – classification – Jet condenser: Principles of parallel flow, counter flow and ejector. Surface condenser: Principles of down flow, central flow and evaporative. Compare jet condenser and surface condenser.	**5**
III	**AIR COMPRESSORS AND GAS TURBINES** **3.1: Air compressors** Introduction – classification – working of single stage reciprocating air compressor – p-V and T-s diagram – isothermal efficiency, work done: without and with clearance volume – volumetric efficiency – simple problems. Principles of multi-stage reciprocating compressor. Rotary compressor: construction and working of roots blower – vane type blower – centrifugal compressor - axial flow compressor. Compressed air motors: principles of reciprocating type and rotary type air motor. **3.2: Gas Turbines** Introduction – classifications – advantages and disadvantages of gas turbines – constant pressure gas turbine - gas turbine with regenerator – intercooler – reheater – effects – closed cycle gas turbines –merits and demerits of open and closed cycle gas turbine. **3.3: Jet Propulsion** Turbo jet engines – merits and demerits – turbo propeller engines – merits and demerits – ramjet - comparison of aircraft and industrial gas turbines.	**8** **4** **3**
IV	**REFRIGERATION AND AIR-CONDITIONING** **4.1: 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. **4.2: Air-Conditioning** Introduction - psychrometric properties – dry air - moist air – water	**7** **7**

	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. Applications of air conditioning system – room air conditioning – central air conditioning – differences between comfort and industrial air conditioning. Factors to be considered in air conditioning - loads encountered in air-conditioning systems.	
V	**THERMAL POWER PLANT AND NUCLEAR POWER PLANT** **5.1: Thermal Power Plant** Layout of thermal power plant – merits and demerits of thermal power plant – pollutants – effects and control – cyclone separator – wet scrubber – electrostatic precipitator – control of NO_2 and SO_2 - fluidised bed combustion. **5.2: Nuclear Power Plant** Nuclear fission and fusion – chain reaction – radioactivity - layout of nuclear power plant - merits and demerits - Nuclear reactors – classification – components of nuclear reactor – reactor core – moderators – control rods – coolant – reflectors - biological shield – pressurized water reactor – boiling water reactor – Candu type reactor – fast breeder reactor – effect of nuclear radiation – disposal of nuclear wastes - comparison of nuclear power plants with thermal power plants.	**6** **8**

Reference Book

1. Applied Thermodynamics, P.K. Nag, TATA McGraw- Hill Publishing Co.
2. Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition, Chand & Co.
3. Thermal Engineering, P.L Ballaney, Khanna Publishers.
4. Thermal Engineering, Er.R.K.Rajput, Lakshmi Publications (P) Ltd.
5. Applied Thermodynamics, Domkundwar and C.P Kothandaraman, Khanna publishers.
6. Refrigeration and Air conditioning, P. L. Ballaney, Khanna Publishers.

7. Power Plant Engineering Thermodynamics, Domkundwar and C.P.Kothandaraman, Khanna Publishers.
8. Power Plant Engineering, G.R. Nagpal, KhannaPublishers.

Reference Web Link / Video

Topic	Website	Link
Thermal and Automobile Engineering	Dote E-Lecture	https://www.youtube.com/watch?v=85K4_4PfRpQ&list=PL1b9Ht9ISqIG_szHgF6Fie9fdDpf8WOE0
Heat Power Engineering	Dote E-Lecture	https://www.youtube.com/watch?v=NpII017XBMI&list=PL1b9Ht9ISqIGJgqTGxcqmSEwLa_WWI83e
Basic Thermodynamics	NPTEL	https://nptel.ac.in/courses/112/105/112105123/
Applied Thermodynamics for engineers	NPTEL	https://nptel.ac.in/courses/112/103/112103275/
Power Plant Engineering	NPTEL	https://nptel.ac.in/courses/112/107/112107291/
Refrigeration and air Conditioning	NPTEL	https://nptel.ac.in/courses/112/105/112105129/

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021420

Semester : IV

Subject Title : Vehicle Body Engineering

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021420 Vehicle Body Engineering	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	TOPIC	TIME
I	Automotive Aerodynamics	15
II	Car Bodies	15
III	Bus Bodies	15
IV	Commercial Vehicle Bodies and Body Materials	14
V	Vehicle Body Repair Works and Painting	14
Test & Revision		7
Total		80

RATIONALE:

To impart knowledge to the students about constructional details of different types of vehicle bodies and about vehicle body repair works and painting.

OBJECTIVES:

- To impart knowledge in automotive aerodynamics.
- To understand the construction of car body, design criteria, types of car and safety aspects of car.
- To understand the construction of bus body and dimensions of bus body and safety aspects.
- To understand the types of commercial vehicles; design of cab and in aerodynamic testing, forces and moments.
- To understand the vehicle body repair works and painting.

4021420 VEHICLE BODY ENGINEERING

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**Automotive Aerodynamics** Objectives, Vehicle Drag - Definition, Types and Effects. Forces and Moments Acting on Vehicle Body - Types and Effects. Various Body Optimization Techniques and Aerodynamic Aids for Optimization of Drag. Drag Reducing Devices in Commercial Vehicles. Wind Tunnel Testing – Concept and Types, Flow Visualization Techniques, Scale Model Testing, Component Balance to Measure Forces and Moments.	8 7
II	**Car Bodies** Car Body-Purpose, Requirements and Types - Saloon, Convertibles, Limousine, Estate Van, Racing and Sports Car. Car Body Construction - Components of Car Body and Purpose of Each Component. Safety Equipments for Car - Seat Belts and Air Bags. Dimensional and Visibility Regulations. Drivers Visibility, Tests for Visibility, Methods for Improving Visibility and Space in Cars. Crash Test and Roll Over Test.	8 7
III	**Bus Bodies** Bus Body – Types - Mini Bus, Single Decker, Double Decker, Two Level, Split Level and Articulated Bus. Bus Body Layout - Floor Height - Engine Location - Entrance and Exit Location - Seating Dimensions. Constructional Details - Frame Construction - Types of Metal Section Used, Double Skin Construction, Conventional and Integral Type Construction. Automatic Door System – Twin Glider Door, Single Glider Door, Folding Door, Sliding Plug Door and Swing Plug Door.	11 4
IV	**Commercial Vehicle Bodies and Body Materials** Types of Commercial Vehicle Body - Light Commercial Vehicle Body Types, Flat Platform, Drop Side, Fixed Side, Tipper Body, Tanker Body - Baffled and Un-Baffled Tanks, Drivers Cab Design - Forward Control Cab	9

	and Normal Control Cab. Vehicle Body Materials - Steel, Light Alloys, Plastics, Crp, Grp, Textiles, Glass, Wood, Aluminium Materials, Adhesives and their Properties.	5
V	**Vehicle Body Repair Works and Painting** Hand Tool, Power Tool and Equipments for Body Repair Works. Body Repair Methods - Paintless Dent Removal, Body Filler, Hammer & Dolly Method and Patching. Refinishing Process - Paint Removal, Preparing Bare Metal, Prime Coat Selection, Final Sanding, Masking, Surface Cleaning. Painting - Objectives, Elements of Paint. Painting Methods – Spray Painting and Immersion Painting. Vacuum Coating, Electrostatic Painting. New Vehicle Painting Process.	6 8

Reference Books

1. Vehicle Body Engineering, Powloski, J., Business Books Ltd, 1989.
2. Body Repair Technology for 4-Wheelers, James E Duffy, Cengage Learning.
3. Body construction and design, Giles, G.J., Illiffe Books Butterworth & Co.
4. The Repair of vehicle bodies, Andrew Livesey and A Robinson, Routledge.
5. John Fenton, “Handbook of Automotive Body and Systems Design”, John Wiley & Sons, 2013.

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021430

Semester : IV

Subject Title : Automobile Electrical and Electronics Systems

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021430 Automobile Electrical and Electronics Systems	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	TOPIC	TIME
I	Basic Electrical and Electronic Principles	15
II	Electromagnetic Induction Machines, Starter Motors, Alternators	15
III	Lighting and Auxiliary System	15
IV	Electronic Spark Ignition & Diesel Ignition and Engine Management Systems	14
V	Control of Automotive Systems through Electronic Management Systems	14
	Test & Revision	7
Total		80

RATIONALE:

Diploma engineers have to deal with electrical and electronics engineering principles and applications in industrial processes of different fields. It is therefore necessary for them to apply the principles of electrical and electronics engineering. This subject make them conversant with electrical and electronic engineering aspects of manufacturing, production, fabrication, automobile and mechanical based processes in industries,

OBJECTIVES:

- To learn the basics in Automotive Electrical, Electromagnetic & Electronic principles
- To know the basic symbols of Electrical & Electronic Components, Wire & Cable Color Codes & Sizes and using those symbols to draw simple Circuit Diagrams
- To learn all about components applying the principles of Electromagnetic & Electromagnetic Induction in an Automobile like Starting Motors, Alternators, Solenoids, Relays, Transformers, Inductors etc. & Lighting, Auxiliary & Sensors Systems in an Automotive Vehicle.
- To study about the evolution of Automotive Spark Ignition Systems and their working
- To study about Electronic Management of Automotive Systems through use of ECMs & Transducers.

4021430 AUTOMOBILE ELECTRICAL AND ELECTRONICS SYSTEMS
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**Basic Electrical and Electronic Principles** Introduction - Definitions – Charge, Current, Electromotive Force, Potential Difference, Theory of Electron Flow and Conventional Flow. Properties of Conductors, Insulators and Semiconductors. Definitions of Electrical Laws - Ohm's Law, Kirchhoff's Laws, Definitions of Resistance & Resistivity, Inductance and Capacitance. Definitions of Magnetism, Electromagnetism & Electromagnetic Induction, Mutual Induction. Electromagnetic Terms & Definitions, Faraday's Laws, Fleming's Rules, Maxwell's Corkscrew Rules, Lenz's Law and their application in Automobiles. Single Pole & Double Pole Wiring, Electrical Safeties and the benefits of "Earthing To Chassis" in Automotive Wiring, Electrical Symbols, Wire Sizes & Colour Codes, their importance in an Electrical Circuits. Introduction - Basic Principles of Semiconductors. Semiconductor Devices – LED- Seven segment LED - Zener Diodes, Transistors & SCRs. Rectifier – Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier & Applications of Semiconductor Devices in various Automotive Systems.	**12** **3**
II	**Electromagnetic Machines, Starter Motors & Alternators** Solenoid Actuator, Relays and types of Relays and their automotive usage. Electromagnetic & Thermal Relays Requirements of The Charging System. Charging System Principles. Alternators – Construction, Generation of Electricity, Rectification of AC to DC, Regulation of Output Voltage - Need for the Regulator, Regulators, Charging Circuits. Advantages of Alternator over Dynamo. Trouble Shooting in the Alternator. Requirements of Starter Motor. Starting Motor – Working Principle - Construction. Starting System Circuit. Starter Drive Mechanisms - Bendix Drive Mechanism, Over Running Clutch Type Drive Mechanism and Coaxial Drive Mechanism in the Heavy Vehicles. Starter Switches and Solenoids. Stepper Motors & Servo Motors,	**3** **7** **5**

III	**Lighting and Auxiliary System** Lighting – Purposes & the needs of Traffic Indicators, Sidelights, Rear Lights, Brake Lights, Reversing Lights, Day Running Lights, Rear Fog Lights, Front Spot, Fog Lights, Park Lamp, Rear Number Plate Lamp, Beam Indicator, Door Lamp, Pillar Lamp, Roof Lamp and Panel Lamps. Dip Switch and Lighting Circuits. Headlight Leveling, Headlight Beam Setting. Wiper and Washer Systems - Construction and Working, Electric Horns - Construction and Working. Window Glass Panel Operating System, Gauges - Fuel Gauge, Oil Pressure Gauge, Coiling Water Temperature Gauge and Ammeter Charging Indicator.	**8** **7**
IV	**Electronic Spark Ignition & Diesel Ignition and Engine Management Systems** Evolution of SI Engine Ignition Systems-from Magneto Ignition System to Electronic Distributer-less Ignition System, the needs for development & benefits gained at each stage. Brief Study of each of the System, Spark Plug types, needs & Usage. Electrical Circuitry Outline of Electronic Engine Controls for MPFI & CRDI Systems-Difference between Electronically Managed Engines & Mechanically Managed Engines with Inherent Merits & Demerits-Description, Working & Testing of various Sensors, Engine Controller & Actuators used in MPFI & CRDI Systems, On-Board-Diagnostic Systems & Instrument Panel. Types of Sensors – Thermistor Sensor, Pressure Sensor, Inductive Sensor, Knock Sensor, Fuel Flow Sensor, Oxygen Sensor and Vehicle Speed Sensor.	**5** **6** **3**
V	**Control of Automotive Systems through Electronic Management Systems** Electronic Control Unit - Working Principle. Sub-Units in Microprocessor Control Systems. Microprocessor And Microcomputer Controlled Devices In Automobiles - Travel Information System and Keyless Entry System. On-Board-Diagnostics and their functions, Identification of different	**6** **8**

	types of Connectors in the circuits of Microprocessor Controlled Systems – Electrical motor control system - Electrical safety standard in Vehicle – MCB, ELCB – Role Electric Vehicle Technology - Impact of Automobile Industry	

Reference Books:

1. Automobile Electrical and Electronics Systems, Tom Denton, London.
2. Automotive Electrical and Electronics, Barry Holembeak, USA.
3. Automotive Computers and Digital Instrumentation, Robert N Brady, New Jersey.
4. Automotive Electronics and Electrical Equipment, William H. Crouse and DL. Anglin, McGraw Hill company.
5. Automobile Electrical Equipment, William. H. Crouse., McGraw Hill Book Co. Inc., New York.
6. Automobile Engineering, RB Gupta, Satya Prakashan, New Delhi.

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021440

Semester : IV

Subject Title : Automotive Engines

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021440 Automotive Engines	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	TOPIC	TIME
I	Thermodynamics, Air Cycles	15
II	Fundamentals of IC Engines, Testing of IC engines:	15
III	Fuel supply system, Fuel Injection Systems	15
IV	Ignition Systems	14
V	Cooling system, Lubrication System, Super charging, Turbo Charging	14
Test and Revision		7
TOTAL		80

RATIONALE:

This is the core technology subject. All automotive vehicles are powered by IC engines. Hence the fundamental knowledge of automobile engine is most essential for the auto technicians. This subject will help in understanding the procedure of inspection, diagnosis and testing of engines and other systems. This subject deals with all systems in the automobile engines.

OBJECTIVES

- Explain the basics of systems, laws of thermodynamics and thermodynamic processes.
- Learn the construction and working fundamentals of IC Engines.
- Performance of petrol and diesel engines and its components.
- Explain the concept and applications of IC engines and its performance
- Learn the working principle of fuel feed system of petrol and diesel engines.
- Explain the concept of fuel Injection system of petrol and diesel engines.
- Learn the working principle of Ignition systems.
- Acquire the knowledge on the lubrication and cooling systems of engines.

4021440 AUTOMOTIVE ENGINES

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**THERMODYNAMICS AND AIR CYCLES**	
	1.1: Thermodynamics	**7**
	Definitions and units of mass, weight, volume, density, specific weight, specific gravity and specific volume – pressure – units of pressure – temperature - absolute temperature – S.T.P and N.T.P conditions – heat – specific heat capacity at constant volume and at constant pressure – work – power – energy – law of conservation of energy – thermodynamic system – thermodynamic equilibrium - properties of systems – intensive and extensive properties – State of system – process – cycle – point and path functions - Zeroth, First and Second laws of thermodynamics. Description only.	
	1.2: Thermodynamic Processes	**3**
	Constant Volume – Constant Pressure – Constant temperature – Isentropic – Polytropic - P-V and T-S diagrams. Free expansion – Throttling process. Description only.	
	1.3: Air Cycles	**5**
	Carnot Cycle – Otto cycle – Diesel Cycle – Dual cycle – Efficiency – Brayton cycle - Stirling cycle. Description only.	
II	**FUNDAMENTALS OF IC ENGINES AND TESTING OF IC ENGINES**	
	2.1: Fundamentals of IC Engines	
	Introduction – Development of IC engines – Classification – IC Engine and Its Components – Working of Four Stroke Cycle Petrol Engine – Working of Four Stroke Cycle Diesel Engine – Valve timing diagram - Working of Two stroke petrol engines – Working of Two stroke diesel engines – Port timing diagram - Applications of IC engines.	**6**
	2.2: Testing of IC engines	
	Performance of IC Engines - Thermodynamic and commercial tests – indicated power – brake power – friction power – efficiencies of I.C. engines – indicated thermal, brake thermal, mechanical and relative	**9**

	efficiencies – Specific fuel consumption – Morse test – procedure – heat balance sheet – simple problems.	
III	**FUEL SUPPLY SYSTEM AND FUEL INJECTION SYSTEMS** **3.1: Fuel supply System** SI Engines fuel supply system - General arrangement - Construction and working principle of Mechanical fuel pump, Electrical fuel pump. Air-Fuel mixtures and its requirement – Working principle of Simple carburetor – Working principle of Solex carburetor, SU carburetor. **3.2: SI Engines fuel injection systems** Types – port injection system, throttle injection system - MPFI – advantages and disadvantages of petrol injection system – Electronic Petrol Injection system – D-MPFI System – L-MPFI system – Group Injection System – Cold start injector. **3.3: CI Engines fuel injection system** Requirement of ideal injection - Construction and working principle of Fuel pump – types of nozzles – Working principle of Electronically controlled diesel injection system - Working principle of common rail injection system. Fuel filters.	**5** **5** **5**
IV	**IGNITION SYSTEMS** **4.1: Battery ignition system** Requirement – Principle of battery ignition system for multi cylinder engines – Components of battery ignition system – Construction of Distributor - Spark plug - types. **4.2: Magneto ignition system** Magneto ignition system – working principle – Advantages and disadvantages. Distributor less ignition system – Coil on plug ignition system. Ignition advance – Advancing mechanisms – Factors affecting the angle of advance and its effects. **4.3: Electronic ignition systems** Electronic ignition systems – Transistorised Coil Ignition – Capacitive Discharge Ignition – Computer controlled coil ignition systems. Firing orders. Importance of ignition timing and ignition advance.	 **4** **5** **5**

V	**COOLING SYSTEM, LUBRICATION SYSTEM, SUPER CHARGING, TURBO CHARGING**	
	5.1: Cooling system Introduction - effects of overheating – areas of heat flow. Air cooling system – Water cooling system - natural and forced circulation. Engine radiators. Hot and cold weather precautions – use of antifreeze solution.	**5**
	5.2: Lubrication System Source of friction losses – Effect of frictional losses. Functions of lubrication – Required properties of lubricant – Additives and their function – Grades of lubricating oils. Lubricating system: Splash lubrication, Pressure feed lubrication – wet sump and dry sump – working principles. Oil filters - Crankcase ventilation.	**5**
	5.3: Super charging and Turbo charging Introduction – thermodynamic cycle with super charging – Types of super chargers – Arrangement of super chargers. Turbo charging: Functions – Types - Construction and working of Turbo charging of a single cylinder engine - advantages and disadvantages	**4**

Reference Books

1. Thermal Engg, R.K.Rajput, 8th Edition, Laxmi publications Pvt Ltd.
2. Applied Thermodynamics, P.K. Nag, 2nd Edition, TATA McGraw - Hill Publishing Co.
3. Thermal Engineering, R.S.Khurmi and J.K.Gupta,18th Edition, S.Chand& Co.
4. Automobile engineering vol-1, vol–2, Kirpalsingh, Standard publishers.
5. Automobile Engineering, G.B.S.Narang, Khanna Publishers.
6. Automotive Mechanics, William H.Crouse and Donald L Anglin, Tata McGraw – Hill Publishing Company Ltd.
7. The Automobile, Harbans Singh Reyat, S.Chand& Co Ltd.
8. Thermal Engineering, P.L.Ballaney, 24th Edition, Khanna Publishers.
9. Applied Thermodynamics, Domkundwar and C.P Kothandaraman, 2nd Edition, Khanna publishers.
10. Vehicle and Engine technology. Vol.-I, Heinz Heisler, ELBS
11. Automotive Mechanics, Joseph Heitner, East–west Press (P) Ltd.
12. Internal Combustion engines, M.L.Mathur & R.P.Sharma, Dhanpat Rai & Sons,

Reference Web Link / Video

Topic	Website	Link
Thermal and Automobile Engineering	Dote E-Lecture	https://www.youtube.com/watch?v=85K4_4PfRpQ&list=PL1b9Ht9ISqIG_szHgF6Fie9fdDpf8WOE0
Heat Power Engineering	Dote E-Lecture	https://www.youtube.com/watch?v=NpII017XBMI&list=PL1b9Ht9ISqIGJgqTGxcqmSEwLa_WWI83e
Fundamentals of automotive system	NPTEL	https://nptel.ac.in/courses/107/106/107106088/

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	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020350 Machine Drawing and 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.
3. 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.

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

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 sheet		**: 30 marks**
Assemble Front view	30	
Computer Aided Drafting		**: 60 marks**
Drafting	20	
Assembly	20	
Dimensioning	20	
Viva-voce		**: 10 marks**
Total		**: 100 marks**

LISTOF EQUIPMENT (For 30 students)

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

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021460

Semester : IV

Subject Title : Automobile Electrical and Electronics Systems Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021460 Automobile Electrical and Electronics Systems 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:

- Evaluating the parts of an Alternator and testing an assembled alternator same on a test bench for proper operation.
- Evaluating the parts of a Starter Motor and testing an assembled Starter Motor on a Test Bench for proper operation.
- Understanding the need for setting of proper ignition timing..
- To understand the Working Principle of Auxiliary Systems
- To understand the Use of Sensors and to test them in an Automobile.
- To construct Electrical Circuits in Automobile and make simple electrical circuits with proper Electrical Symbols, Cable Sizes &Colour Codes.

4021460 AUTOMOBILE ELECTRICAL AND ELECTRONICS SYSTEMS PRACTICAL

Experiments

Part – A

1. Testing of Alternator Parts such as Stator, Rotor and Rectifier for Resistance, Continuity for Insulation Effectiveness using Multifunction Tester.
2. Testing of Starter Motor Parts such as Test Field Windings, Brush Holders, Armature and Solenoid Switch for Continuity Using Multifunction Tester
3. Testing of Electronics fuel Ignition system
4. Servicing of the Wiper Motor and Horns – Tuning.
5. Identifying and testing of the various terminals of 4-Point, 5-Point, 6-Point & 8-Point Relays through their markings using Multifunction Tester
6. Testing of Stepper motor drive

Part – B

1. Construction and Testing of Half Wave Rectifier, Full Wave Bridge Rectifier without Filters.
2. Identification and testing of display devices- LED, 7 segment LED
3. Testing of various Sensors using Multifunction Tester
4. Construction and Testing of Fuel and Temperature Gauges Circuit.
5. Construction and Testing of Head Lights, Parking Lights and Direction Indicators Circuit.
6. Connection and Testing of MCB, ELCB

BOARD EXAMINATION

Note:

- All the exercises/experiments in both sections should be completed. Two exercises/experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises/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 machineries / equipments before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
Part- A		
1	Circuit Diagram	10
2	Connection/Reading	20
3	Calculation/Graph	15
Part- B		
4	Circuit Diagram	10
5	Connection/Reading	20
6	Calculation/Graph	15
7	**Viva-voce**	10
Total		100

LIST OF EQUIPMENT / TOOLS/MACHINERY'S REQUIRED

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1.	Alternator	2 No's
2.	Starter Motor	2 No's
3.	Wiper Motor	2 No's
4.	Horn	2 No's
5.	Relay (4 point, 5 point, 6 point,8 point)	Each 1 No
6.	Stepper motor drive kit	1 No
7.	Engine crankshaft angular position sensor	2 No's
8.	Speed sensor	2 No's
9.	Pressure sensor	2 No's
10.	Fuel gauge	1 No
11.	Knock sensor	1 No
12.	Oxygen sensor	1 No
13.	Temperature gauge	1 No
14.	Head Light	1 No
15	Parking Light	1 No
16	Direction Indicator	1 Set
17.	Electronic fuel Ignition Systems kit	1 No
18.	ELCB	1 No
19.	MCB	1 No
20.	Transformer (230 V/ 6 V)	2 No's
21.	Transformer (230 V/ 6 V – 0 V- 6 V)	2 No's
22.	Diode 1N4007	10 No's
23.	Bread Board	2 No's
24.	Digital Multimeter	1 No
25.	Analog Multimeter	1 No

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021470

Semester : IV

Subject Title : Automotive Engines Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021470 Automotive Engines Practical	4	64	25	100*	100	3 Hrs.

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

Objectives

- To Study the Flash and the Fire Point of a Fuel
- To Gain the Practical Exposure on Engine Port and Valve Timings
- To find the Viscosity of Lubricants.
- To find the COP of a refrigerator
- To study the various parts of an Engine
- To get an exposure on assembly and functioning of various pumps and injector.
- To study about MPFI and CRDI systems

4021470 AUTOMOTIVE ENGINES PRACTICAL

Experiments

PART A

1. Find Flash and Fire point of fuel using open cup and closed cup apparatus and compare the value for the given sample.
2. Find Viscosity of lubricating oil using Saybolt viscometer.
3. Find Viscosity of lubricating oil using Red wood viscometer.
4. Draw the Port timing diagram of a single cylinder two stroke diesel engine or petrol engine
5. Draw the Valve timing diagram of a single cylinder four stroke diesel engine or petrol engine.
6. Determine the COP of the vapour compression refrigerator system.

PARTB

1. Dismantle and assemble camshaft, timing gear and valves. Adjust the valve Clearance.
2. Dismantle and assemble oil pump and water pump after inspection and service.
3. Dismantle and assemble the fuel pump in a petrol engine after inspection and service.
4. Dismantle and assemble the distributor pump and injector after inspection and service.
5. Identify the components of the MPFI system in the kit.
6. Identify the components of the CRDI system in the kit.

BOARD EXAMINATION

Note:

- All the exercises/experiments in both sections should be completed. Two exercises/experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises/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 machineries / equipments before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
Part- A		
1	Procedure	10
2	Tabular Column / Formulae	10
3	Observation / Calculation / Diagram	25
4	Result / Graph	5
Part- B		
5	Procedure / Explanation	10
6	Observation / Dismantling	15
7	Result / Assemble	15
	Viva-voce	10
Total		100

LIST OF EQUIPMENT / TOOLS/MACHINERY'S REQUIRED

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1	Open cup apparatus	1 No.
2	Closed cup apparatus	1 No.
3	Saybolt viscometer	1 No.
4	Redwood viscometer	1 No.
5	Two stroke diesel or petrol engine cut section	1 No.
6	Four stroke diesel or petrol engine cut section	1 No.
7	Refrigerator test rig	1 No
8	Four stroke diesel engine cut section model	1 No
9	Cam shaft	1 No
10	Timing gear	1 No
11	Oil & water pump	1 No (each)
12	Fuel pump	1 No
13	Distributor pump	1 No
14	Injector	1 No
15	MPFI Kit	1 No
16	CRDI Kit	1 No
17	Basic and special tools	sufficient quantity
18	Service tools	sufficient quantity
19	Consumables	sufficient quantity

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021510

Semester : V

Subject Title : Fuels, Combustion and Emission Control

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021510 Fuels, Combustion and Emission Control	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	TOPIC	TIME
I	Fuels and Combustion	18
II	Energy, Fuel for IC engines, Alternate Fuels	18
III	Combustion in SI Engines, CI Engines, Air Pollution	18
IV	Filters and Manifolds, Engine Noise, Exhaust Control	18
V	Pollution and Emission Control standards and Act.	17
Test & Revision		7
Total		96

RATIONALE

Impart knowledge on the basics of fuels and its types. The need for alternate fuels and emission and pollution control and its standards are taught.

OBJECTIVES

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

- To understand the types of fuel, the methods for determining the calorific values of fuels, combustion calculations and the nuances of combustion.
- To create an awareness on air pollution due to I.C. engines and its ill effects.
- To study the methods of reducing or eliminating the harmful gases from engine and gas turbine exhausts.
- To study the different norms and legislations to put a check over the air pollution.
- To study the concepts of alternative fuels, automobile pollution and control.

4021510 FUELS, COMBUSTION AND EMISSION CONTROL

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**FUELS AND COMBUSTION** **1.1: 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 – simple problems. **1.2: Combustion** 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 - simple problems.	**6** **12**

II	**ENERGY AND ALTERNATE FUELS** **2.1: Energy** Estimation of petroleum reserve – World Energy Scenario - Energy Survey of India – survey of oil consumption in India - Availability of petroleum products in India. Indian initiatives in alternate fuels. Fuels for IC Engines: Introduction – Desirable properties - Classification – Description the processing of crude oil – Fuels for SI Engines – octane number – octane rating - Fuels for CI Engines – cetane number – cetane rating. **2.2: Alternate Fuels** Introduction – list of alternate fuels - Need for alternate fuel – Availability of alternate fuels. Air craft fuels – Liquefied Petroleum Gas (LPG): Schematic diagram of LPG engine – advantages and disadvantages. Compressed Natural Gas (CNG): Schematic diagram of CNG engine – emissions - advantages and disadvantages. Ethanol: production process – emissions - advantages and disadvantages. Methanol: production process – emissions - advantages and disadvantages. Alcohol (Diesel Blends) – Dimethyl ether – Bio diesel.	**8** **10**
III	**COMBUSTION IN SI ENGINES, CI ENGINES AND AIR POLLUTION** **3.1: Combustion in SI engines** Ignition limit – combustion stages – factors affecting SI combustion – Detonation and its effects – methods to control detonation - requirement of combustion chamber – types – emission of SI engines. **3.2: Combustion in CI engines** Combustion stages – factors affecting delay period – knocking of CI engines – methods to control knocking - requirement of combustion chamber – types – emissions of CI engines – particulate matter emissions. **3.3: Air Pollution** Introduction - Need - pollutants – sources of pollutants. Exhaust gas analysis: Orsat apparatus – construction and working principle. Smoke meter – exhaust gas analyser – Working principle. Control of smoke emissions from IC engines.	**6** **6** **6**

IV	**FILTERS AND MANIFOLDS FOR IC ENGINES, ENGINE NOISE AND EXHAUST CONTROL** **4.1: Filters and manifolds for IC Engines** Air filters – maintenance of air filter – cleaning of air filters. Engine fuel filter – types – maintenance. Engine oil filter – uses. Manifolds: Introduction – intake manifold - factors involved in design. Exhaust manifold – maintenance. **4.2: Engine Noise** Engine noise sources - Engine noise reduction – exhaust muffler – description – types – Engine silencers – selection of silencer. **4.3: Exhaust control** Construction and working principles of Catalytic converter, Diesel particulate filter, Exhaust Gas Recirculation, Learn burn engine and Oxygen Sensor (Lambda Sensor). Crank case emission control – evaporative emission control systems.	**6** **5** **7**
V	**POLLUTION AND EMISSION CONTROL STANDARDS AND ACT.** The air prevention and control of pollution act 1981 – introduction – functions of central boards – functions of state board – power of the board - prevention and control of air pollution - penalties and procedure. Emission standards - Indian standards of emission for petrol and diesel engines – Bharat Stage emission standards – BS IV, BS VI. Impact of shifting to BS VI. Euro standards – EURO 4, EURO 5 and EURO 6. Japan emission standards. Fuel quality standards. Microprocessor based control system – computer controls in automobiles. Pollution controlled vehicles.	**7** **6** **4**

Reference Books:

1. Automobile Technology, R.B.Gupta, SatyaPrakashan, New Delhi.
2. Internal Combustion Engines, Taylor C F, MIT Press.
3. Internal Combustion Engine Fundamentals, Heywood J B, McGraw Hill Book Co.
4. Internal combustion engine, Ramalingam. K.K., SciTech publications.
5. Advanced IC engines, S.S.Thipse, Jaico Publishing House
6. Alternative Fuels Guide Book, Bechtold,R.L., SAE, 1997.

7. Alcohols and motor fuels progress in technology, Series No.19, SAE Publication USA 1980.
8. SAE Paper Nos.840367, 841156, 841333, 841334.
9. The properties and performance of modern alternate fuels – SAE Paper No.841210.
10. Automobile pollution, Dr.Satykush, IVY Publishing House.
11. Service Manuals from Different Vehicle Manufacturers.
12. Internal Combustion Engines, “Ganesan.V”, Tata-McGraw Hill Publishing Co.
13. Engine Emission, “Springer and Patterson”, Plenum Press, 1990.
14. SAE transactions, " vehicle emission ", 1982 (3 volumes).
15. The Air prevention and control of pollution Act, 1981
16. Bharat Stage Emission Standards (BS Norms)
17. Japan Emission Norms

Reference Web Link / Video

Topic	Website	Link
Engine Combustion	NPTEL	https://nptel.ac.in/courses/112/104/112104033/
Fundamentals of automotive system	NPTEL	https://nptel.ac.in/courses/107/106/107106088/

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021520

Semester : V

Subject Title : Power Units and Transmission

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021520 Power Units and Transmission	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	TOPIC	TIME
I	Frame, Front Axle and Steering System	15
II	Clutch and Gear Box	15
III	Final Drive, Differential and Hydrostatic Drive	15
IV	Suspension System and Rear Axle	14
V	Braking System, Wheels and Tires	14
Test & Revision		7
Total		80

RATIONALE:

This subject provides knowledge about the various components of vehicle and the transmission train used. This subject will also help the students during inspection, installation, operation and maintenance of transmission system of automobile. This subject is a core subject for automobile engineers and they should develop desired knowledge and skills over it.

OBJECTIVES:

- To Understand the Various Transmission Members of the Automotive Vehicle.
- To Understand the Principle of Operation of Clutch.
- To Understand Working and Construction of Various Types of Gear Boxes.
- To Understand Working of Automatic Transmission.
- To Understand the Types and Working of Driveline.
- To Understand the Working of Differential Mechanism.
- To Understand the Types of Rear Axles.
- To Understand Types of Wheels and Tire.
- To Understand the Working of Braking System

4021520 POWER UNITS AND TRANSMISSION

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**FRAME, FRONT AXLE AND STEERING SYSTEM**	
	1.1: Frame	
	Chassis - Types of Chassis Layout - Various Types of Frames - Loads Acting on Vehicle Frame.	**3**
	1.2: Front Axle	**5**
	Construction - Beam and Tubular. Classification of Axle According to their function - Live Axle and Dead Axle. Stub Axle: Types of Stub Axle – Elliot, Reverse Elliot, Lemoine and Reverse Lamoine.	
	1.3: Steering System	**7**
	Ackerman's and Davi's Steering Mechanisms. Front Wheel Geometry - Castor, Camber, King Pin Inclination, Toe-In and Toe-Out. Types of	

	Steering Gear Boxes - Recirculating Ball and Rack & Pinion. Power and Power Assisted Steering.	
II	**CLUTCH AND GEAR BOX** **2.1: Clutch** Role of Clutch in Driving System, Requirements of Transmission System. Construction and Working Principle of Different Types of Clutches - Single Plate Clutch, Multiplate Clutch, Cone Clutch, Centrifugal Clutch, Semi-Centrifugal Clutch and Diaphragm Clutch. Hydrodynamic Transmission - Fluid Coupling and Torque Converter. **2.2: Gear Box** Objective of the Gear Box. Types of Gear Boxes – Sliding Mesh, Constant Mesh and Synchromesh Device. Epicyclic Gear Box.Automatic Over-Drive. 4 Wheel Drive - Transfer Cases. Continuously Variable Transmission.	**8** **7**
III	**FINAL DRIVE, DIFFERENTIAL AND HYDROSTATIC DRIVE** **3.1: Final Drive** Universal Joints – Purpose. Types of Universal Joint - Variable Velocity Joints - Spider Type, Ring Type And Ball and Trunnion Type, Constant Velocity Joints - Rzeppa, Bendix Weiss and Tracta. Propeller Shaft, Rear Axle Drives - Hotchkiss Drive and Torque Tube Drive. Final Drive - Different Types of Final Drive - Worm and Worm Wheel, Straight Bevel Gear, Spiral Bevel Gear and Hypoid Gear Final Drive. **3.2: Differential and Hydrostatic Drive** Differential – Principle and Constructional Details of Differential Unit, Non–Slip Differential, Differential Locks. Front Wheel Drive. Hydrostatic Drive.	**10** **5**
IV	**SUSPENSION SYSTEM AND REAR AXLE** **4.2: Suspension System** Need for Suspension System, Types of the Suspension System -Rigid Axle Suspension and Independent Suspension. Types of Suspension Springs **–** Leaf Springs - Quarter Elliptic, Semi Elliptic, Three Quarter Elliptic, Full Elliptic and Transverse Leaf Spring, Coil Spring, Torsion Bar, Air Bags and Rubber Spring. Antiroll Bar, Function and Construction of Hydraulic Dampers - Shock Absorbers. Active Suspension System	**10**

	4.1: Rear Axle Types Of Rear Axles -Semi-Floating Axle, Full-Floating Axle, Three Quarter Floating Axle. Multi Axles Vehicles.	**4**
V	**BRAKING SYSTEM, WHEELS AND TIRES** **5.1: Braking System** Need for Brake Systems, Stopping Distance. Brake Types - Drum And Disc Brakes. Types of Braking Systems - Mechanical Braking System, Hydraulic Braking System and Pneumatic Braking System. Principle of Master Cylinder, Wheel Cylinder, Leading and Trailing Shoes. Power – Assisted Braking System, Servo Brakes. Antilock Braking System. Bleeding Of Brakes. Parking Brakes. **5.2: Wheels And Tires** Wheels - Types of Wheels – Spoked, Pressed Steel and Cast Alloy Wheel. Tires -Types of Tires – Cross Ply Tires, Radial Tires and Tubeless Tires. Run Flat Tires. Causes of Excessive Tire Wear. Care and Maintenance of Tires.	**9** **6**

Reference Books:

1. Chassis, Body and Transmission, Vijay Singh & Raj Kumar, Ishan Publications, Jalandhar.
2. Automotive Transmission & Power Train, William H. Grouse.
3. Modern Transmission systems, Judge, A.W., Chapman and Hall Ltd., 1990
4. Advanced Vehicle Technology, Heinz Heisler, 2nd Edition,2002, Butterworth-Heinemann
5. Dr.kripal Sing, Automobile Engineering Vol 1 & 2, Standard Publisher Distributors , Delhi

Reference Web Link / Video

Topic	Website	Link
Fundamentals of automotive system	NPTEL	https://nptel.ac.in/courses/107/106/107106088/

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021531

Semester : V

Subject Title : Two-Wheeler and Three-Wheeler Technology

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021531 Two-Wheeler and Three-Wheeler Technology	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	TOPIC	TIME
I	The Power Unit and Fuel System	15
II	Ignition Systems and Electrical System	15
III	Chassis and Sub Systems	15
IV	Transmission System, Brakes and Wheels	14
V	Two and Three Wheeler	14
Test & Revision		7
Total		80

Rationale:

There is an increase in need of public transport in cities and rural areas. This has lead to huge demand of two and three wheelers. Presently Two and three wheelers play an important role in the public transport in all over the world. The subject is pre-requisite for understanding concept of transmission unit, fuel system, electrical system Chassis, wheels, tires and maintenance and servicing of two and three wheelers.

Objectives:

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

- To learn the different types of two and three wheelers.
- To learn the components and their importance and working in two and three wheelers.
- To learn the maintenance of two and three wheelers.
- To present a problem oriented in depth knowledge of two and three wheeler technology.
- To address the underlying concepts and methods behind two and three wheeler technology.

4021531 TWO-WHEELER AND THREE-WHEELER TECHNOLOGY
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the topic	Hours
I	**THE POWER UNIT AND FUEL SYSTEM** **1.1: The power unit** Two stroke and four stroke - SI & CI engine construction and working - merits and demerits. Engine selection criteria for two-wheeler and three wheeler. Valve operating mechanism. Symmetrical and unsymmetrical valve & port timing diagrams - Construction and function of exhaust system: Muffler types and their applications – Tail pipe arrangement and location - scavenging process. **1.2: Fuel system** Fuel system: Carburetor – functions – working principle. Electronic petrol injection system. Lubrication system in four stroke engines – Emission control system – Working of Catalytic convertor, Exhaust Gas Recirculation, Positive crankcase ventilation.	**8** **7**

II	**IGNITION SYSTEMS AND ELECTRICAL SYSTEM** **2.1: Ignition systems** Ignition systems - Magneto coil - battery coil ignition system - Electronic ignition System. Starting system - Kick starter system – Self starter system. DTSI - Speedo meter – Mechanical and Digital - Construction and working. **2.1: Electrical system** Battery - Ratings in Two and Three wheelers. Layout of electrical system in two and three wheelers. Dash units – Use of Speedo meter, trip meter, engine speed indicator/tachometer. Arrangements of Head lamp – tail lamp and indicator light.	**9** **6**
III	**CHASSIS AND SUB SYSTEMS** **3.1: Chassis** Main frame for two and three wheelers: Single cradle frame - double cradle frame - Tubular frame - twin-spar frame. Chassis: Conventional chassis –integral construction. Layout of two-wheeler and three-wheeler vehicle. Different drive systems for two wheelers and three wheelers **3.2: Sub systems** Clutch -Single plate, multiple plate wet and centrifugal clutch- Gear box- Constant mesh and sliding mesh- CVT -Continuously variable Transmission-Gear controls in two wheelers. Front and rear suspension systems- Shock absorbers. Panel meters and controls on handle bar of two and three wheelers.	**7** **8**
IV	**TRANSMISSION SYSTEM, BRAKES AND WHEELS** **4.1: Transmission system:** Layout of transmission system – Multi-disc clutch – chain drive – belt drive – gear box: Constant mesh gear box working principle – gear shifting mechanism. **4.2: Brakes and Wheels:** Drum brakes & Disc brakes for two and three wheelers - Construction and Working and its Types - Front and Rear brake link layouts. Brake actuation mechanism. Selection criteria of wheels and tires – Wheels: Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tires and tubes Construction & its Types.	**7** **7**

V	**TWO AND THREE WHEELER** **5.1: Two wheeler** Two wheeler- case study of Sports bike, Motor cycles, Scooters and Mopeds – Parts, Components, maintenance and servicing. **5.2: Three wheeler and E-Vehicle** Three wheeler- Case study of Auto rickshaws, Pick up van, Delivery van Trailer- parts, components, maintenance and Servicing. E-Vehicle: Manufacturer in India – two wheeler and three wheeler models - Compare.	**6** **8**

Reference Book

1. Irving P.E Motor Cycle Engineering. Temple Press Book London.
2. The Cycle Motor manual Temple Press Ltd London
3. Maintenance Manuals of Leading Two & Three Wheelers Manufacturers in India.
4. Dr.Kirpal Sing, Automobile Engineering Vol 1 & 2, Standard Publisher Distributors , Delhi
5. Dhruv U. Panchal, Two and Three Wheeler Technology, PHI Learning Private Limited, Delhi

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021532

Semester : V

Subject Title : Tractor and Farm Equipment

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021532 Tractor and Farm Equipment	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	TOPIC	TIME
I	General Design of Tractors and Accessories	15
II	Ploughing Implements	15
III	Harvesting and Threshing Equipments	15
IV	Sprayers and Dusters	14
V	Maintenance of Tractors	14
Test & Revision		7
Total		80

Rationale:

Farm equipment provide higher work output rates to sustain higher demand for increased agricultural production. Farm tools, implements, and equipment play very important role in horticultural operations. Their availability makes the work much easier and faster. However, even if one may have the most sophisticated tools and implements, but does not know how to use them, they are useless. This subject designed to understand the basic farm equipment.

Objectives:

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

- To learn the types of tractors and its operating principles.
- To study about the ploughing implements.
- To understand the harvesting and threshing equipment.
- To address the fertilizers and equipment used for it.
- To know the maintenance procedure of tractors

4021532 TRACTOR AND FARM EQUIPMENT

DETAILED SYLLABUS

Theory

Unit	Name of the Topics	Hours
I	**GENERAL DESIGN OF TRACTORS AND ACCESSORIES** Classification of Tractors –Track laying tractor – heavy wheeled tractors – general purpose tractors – two wheeled tractors. Main components of Tractor – safety rules – Power Take Off Shaft – Belt pulley – Power Tiller. The tractor hydraulic system – operating principle.	7 8
II	**PLOUGHING IMPLEMENTS** Primary and Secondary Tillage equipment - DISC Plough – Mould Board Plough – Tiller and Harrows – Construction and maintenance – furrow mounted plough – plough controls - Mounting the plough – ploughing methods systematic ploughing, round and round ploughing and one way ploughing - hitching – Three point linkage – Cage Wheel and its uses.	8 7

III	**HARVESTING AND THRESHING EQUIPMENTS** Harvesting – conventional and Modern Harvesters – Threshing – Principle of Paddy Threshers construction and maintenance – combine – construction and advantages, disadvantages – safety precautions. Cultivation machinery – cultivators – effecs and uses of cultivator – disc harrows – spring tine cultivator – seed harrows – effects and uses – chain harrows – effects and uses – rotary cultivator – uses. Corn drills – seed metering mechanisms – depth of sowing – fertilizer metering unit – checking the sowing rate. – Combine harvester – potato crop machinery – hand feed and automatic – sugar feet crop machinery.	8 7
IV	**SPRAYERS AND DUSTERS** Classification of sprayers and dusters Manual and Power sprayers and Dusters – components of sprayers and dusters – different pumps, nozzles, used in sprayers – maintenance. Fertilizer distributors – rotating plate and flicker fertilizer unit – spinning disc type – the spreader mechanism – rate of application of manure. Haymaking machinery – Forage harvester – The Buck rake.	7 7
V	**MAINTENANCE OF TRACTORS** Daily Maintenance of Tractors – Maintenance of Tractors on hour basis – Trouble shooting of Tractor engines, clutch, Gear box – Major overhaul of engines. Maintenance of the plough – routine maintenance of cultivating machinery – maintenance to grain drills – maintenance of fertilizer distributor – maintenance of farmyard manure spreaders.	7 7

Reference Book

1. Elements of Agricultural Engineering Jagdishwar Sahay.
2. Farm Tractor– Maintenance and Repair S.C.Jain, C.T.Raj, TATA MC Graw Hill.
3. Farm Machinery and Equipment – Smith & Wilkey, Tata MC Graw Hill.
4. Farm Machinery– C.Culpin.
5. Basic Farm Machinery, JM Shippen and JC Turner, Pergamon International Library.- Second edition

Reference Web Link / Video

Topic	Website	Link
Farm Machineries	NPTEL	https://nptel.ac.in/courses/126/105/126105009/

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021533

Semester : V

Subject Title : Industrial Automation

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021533 Industrial Automation	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	TOPIC	TIME
I	Automation	15
II	Drive systems	15
III	Robotics, Automated Inspection and Testing	15
IV	Artificial Intelligence (AI), Industry 4.0	14
V	Rapid Prototyping (RP)	14
Test & Revision		7
Total		80

RATIONALE

Impart knowledge about the automation process in the automobile industries. To acquire knowledge about the hydraulic and pneumatic systems and its functions of the components. Understand the control methods of automation.

OBJECTIVES

- To learn the types of chassis and axles.
- To study about the steering system and its methods.
- To understand the suspension systems and its components.
- To learn the functions of universal joint and propeller shafts.
- To study working principle of differential unit.
- To learn about the types of brakes and tires.
- To know the function of clutch and gear box and its types

4021533 INDUSTRIALAUTOMATION

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**AUTOMATION** **1.1: Introduction to Automation** Definition, automation principles and strategies - scope of automation - low cost automation - Production concepts and automation strategies. **1.2: Automation in Manufacturing Industries** Introduction - Automation in production system - Principles and strategies of automation - Basic elements of an automated system. Material handling and identification technologies: Overview of material handling systems - Types of material handling equipment - Conveyor system - Automated guided vehicle system - Automated storage systems – Description of Automatic Identification Methods. **1.3: Automation in Process Industries** Introduction to computer based industrial automation - Direct Digital	**2** **5** **4**

	Control (DDC) - Distributed Control System (DCS) - Supervisory Control and Data Acquisition (SCADA) based architectures only. **1.4: Programmable Logic Controller (PLC)** Block diagram of PLC - Programming languages of PLC - Basic instruction sets - Levels of process safety through use of PLCs. Introduction to communication protocols - Profibus, Field bus, HART protocols.	**4**
II	**DRIVE SYSTEMS** **2.1: Electrical Drives** Electric machines - Power converter - controllers – DC motor drives – braking. Sensing and feedback elements – current and speed loops, P, PI and PID controllers – response comparison. Induction motor drives – stator voltage control of induction motor – V/F control- Scalar and vector control of induction motor. Synchronous motor drives – principles of synchronous motor control - full and half step motor drives, micro-stepping - Switched reluctance motor drive, Brushless DC motor drive- PMSM drives, BLDC drive. **2.2: Fluid power** Introduction – applications - advantages and limitations. Types of fluid power systems, Properties, Types of fluids – Fluid power symbols. Basics of hydraulics - Hydraulic system and components: Hydraulic Pumps – Classification - selection and design considerations. Fluid Power Actuators – Linear hydraulic actuators and types – Semi-rotary and rotary actuators. **2.3: Pneumatic system and components** Introduction to Pneumatics – Compressors – Types – Air treatment – FRL Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid power circuit design, Speed control circuits, synchronizing circuit, Pneumo-hydraulic circuit, Sequential circuit design. Servo systems – Hydro mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluid power system maintenance and troubleshooting: Fluidics – Introduction to fluidic devices. Fluid power circuits; failure and troubleshooting.	**6** **5** **4**

III	**ROBOTICS, AUTOMATED INSPECTION AND TESTING** **3.1: Robotics** Robot anatomy - Position and orientation – Various joints - Degrees of freedom - Direct kinematics - Inverse kinematics - Linear and angular velocities - Manipulator - rotary joints – Inverse - Wrist and arm - Static analysis - Force and moment Balance - Trajectory planning, Pick and place operations, Continuous path motion, Interpolated motion, Straight line motion. Gripper force analysis and gripper design for typical applications, design of multiple degrees of freedom, active and passive grippers - Factors influencing the choice of a robot, robot performance testing- Impact of robot on industry and society **3.2: Automated Inspection and Testing** Automated Inspection - Principles and Methods - Sensor Technologies for Automated Inspection - Coordinate Measuring Machines - Machine Vision - optical Inspection Methods. Robotic vision systems - image representation - object recognition and categorization- depth measurement - image data compression - visual inspection.	**8** **7**
IV	**ARTIFICIAL INTELLIGENCE (AI), INDUSTRY 4.0** **4.1: Artificial Intelligence (AI):** Introduction - History of AI. Intelligent agents: Agents and Environment - Reactive agent – deliberative - goal-driven, utility-driven, and learning agents. Artificial Intelligence programming techniques. Introduction to ML and DL Concepts Expert systems: - Architecture of expert systems - Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON. AI applications in Industry Automation using - natural language processing - computer vision - speech recognition. Description only. **4.2: Industry 4.0** Introduction - The Various Industrial Revolutions. Challenges for Industry 4.0 - Internet of Things (IoT) - Industrial Internet of Things	**7** **7**

	(IIoT). Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities. Technologies for enabling Industry 4.0 - Cyber Physical Systems - Robotic Automation - Collaborative Robots - Support System for Industry 4.0 - Mobile Computing - Cyber Security. (Description only)	
V	**RAPID PROTOTYPING (RP)** Introduction - History of Rapid Prototyping (RP) systems - Growth of RP industry - Classification of RP systems. 3D printing technologies - selection of material and equipment - 3D printing in Industry 4.0 environment. RP processes: Stereo lithography, Laser Sintering, Fused Deposition Modeling, Laminated Object Manufacturing, Solid Ground Curing – working principle. Rapid Tooling: Indirect rapid tooling - Direct rapid tooling - soft tooling Vs hard tooling. Rapid Manufacturing Process Optimization- Factors influencing accuracy and errors. Software for RP - STL files - internet based software, collaboration tools. Augmented reality and virtual reality - The historical development of AR and Virtual Reality - Requirements for AR and VR - Benefits of AR and VR.	**4** **6** **4**

Reference Books

1. Pneumatic Systems Principles and Maintenance S.R. Majumdar Tata McGraw Hill Pub co
2. Introduction to Programmable Logic Controllers, Gary Dunning Thomson Delmar Learning
3. Fluid Power by Harry L. Stewart – Audel Series
4. Hydraulics & Pneumatics Power for production Harry L Stewart Industrial Press Inc, New York
5. Pneumatic circuit by Harry L. Stewart – Audel Series
6. Fundamentals of pneumatic control Engg – Text book By Festo
7. Introduction to Pneumatics – Test Book by Festo

Reference Web Link / Video

Topic	Website	Link
Industrial automation and control	NPTEL	https://nptel.ac.in/courses/108/105/108105088/

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021540

Semester : V

Subject Title : Automobile Servicing Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021540 Automobile Servicing 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 analyse faults in a vehicle as per the service manual.
- Learn the procedure for servicing of various components of the car.
- Illustrate the complete methodology of evaluation and maintenance of automobile.
- Perform dismantling and assembling of automobile components using tools.
- Enumerate the importance of maintenance and also the step by step procedure for maintaining the various automotive systems.

4021540 AUTOMOBILE SERVICING PRACTICAL

Exercises

1. **Check and identify the status of the following as per the preventive maintenance procedure under the hood as per the service manual of a car.**
   Check the air filter, Check the accessory belts, Check the radiator, Check the hoses, Check the fluid levels and Check the windshield wipers.

2. **Check and identify the status of the following as per the maintenance procedure of a vehicle cooling system.**
   Look at radiators, analyse about antifreeze / coolant, Review radiator pressure caps, Shoot the breeze about fan, understand water pumps, study about thermostats, Explore heater cores

3. **Check and identify the status of the following as per drive train of a car.**
   How power flows through drive train, Manual transmission, Automatic transmission, Trouble shooting, Maintenance of the drive train, Common transmission repairs

4. **Check and identify the status of the following as per the manual of a vehicle in the brake system.**
   Check the brake system, check fluid level and leaks, change the fluid, Bleeding procedure, adjust parking brake, check the antilock braking system (ABS).

5. **Check and identify the status of the following as per the manual of a vehicle in the steering and suspension systems**
   Understand the steering system and suspension systems

6. **Check and identify the status of the spark plug.**
   Remove the spark plug, Inspect the spark plug, Measure and re-gape the spark plug, Install the spark plug, Check distributor, dwell meters, timing light.

7. **Check and identify the status of the Fuel system.**
   Check and replace fuel and air filter, check your fuel pump, PCV valve and accelerator pump, adjust idle speed, idle mixture and choke, Install carburetor.

8. **Check and identify the status of the engine oil.**

   Oil grade and additives requirement, how often to change, change the oil and oil filter, recycle the oil and filter

9. **Check and identify the status of the lubrication oil.**

   Study the lube oils, need of lube oil, lubricate steering linkage, lubricate suspension system.

10. **Check and identify the status of the tires.**

    Understand the anatomy of a tire, Deciphering tire codes, choose right tire, check for wear. Maintenance of the tire – air pressure, rotate, align and balance.

11. **Check and identify for the heart burn issues in car.**

    Check and add coolant, remove radiator cap, determine the coolant needs to be flushed or changed, flush and change the coolant, find leaks and repair, replace hoses and hose clamps, replace water pumps, adjust / replace the accessory belt, replace a thermostat.

12. **Check, measure and adjust the caster, chamfer, king pin inclination, toe-in and toe- out of a car using Wheel alignment.**

13. **Remove the wheel from the vehicle and balance the wheel using wheel balancing machine.**

BOARD EXAMINATION

Note:

- All the exercises should be completed before the Board Examinations. 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.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
1	Procedure/Explanation	20
2	Tools and its handling methods	15
3	Observation reports	25
4	Service / Maintenance and troubleshooting steps	25
5	Result	5
6	Viva-voce	10
Total		100

LIST OF EQUIPMENT / TOOLS/MACHINERY'S REQUIRED

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1	LMV	02
2	Drive train system	01
3	Brake system	01
4	Steering system	01
5	Suspension system	01
6	Fuel system	01
7	Coolant system	01
8	Tires	01
9	Wheel balancer	01
10	Wheel aligner	01
11	Vehicle lift	01
12	Hydraulic press	01
13	Transmission jack	01
14	Jack and Jack stand	01
15	Service manuals	Sufficient quantity
16	Automobile Shop floor tools	Sufficient quantity
17	Tool box	Sufficient quantity

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021550

Semester : V

Subject Title : Engine Testing and Emission Measurement Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021550 Engine Testing and Emission Measurement 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:

This subject will enable the students in determining the performance of petrol and diesel engine at various loading condition and also understanding the procedure of Emission Measurement in diesel and petrol engine.

Objectives:

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

- To conduct the performance test of petrol and diesel engines and draw the performance curve
- To analyze the emission gases from petrol and diesel
- To prepare a heat balance sheet petrol or diesel engines
- To prepare Morse test on a petrol or diesel engines
- To conduct the bomb calorimeter experiment and find the calorific value of the diesel
- To find the intensity of smoke from a diesel engine

4021550 ENGINE TESTING AND EMISSION MEASUREMENT PRACTICAL

Experiments

1. Conduct the variable speed performance test of a single cylinder petrol engine and draw the curve. 1. BHP, IHP, FHP Vs Speed 2. Volumetric efficiency, SFC Vs Speed.

2. Conduct the constant speed performance test of a single cylinder diesel engine and draw the curve. 1. BHP, IHP, FHP Vs Speed 2. Volumetric efficiency, SFC Vs Speed.

3. Find the Indicated Horse Power of a multi cylinder engine by Morse test.

4. Prepare the heat balance sheet on single cylinder petrol / diesel engine.

5. Prepare the heat balance sheet on multi cylinder petrol / diesel engine.

6. Analysis of exhaust gases from engine by Orsat apparatus.

7. Find the intensity of smoke from a diesel engine using smoke meter.

8. Measure the emissions in exhaust of an engine by exhaust gas analyser.

9. Find the Calorific Value of diesel using Bomb calorimeter.

Reference Web Link / Video

Topic	Website	Link
Automotive Systems	Virtual Labs	http://vlabs.iitkgp.ernet.in/rtvlas/#

BOARD EXAMINATION

Note:

- All the experiments should be completed before the Board Examinations. Any one experiment will be given for examination.
- 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

Sl. No.	Description	Max. Marks
1	Procedure	15
2	Observation / Tabular column	20
3	Formulae	15
4	Calculations	35
5	Result / Graph	5
6	Viva-voce	10
Total		100

LIST OF TOOLS / EQUIPMENTS/ MACHINERY'S

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1	Single cylinder petrol engine with following arrangement 1.Load test arrangement 2. Heat balance test arrangement	01
2	Single cylinder diesel engine with following arrangement 1.Load test arrangement 2. Heat balance test arrangement	01
3	Multi cylinder petrol / diesel engine with following arrangement 1.Morse test arrangement 2. Heat balance test arrangement	01
4	Orsat apparatus	01
5	Smoke meter	01
6	Exhaust gas analyser	01
7	Bomb calorimeter with all accessories	01
8	Consumables	Sufficient quantity
9	Measuring Instruments	Sufficient quantity
10	Safety devices (PPE kit, Fire Protecting Equipment etc..)	Sufficient quantity

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021561

Semester : V

Subject Title : Two-Wheeler and Three-Wheeler Technology Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021561 Two-Wheeler and Three-Wheeler Technology 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:

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

- To demonstrate the various components of two and three wheelers by dismantling and reassemble the same
- To inspect the cooling system, lubrication system and fuel supply system after dismantling and assembling
- To dismantle, Inspect, overhaul and assemble the transmission system.
- To dismantle, Inspect, overhaul and assemble the final drive unit.
- To Inspect the front and rear suspension system after dismantling and assembling

4021561 TWO WHEELER AND THREE WHEELER TECHNOLOGY PRACTICAL

EXERCISES

1. Dismantle, check and assemble the engine cooling system of Two and Three wheeler.
2. Check the engine oil level and replace the oil in Two and Three wheeler.
3. Dismantle and assemble the clutch used in Two and Three wheeler.
4. Adjust the clutch free play, throttle cable and inspect the common troubles and causes in Two and Three wheeler.
5. Overhaul and lubricate the gear box of Two and Three wheeler.
6. Dismantle, lubricate and assemble the propeller shaft and differential
7. Dismantle, lubricate and assemble the rear axle of the three wheeler
8. Check frame alignment, dismantle and assemble the leaf spring assembly
9. Dismantle and assemble the front suspension and rear suspension of two wheeler
10. Remove the tire, lubricate bearings, refit and adjust the chain of two wheeler
11. Dismantle, Service and assemble the disc brake system – Master cylinder, Wheel Cylinder, Caliper and brake pad of two wheeler

BOARD EXAMINATION

Note:

- All the exercises should be completed before the Board Examinations. 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.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
1	Procedure/Explanation	20
2	Tools handling procedure	20
3	Dismantling and identifying the components	25
4	Assembly	25
5	Viva-voce	10
Total		100

LIST OF TOOLS / EQUIPMENTS / MACHINERY'S

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1	Two Wheeler	2
2	Three Wheeler	1
3	Special tools	5 sets
4	Shop Floor Tools	3 sets
5	Two Wheeler engine	1
6	Three Wheeler Engine	1
7	Spare components	Sufficient quantity

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021562

Semester : V

Subject Title : Tractor and Farm Equipment Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021562 Tractor and Farm Equipment Practical	4	64	25	100*	100	3 Hrs.

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

Objectives:

- To learn and practice to operate tractor.
- To understand and practice the ploughing.
- To study and practice with the implements used for farming.
- To know the different types of sprayers used fertilizer.
- To understand and maintain the tractor.

4021562 TRACTOR AND FARM EQUIPMENTPRACTICAL

List of Experiments

1. Driving the Tractor– Driving Practice only.
2. Hitching the given implement with the tractor by three point linkage and unhitching practice.
3. Ploughing practice with Mould Board Plough.
4. Ploughing practice with DISC harrows.
5. Ploughing practice with Tiller.
6. Power Tiller– study, its usage in the field and maintenance.
7. Cage wheel– fitting the cage wheel after removing the wheels from Tractor.
8. Spraying practice with power sprayer and its maintenance.
9. Tractor maintenance Schedule.

BOARD EXAMINATION

Note:

- All the exercises should be completed before the Board Examinations. 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.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max.Marks
1	Procedure / Explanation	20
2	Tool Handling / Dismantling	40
3	Observation / Refitting	30
4	Viva voce	10
Total		100

LIST OF TOOLS / EQUIPMENTS / MACHINERY'S

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1	Tractor	1
2	Power triller	1
3	Ploughing implements kits	1 set
4	Power sprayer	1
5	Special tools	5 set
6	Spanners and Tools	Sufficient quantity

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021563

Semester : V

Subject Title : Industrial Automation Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021563 Industrial Automation 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:

- Impart knowledge in industrial automation
- Exposure to different PLC programming languages
- Able to provide adequate knowledge in SCADA and DCS
- Study of HART and Field bus protocol.
- Impart knowledge on Robot programming and Robot operation control
- Expose students to SCADA and various data communication protocols
- Learn IOT, 3D Printing

4021563 INDUSTRIAL AUTOMATION PRACTICAL

Experiments

PART A

1. Study of HART and Field bus protocol
2. Study of Distributed Control System and different instruction sets.
3. Study the simulation of movements in HMI and SCADA (using Analog data)
4. Trouble Shooting the Sensor and Actuator using Multistation MPS.
5. Study the operator control of Robot and jog the Robot
6. Application and case studies related to manufacturing industries
7. Application and case studies related to process industries.

PART B

1. Design and development of IoT based transmitter
2. Development of Ladder logic programme for control of real time processes.
3. Development of SCADA for a control of real time processes.
4. Robot Programming: “In-air” program (Point to Point motion)
5. Actuation of Pneumatic circuit for Rotary Pusher Module and interface with Programmable Logic Control
6. Actuation of Single Acting Cylinder using a two-way Pressure Valve using Flow Control Valve.
7. Design and print a model using 3D printer.

BOARD EXAMINATION

Note:

- All the exercises/experiments in both sections should be completed. Two exercises/experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises/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 machineries / equipment before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
	PART - A	
1	Procedure / Explanation	30
	PART - B	
2	Procedure	15
3	Circuit / Layout	20
4	Programming / Execution	20
5	Result	05
6	Viva voce	10
	Total	100

LIST OF TOOLS / EQUIPMENTS / MACHINERY'S

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1	Robot kit	1
2	3D printer	1
3	PLC Kit	1
4	Pneumatic kit	1
5	SCADA Software	Sufficient quantity
6	IOT Components	1
7	Consumables	Sufficient quantity
8	Kits/components required for the study experiment	-

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4020570

Semester : V

Subject Title : Entrepreneurship & Startups

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020570 Entrepreneurship & Startups	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	Topic	Hours
1	Entrepreneurship – Introduction and Process	10
2	Business Idea and Banking	10
3	Start ups, E-cell and Success Stories	10
4	Pricing and Cost Analysis	10
5	Business Plan Preparation	10
Field visit and Preparation of case study report		14
Total		64

RATIONALE:

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

OBJECTIVES:

At the end of the study of 5th semester the students will be able to

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

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
1	**ENTREPRENEURSHIP – INTRODUCTION AND PROCESS** • Concept, Functions and Importance • Myths about Entrepreneurship • Pros and Cons of Entrepreneurship • Process of Entrepreneurship • Benefits of Entrepreneur • Competencies and Characteristics • Ethical Entrepreneurship • Entrepreneurial Values and Attitudes • Motivation • Creativity • Innovation • Entrepreneurs - as problem solvers • Mindset of an employee and an entrepreneur • Business Failure – causes and remedies • Role of Networking in entrepreneurship	10
2	**BUSINESS IDEA AND BANKING** • 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	10

	• Role of Government policy • Entrepreneurial support systems • Incentive schemes for State Government • Incentive schemes for Central Government	
3	**STARTUPS, E-CELL AND SUCCESS STORIES** • 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	**10**
4	**PRICING AND COST ANALYSIS** • Calculation of Unit of Sale, Unit Price and Unit Cost • Types of Costs - Variable and Fixed, Operational Costs • Break Even Analysis • Understand the meaning and concept of the term Cash Inflow and Cash Outflow • Prepare a Cash Flow Projection • Pricing and Factors affecting pricing • Understand the importance and preparation of Income Statement • Launch Strategies after pricing and proof of concept • Branding - Business name, logo, tag line • Promotion strategy	**10**
5	**BUSINESS PLAN PREPARATION** • Generation of Ideas,	**10**

	• Business Ideas vs. Business Opportunities • 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 • Types of business risks	

REFERNCE BOOKS:

1. Dr. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra - 282002
2. Dr. G.K. Varshney, Business Regulatory Framework , Sahitya Bhawan Publications, Agra - 282002
3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship , McGraw Hill (India) Private Limited, Noida - 201301
4. M.Scarborough, R.Cornwell, Essentials of Entrepreneurship and small business management, Pearson Education India, Noida - 201301
5. Charantimath Poornima M. Entrepreneurship Development and Small Business Enterprises, Pearson Education, Noida - 201301
6. Trott, Innovation Management and New Product Development, Pearson Education, Noida - 201301
7. M N Arora, A Textbook of Cost and Management Accounting, Vikas Publishing House Pvt. Ltd., New Delhi-110044
8. Prasanna Chandra, Financial Management, Tata McGraw Hill education private limited, New Delhi
9. I. V. Trivedi, Renu Jatana, Indian Banking System, RBSA Publishers, Rajasthan
10. Simon Daniel, HOW TO START A BUSINESS IN INDIA, BUUKS, Chennai - 600018

11. Ramani Sarada, The Business Plan Write-Up Simplified - A practitioners guide to writing the Business Plan, Notion Press Media Pvt. Ltd., Chennai 600095.

Board Examination – Evaluation Pattern

Internal Mark Allocation

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

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

Guidelines for assignment:

First assignment – Unit I

Second assignment – Unit II

Guidelines for Seminar Presentation - Unit III

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

BOARD EXAMINATION

Note

1. The students should be taught all units and proper exposure and field visit also arranged. All the portions should be completed before examinations.
2. The students should maintain theory assignment and seminar presentation. The assignment and seminar presentation should be submitted during the Board Practical Examinations.
3. The question paper consists of theory and practical portions. All students should write the answers for theory questions (45 Marks) and practical portions (55 Marks) should be completed for board examinations.
4. All exercises should be given in the question paper and students are allowed

to select by lot. If required the dimensions of the exercises may be varied for every batch. No fixed time allotted for each portion and students have liberty to do the examination for 3Hrs.

5. For Written Examination: theory question and answer: 45 Marks

   Ten questions will be asked for 3 marks each. Five questions from each unit 1 & 2. (10 X 3 = 30).

   Three questions will be asked for 5 marks each. One question from each unit 1, 2 & 3. (3 X 5 = 15)

6. For Practical Examination: The business plan/Feasibility report or Report on Unit 4 & 5 should be submitted during the board practical examinations. The same have to be evaluated for the report submission (40 marks).

DETAILED ALLOCATION OF MARKS

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

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021610

Semester : VI

Subject Title : Hybrid Electrical Vehicle and Policies

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021610 Hybrid Electrical Vehicle and Policies	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	TOPIC	TIME
I	Environmental impact and history & Electric vehicle Types	18
II	Battery Operated Electric Vehicle	18
III	Hybrid Electric Vehicle	18
IV	Battery System & Power Converters for EV's	18
V	Electric Mobility Policy Frame work India &Tamil Nadu E-vehicle Policy 2019	17
Test & Revision		7
Total		96

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.

4021610 HYBRID ELECTRICAL VEHICLE AND POLICIES

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**ENVIRONMENTAL IMPACT AND HISTORY & ELECTRIC VEHICLE TYPES** Environmental impact and history: Environmental impact of conventional vehicle - Air pollution – Petroleum resources – History of Electric vehicles & Hybrid Electric Vehicles – Need for Electric Vehicle – Major Components of Electric Vehicle	**6**
	Electric vehicle Types: 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)	**7**
	Drive Arrangement: According to drive arrangement Types – Conventional type – No Transmission type – No differential type – In Wheel Motor type	**5**
II	**BATTERY OPERATED ELECTRIC VEHICLE (BEV)** BEV: Configurations of Electric Vehicle – Performance of Electric Vehicles – Tractive Effort in Normal Driving – energy consumption.	**4**
	Electric Propulsion Systems: 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	**7**
	Other Control System for EV: Electronics Power Steering – Torque Sensor – EPS Motor – Advantages of Electronics Power Steering – Suspension System – Semi Tailing arm type, Trailing arm, Air Suspension, Regenerative Suspension System – Braking System for EV	**7**

III	**HYBRID ELECTRIC VEHICLE (HEV)** HEV: Hybrid Electric Vehicle – Advantages, Disadvantages – Components of Hybrid Electric Vehicle – IC Engine, Electric Motor, Controller, DC/DC Converter, Transmission, Batteries – Working of Hybrid Vehicle – Starting, Braking, Cruising, Passing. Types of Hybrid Vehicle: Hybridisation – Micro Hybrid, Mild Hybrid, Fully Hybrid – Advantages, Disadvantages & its Applications Drive Configuration: Series Hybrid – Control Strategies, Advantages & Disadvantages, Configuration - Parallel Hybrid – Electric motor fixed with an Electric motor to the crankshaft, Control Strategies, Advantages & Disadvantages, Configuration – Split Power Hybrid	**7** **3** **8**
IV	**BATTERY SYSTEM & POWER CONVERTERS FOR EV'S** Battery: 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 Battery Charging Techniques: 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 Power Converters: Role of Power Converters – Block diagram of Power Converters in EV – Types of Power Converters – DC to DC Converter, Inverter and Rectifier	**7** **6** **5**
V	**ELECTRIC MOBILITY POLICY FRAME WORK INDIA &TAMIL NADU E-VEHICLE POLICY 2019** Electric Mobility Policy Frame work India: 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 –	**9**

	Advantage of EV Eco system – Scope and Applicability of EV Policy. 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 – Charging structure – implementing agencies – R&D and Business Incubation – Recycling Ecosystem – Battery and EVs	**8**

Reference Books

1. A.K Babu, Electric & Hybrid Vehicle, Khanna Publication, New Delhi – 2018 Edition
2. Iqbal Husian, Electric and Hybrid Vehicle Design Foundamentals, CRC Press, Boca Raton, Florida
3. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi, CR Press, London, New York.
4. 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
5. 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.
6. Electric Vehicles: A future Projection CII October 2020 report.
7. Design and analysis of aluminum/air battery system for electric vehicles, Shaohua Yang, Harold Knickle, Elsevier.
8. Propelling Electric Vehicles in India, Technical study of Electric Vehicles and Charging Infrastructure

Reference Web Link / Video

Topic	Website	Link
Fundamentals of Electric vehicles: Technology & Economics	NPTEL	https://nptel.ac.in/courses/108/106/108106170/
Electric vehicles	IIT DELHI	https://www.youtube.com/watch?v=L2HbpEMfryM&list=PLp6ek2hDcoNCROoQbG05xNfiBEY7492Vn

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021620

Semester : VI

Subject Title : Industrial Management and Transport Engineering

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021620 Industrial Management and Transport Engineering	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	Topic	Hrs.
I	Principles of Management and Personnel Management	15
II	Financial management and Material Management	15
III	Goods Transport, Passenger Transport and Costing in Road Transport	15
IV	Motor Vehicles Act, Taxation, Insurance and Traffic rules & signs	14
V	Engineering Ethics and Human Values	14
Test & Revision		7
Total		80

Rationale

The Automobile technicians can play key role in management of transport organization. The transport industry provided good employment opportunities for Diploma in Automobile engineer as service engineer, fleet supervisor and depot supervisor. The automobile technician requires in-depth knowledge of motor vehicle act, rules, record keeping, estimation and valuation of vehicle, standard operating procedures. This subject imparts knowledge on principles of management, personnel management, financial management and material management.

Objective

- To learn the principles of Management and personnel management.
- To study about the financial management and material management.
- To learn the Goods and Passenger transport operations.
- To study about the motor vehicles act.
- To learn the principles of engineering ethics and human value

4021620– INDUSTRIAL MANAGEMENT AND TRANSPORT ENGINEERING

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT** **1.1: Principles of Management** Definition of management – Organization – F.W. Taylor's and Henry Fayol's Principles of Management – Functions of Manager – 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) – Activity Based Management (ABM) – Global Perspective – Principles and brief description. **1.2: Personnel Management** Responsibility of human resource management – Selection procedure – Training of workers – Apprentice training – On the job training. Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages – Wage fixation – Type of	**6** **5**

	wage payment – Halsey's 50% plan, Rowan's plan and Emerson's efficiency plan. **1.3: Organizational behavior** Definition – organization – Types of Organization – Taylor's Pure functional types – Line and staff and committee type – Organizational Approaches - individual behavior - causes - environmental effect - Behavior and Performance, Perception - organizational implications.	**4**
II	**FINANCIAL MANAGEMENT AND MATERIAL MANAGEMENT** **2.1: Financial Management** Fixed and working capital – Resources of capital – shares preference and equity shares – debentures – Type of debentures – Public deposits, Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit – Problems. Depreciation – Causes – Methods - Straight line, sinking fund and percentage on diminishing value method. **2.1: Material Management** Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level - Economic order quantity – problems – supply chain management - Purchasing procedure – Store keeping – Bin card.	**8** **7**
III	**GOODS TRANSPORT, PASSENGER TRANSPORT AND COSTING IN ROAD TRANSPORT** **3.1: Goods Transport** Simple layout of garages and depot for goods transport vehicle – Material Handling equipment - Scheduling of goods transport - Management Information System (MIS) in goods transport operation - transshipments and subcontracting - Storage & transportation of petroleum products. **3.2: Passenger Transport** Administrative set up of a passenger Transport organization, traffic investigation to improve services – peak hour demands – Application of C.P.M in evaluation of shortest operating distance of vehicle. Classification of vehicles: express, limited stop, relief services. Fare structure, Fare table calculation, and Fare collection methods - vehicle	**5** **8**

	schedule in city service – drivers and conductors duty schedules – ticket system, trip sheet – incentive schemes for improving the service. **3.3: Costing in Road Transport** Total cost, fixed cost, variable cost, running cost, overheads – control of costs – different methods.	**2**
IV	**MOTOR VEHICLES ACT, TAXATION, INSURANCE AND TRAFFIC RULES & SIGNS** **4.1: Motor Vehicles Act** Motor Vehicle act - Definition – Licensing of drivers and conductors - procedure for registering a new vehicle - fitness certificate - issue of non-road worthy certificate – Inspection of transport vehicle - inspection of accidents and recording – enforcement of emission norms. Permit: Public service vehicle permit - Goods carriage permit - National Permit - Contract carriage permit. Licensing taxies and buses – offences - penalties and procedure. **4.2: Taxation** Structure - method of laying taxation - Goods vehicle taxation - passenger vehicle taxation - tax exemption - one / life time taxation. Toll tax reasons and operational management. **4.3: Insurance:** Types of Insurance - accident claims and settlement - duty of driver in case of accident. **4.4: Traffic rules & signs** Traffic rules - Traffic signs - road signs - road safety norms.	**7** **3** **2** **2**
V	**ENGINEERING ETHICS AND HUMAN VALUES** **5.1: Engineering Ethics** Definition - engineering ethics - personal and business ethics - duties and rights - engineering as a profession – core qualities of professional practitioners - environment and their impact - code of ethics - procedure for solving ethical conflicts – ethical Judgment - Kohiberg's stages of moral development - value based ethics - engineers as managers, consultants and leaders - environmental ethics - computer ethics - Intellectual Property Rights (IPRs).	**8**

	5.2: Human values morals – values – integrity - service learning – civic virtue - respect for others - living peacefully - caring – sharing –honesty - courage - valuing time cooperation - commitments – empathy - self-confidence – character - stress management.	**6**

Reference Book

1. O.P.Khanna, Industrial Engineering and Management, Revised Edition – 2004, Dhanpat Rai, Publications(P)Ltd.
2. T.R.Banga & S.C.Sharma, Engineering Economics and Management, McGraw Hill.
3. Heinz Weihrich, Harold Koontz, Management, A global perspective, McGraw Hill international edition 1994.
4. Joseph L.Massie, Essentials of Management, 4th Edition, Prentice-Hall of India.
5. Goods vehicle Operation– Dunbar.
6. Bus Operation – Dunbar.
7. Tamilnadu Motor Vehicle Act 1989.
8. John Duke - Fleet Management – McGraw-Hill Co, USA -1984
9. S.Chandran, Organizational Behaviours, Vikas Publishing House Pvt. Ltd. Latest
10. M.Govindarajan and S.Natarajan ,Principles of Management ,Prentce Hall of India Pvt.Ltd. New Delhi.Latest.
11. Charles B. Fledderman, Engineering ethics, pearson prentice hall, New Jersey, 2004.

Reference Web Link / Video

Topic	Website	Link
Industrial Engineering	NPTEL	https://nptel.ac.in/courses/112/107/112107142/
Ethics in Engineering Practice	NPTEL	https://nptel.ac.in/courses/110/105/110105097/
Humanities and Social Sciences - Exploring Human Values	NPTEL	https://nptel.ac.in/courses/109/104/109104068/

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4020531

Semester : VI

Subject Title : Computer Integrated Manufacturing

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020531 Computer Integrated Manufacturing	5	80	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks 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 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 – 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 Analysis: Introduction – Development - Basic steps – Advantages.	**6** **6** **3**
II	**Computer Aided Manufacturing** CAM – Definition - functions of CAM – benefits of CAM. Introduction of CIM – concept of CIM - evolution of CIM – CIM wheel – Benefits – integrated	**3**

	CAD/CAM. Group technology: Part families - Parts classification and coding - coding 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 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).	**6** **5**
III	**CNC Programming** 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.	**16**
IV	**FMS, AGV, AS/RS, Robotics** FMS: Introduction – FMS components – FMS layouts – Types of FMS: 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 - working principle – types – benefits. AS/RS – working principle –types – benefits. Robotics: Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical grippers – vacuum grippers – robot programming concepts - Industrial applications of Robot: Characteristics - material transfer and loading –	**5** **3** **6**

	welding - spray coating - assembly and inspection.	
V	**Advanced Concepts Of CIM** 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.	**14**

REFERENCES BOOKS:

1. R.Radhakrishnan, and S.Subramanian, “CAD/CAM/CIM”, New Age International Pvt. Ltd.
2. Mikell P.Groover, and Emory Zimmers, “CAD/CAM”, Jr.Prentice Hall of India Pvt., Ltd.
3. 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.
6. Yoram Koren, “Computer control of manufacturing systems,”, McGraw Hill Book.
7. Chris Mcmahon and Jimmie Browne, “CAD/CAM – Principle Practice and Manufacturing Management”, Addision Wesley England, Second Edition,2000.
8. Dr.Sadhu Singh, “Computer Aided Design and Manufacturing,”, Khanna Publishers, NewDelhi, Second Edition,2000.
9. S.Kant Vajpayee, “Principles of Computer Integrated Manufacturing,”, Prentice Hall of India, 1999.
10. David Bed worth, “Computer Integrated Design and Manufacturing,”, TMH, 1998.

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021632

Semester : VI

Subject Title : Heavy Vehicle Engineering

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021632 Heavy Vehicle Engineering	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	TOPIC	TIME
I	Truck classifications, Shop Safety and Operations	14
II	Electrical Systems	15
III	Transmission System	15
IV	Drive Shafts, Steering system	14
V	Suspension Systems, Wheels and Tires, Brake systems	15
Test & Revision		7
Total		80

RATIONALE:

For the decades a shortage of truck technicians existed throughout the world. The job opportunities and rates of pay in the trucking industry are increased. Good truck technicians are in high demand. The skill required of the truck technician is that of being a lifelong learner to keep abreast of the fast-changing technology of this industry. Considering the above factors this subject is introduced.

OBJECTIVES:

- Explain the basic truck classifications.
- Describe the safety warnings in the work area.
- List some common tools used in heavy truck repair.
- Define the role of a battery in a vehicle electrical system.
- Identify the components of a charging system.
- Troubleshoot truck electrical circuit components.
- Describe the electronic components.
- Understand the operation and maintenance of the clutch.
- Identify the standard transmissions.
- Describe the automatics transmissions.
- Describe the components and operation of steering systems.
- Explain the wheels and tires.
- Define the Brakes systems.

4021632 HEAVY VEHICLE ENGINEERING

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**TRUCK CLASSIFICATIONS, SHOP SAFETY AND OPERATIONS**	
	1.1: Truck classifications	**6**
	By Weight – By Wheel Number – Major Manufacturers – Components of Heavy Duty Truck – Career Opportunities for Heavy Duty Truck Technicians.	
	1.2: Shop Safety and Operations	**8**
	Personal Safety - Work Area Safety – Fire Safety – Hazardous Materials	

	– Handling and Disposal of Hazardous Waste. Tools: Hand Tools – Power Tools – Measuring Tools. Fasteners: Grades and Glasses – Fastener Replacement – Repairing Damaged threads – Riveting. Preventive Maintenance – Driver Inspection Report - Commercial Vehicle Safety Alliance Standard Inspection Procedure – PM Trailer Inspection Guide – Federal Inspection regulations – Lubricants – Winterizing.	
II	**ELECTRICAL SYSTEMS** Electrical Motor and Generator principle – Coils – Transformers and Solenoids – Battery Operating Principles – Battery Ratings – Battery Maintenance – Battery Testing: Visual Inspection – State of charge test – Battery load test. Charging Battery – Slow Charging and Fast Charging – Charging Safety – Jump Starting – Battery Storage and Recycling Procedure – Alternator: Construction – Operation. Starting Systems – Lighting Systems – Head lights – Adjustment – Replacement – Dimmer switch – Trailer circuit connector – Panel component – Rapid checking of a truck electrical circuit. Electronic Service tools (EST) – Flash or Blink codes – Prolink 9000 – SAE / ATA J 1587 / J 1708 / J 1939 Codes and Protocols – Electrical Wiring, Connector and Terminal repair.	**8** **4** **3**
III	**TRANSMISSION SYSTEM** **3.1: Clutch** Clutch Function – Components – Clutch Brakes – Clutch Linkages – Trouble shooting – Periodic Maintenance – Clutch Adjustment – Clutch Linkage inspection and adjustment – Clutch Servicing – Clutch Inspection – Clutch installation. **3.1: Gear box** Gears – Gear Train configurations – Gear shift Mechanisms – Gear shift Lever – Counter shaft gear train – Air operated gear shift system – Eighteen Speed Transmission – Thirteen Speed transmissions – Deep reduction Transmissions – Transfer Cases – Power Take off Unit. **3.3: Transmission** Transmission Servicing – Lubrication – Preventive Maintenance Inspection- Trouble Shooting – Overhauling the transmission – Torque	**3** **5** **7**

	converter Components. Automatic Transmissions – Simple Planetary Gear Sets – Components – Working principle – Compound Planetary Gear Sets – Four Speed Transmission Power Flows – Five Speed Transmission Power Flows – Hydraulic control Four Speed transmission - Hydraulic control Five Speed transmission - Hydraulic Retarders – Electronic Control transmissions.	
IV	**DRIVE SHAFTS AND STEERING SYSTEM** **4.1: Drive Shafts** Construction – Drive shaft inspection – Drive Axles – Differential Gearing Types – Single Reduction Axle – Double Reduction Axle- Tandem Drive Axle – Drive Axle Failures. **4.2: Steering system** Components – Steering system inspection – Front-End Alignment – Toe – Caster – Camber – Kingpin inclination – Turning angle – Ackerman Geometry – Axle Alignment – Electronic Alignment Equipment – Steering Axle Inspection – Overhaul – Manual Steering Gears – Power Steering Systems – Air Assisted Steering Systems – Electronically Variable Steering – Load Sensing power Steering.	**5** **9**
V	**SUSPENSION SYSTEMS, WHEELS AND TIRESANDBRAKE SYSTEMS** **5.1: Suspension Systems** Types – Front Suspension – Rear Suspension – Single axle spring suspension – tandem axle spring suspension – Spring suspension with shock absorbers – Equalizing beam suspension system: Leaf spring type – rubber cushion type – Air spring suspensions – components – Air spring mechanics – Cab Air Suspension. **5.2: Wheels and Tires** Cast Spoke wheel – Disc wheel – wide base wheel – Tires: Types – Radial – Bias – Tire Size – Tire care and maintenance – Tire, rim and Wheel Service – Tire and rim Safety – Spoke wheel installation – Disc Wheel Installation – Wheel and Tire Balancing – Wheel hubs, Bearings and Seals – Wheel Bearing Adjustment	**5** **5**

	5.3: Brake systems Air Brake System – Components - Truck air brake system – Trailer air brake system. Hydraulic Brake systems – Components – Hydraulic Drum Brake – Air Over Hydraulic Brake systems – Hydraulic Brake Service Procedures – ABS Components – Automatic Traction Control Systems – Fifth Wheel.	**5**

Reference Books

1. Heavy Duty Truck Systems, Ian Andrew Norman, Sean Bennett, John A.Corinchck, Delmar, Thomson Learning.
2. Tire and Vehicle Dynamics, Hans B. Pacejka, SAE International
3. Brake Technology Handbook, Kartheinz Bill, Bert J Breuer, SAE International
4. Vehicular Engine Design, Kevin L Hoag, SAE International
5. Handbook of Automotive Engineering, Ulrich W.Seiffert, Hans Hermann Bracess, SAE International
6. Advanced Hybrid Power trains for Commercial Vehicles, Haoran Hu, Simon Baseley, Rudolf M Smaling, SAE International

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021633

Semester : VI

Subject Title : Heating Ventilation and Air Conditioning Systems

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021633 Heating Ventilation and Air Conditioning Systems	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	TOPIC	TIME
I	Basics of Air-Conditioning and Refrigeration Systems	15
II	Psychrometry and Air-Conditioning Systems	15
III	Cooling and Heating Load Calculations and Analysis	15
IV	Air Routing, Temperature Control and Servicing	14
V	Automobile Air-Conditioning Systems	14
	Test & Revision	7
Total		80

Rationale

All the automobile are vehicles are equipped with Air Conditioning. Hence the fundamental knowledge of air Conditioning is most essential for an automobile. This course will help in understanding the principle of Refrigeration, Air-Conditioning and Psychrometry properties and also understanding the duct and ventilation design.

Objectives

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

- To understand the components of the automotive air-conditioning and their functions
- To understand the recent developments in this field
- To present a problem oriented in-depth knowledge of Automotive air conditioning
- To address the underlying concepts and methods behind Automotive air conditioning

4021633 HEATING VENTILATION AND AIR CONDITIONING SYSTEMS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**BASICS OF AIR-CONDITIONING AND REFRIGERATION SYSTEMS** Introduction - Types of Refrigeration Systems – Working principle of vapour Compression Refrigeration System, vapour Absorption Refrigeration System. Applications. Coefficient of Performance - Ton of Refrigeration - Simple problems. Refrigerants: Primary and Secondary Refrigerants - Classification of Refrigerants - Properties - Commonly used refrigerants - Alternative refrigerants - Eco-friendly Refrigerants - Applications of Refrigerants. Major Refrigerants used in Automobile Air-conditioning system.	**8** **7**
II	**PSYCHROMETRY AND AIR-CONDITIONING SYSTEMS** Psychrometry – Basic Terminology - Psychrometric Mixtures - Psychrometric Tables and Charts - Psychrometric Processes - Comfort Charts - Simple problems in Psychrometric Processes - Factors Affecting Comfort Temperature and Effective Temperature.	**8**

	Air-Conditioning System Layouts. - Central Air-conditioning systems - System Components – Compressor – Evaporator – Condenser - Expansion Devices - Receiver dryer - Fan Blowers - Heating System. Switch and Electrical Wiring Circuit. Air Distribution Systems: Distribution ducting - Sizing - Supply duct - Return Duct - Type of Grills - Diffusers, Ventilation - air Noise Level - Layout of Duct Systems for Automobiles.	**7**
III	**COOLING AND HEATING LOAD CALCULATIONS AND ANALYSIS** Load Calculations and Analysis. Design considerations for achieving desired room conditions with respect to prevailing outside/environment conditions. Factors affecting the load on Refrigeration and Air-conditioning Systems. Cooling and Heating Load Calculations. Load calculations for Automobiles. Problems on Cooling and Heating Load Calculations. Effect of Air-conditioning load on Engine Performance in terms of loss of available Peak Torque/Power and Fuel Consumption.	**7** **8**
IV	**AIR ROUTING, TEMPERATURE CONTROL AND SERVICING** Air Routing and Temperature Control: Objectives of the Dashboard Re-circulating Unit - Automatic Temperature Control - Controlling Flow - Control of Air-handling systems and Air Flow Through – Evaporator Care. Air-Conditioning Service: Air-Conditioner Maintenance and Service - Removing and replacing Components. Compressor Service. Testing, Diagnosis and Trouble Shooting of Air-conditioning system. Refrigerant Gas Charging Procedure and Servicing of Heater System.	**7** **7**
V	**AUTOMOBILE AIR-CONDITIONING SYSTEMS** Automotive Heaters - Manually Controlled and Automatically Controlled Air-conditioner and Heater System. Common controls such as thermostats, Humidistat, Control Dampers, Pressure Cut-outs, Relays Automatic temperature control. Automobile Air-conditioning - Air conditioning for Passengers - Isolated Vehicles - Refrigerated Transport Vehicles. Applications related with Very Low Temperatures - Location of Air-conditioning Components in a Car – Schematic Layout of a Vehicle Refrigeration System	**7** **7**

Reference Books

1. Automotive Air conditioning, William H Crouse and Donald L Anglin, McGraw Hill Inc.
2. Air Conditioning, Paul Lang, C.B.S. Publisher & Distributor, Delhi.
3. Automotive Air-Conditioning, Paul Weiser – Reston Publishing Co.
4. Automotive Air Conditioning, Goings,L.F., American Technical services
5. Automotive Air Conditioning, McDonald,K.L., Theodore Audel series
6. Automotive Air Conditioning, Paul Weisler, Reston Publishing Co. Inc.

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021640

Semester : VI

Subject Title : Hybrid Electrical Vehicle Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021640Hybrid Electrical Vehicle Practical	5	80	25	100*	100	3 Hrs.

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

RATIONALE:

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. This subject introduced by keeping all the above factors.

OBJECTIVES:

- To learn and practice the charging systems of Electric Vehicles.
- To understand the concept of Electric Vehicle components.
- To study the configurations of Electric Vehicles and assemble.
- To acquire knowledge about Energy Storages, Charging System, Effects and Impacts.

4021640 HYBRID ELECTRICALVEHICLEPRACTICAL

Exercises

Part – A

1. Test the Lead acid Battery on Open Circuit Voltage, Hydrometer and High Discharge Tests.
2. Construct and test battery back for an Electric Vehicle. (Test the batter pack supply to glow the Head lamp)
3. Test buck converter (DC to DC converter)
4. Test the Inverter circuit (DC to AC Converter)
5. Test the BLDC motor with triggering angle or Throttle control
6. Test the battery charger unit and note the various charging parameter

Part – B

1. Assemble and test the wiring harness for two-wheeler accessories
2. Identify and test EV components (Controller, Throttle, EV motor, Power ON Key & brake)
3. Test the Lead acid battery by using Battery voltage tester or Current Tester and indicate the status
4. Assemble and test E-bicycle with wiring harness
5. Assemble and test E-Bike with central drive mechanism (Chain drive) wiring harness
6. Assemble and test E-Auto rickshaw with differential and wiring harness

BOARD EXAMINATION

Note:

- All the exercises/experiments in both sections should be completed. Two exercises/experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises/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 machineries / equipments before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max.Marks
PART A		
1	Procedure / Observation	15
2	Test report	30
PART B		
3	Procedure / Explanation	15
4	Assemble / Test Report	30
5	Viva-voce	10
Total		100

LIST OF EQUIPMENT / TOOLS/MACHINERY'S REQUIRED
(for a batch of 30 students)

Sl. No.	Machines / Tools / Equipments	Quantity
1.	Lead acid battery	8 No's
2.	Battery Load tester	2 No's
3.	Buck Converter (5 V or 24 V or 48 V)	2 No's
4.	Battery Charger Unit with Lead Acid battery	2 No's
5.	Inverter Trainer Kit	1 No
6.	BLDC motor control Trainer kit	1 No
7.	Two wheeler Wiring Harness board or kit	1 No
8.	E – Bicycle kit or Accessories 24V DC Controller	2 No's

	24 V DC motor Throttle Brake Power ON key Head lamp with Horn	
9.	E – Bike kit or Accessories 48 V BLDC Controller 500W or 750 W, 48 V BLDC motor Throttle Brake Power ON key Display Board Head lamp with Horn Left & Right Indicator	2 No's
10.	500 W or 750 W, 48 V BLDC motor with differential arrangement	1 No
11.	**Consumable: -** Battery Cell - 1.5 V or 3.65 V Soldering Iron Flux De-solder gun or Solder wick Lead **Tools** Continuity Tester Line Tester Multi-meter Hydrometer Screw Drive set Spanner set	As per requirement (LS)

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4020561

Semester : VI

Subject Title : Computer Integrated Manufacturing Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

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

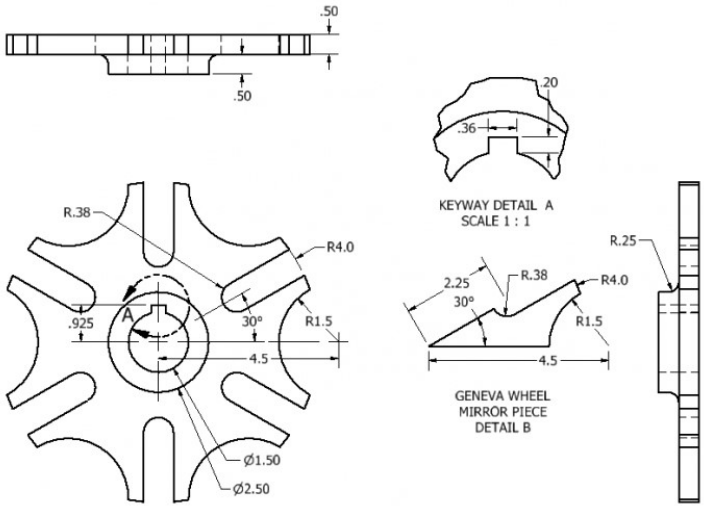
DETAILED SYLLABUS

Contents: Practical

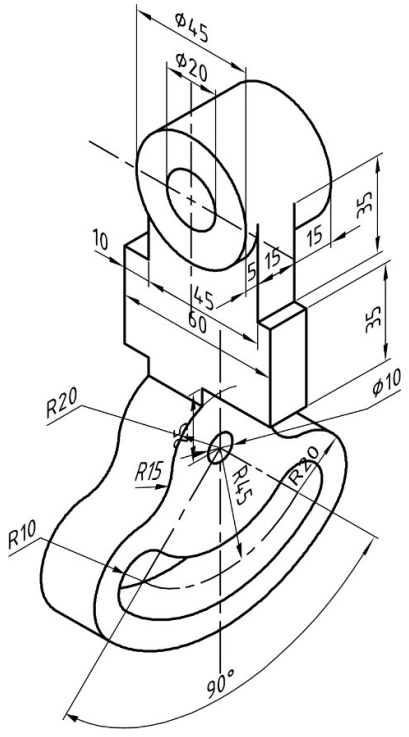
PART A: SOLID MODELLING

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

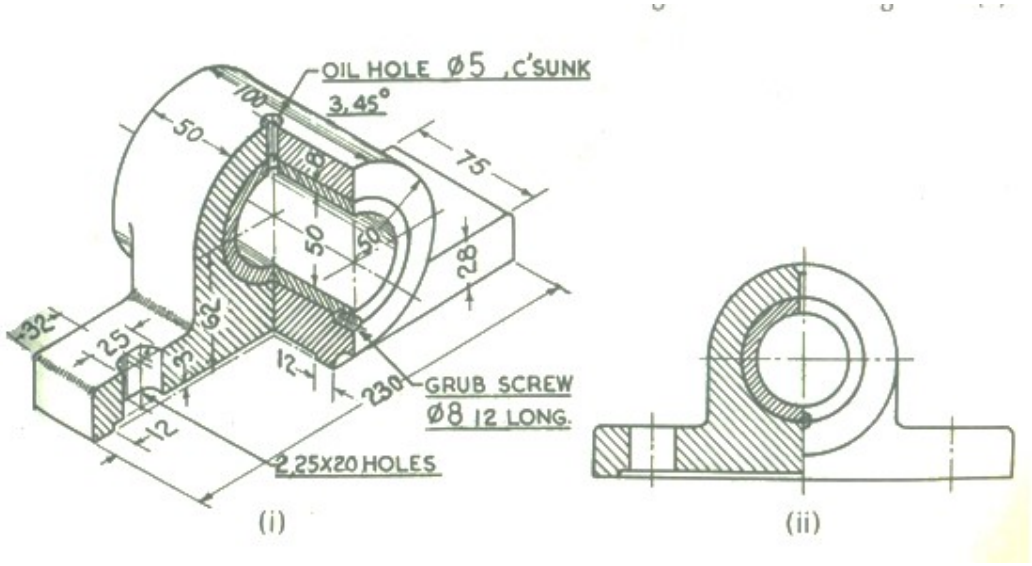
Exercise No. 1. Geneva Wheel



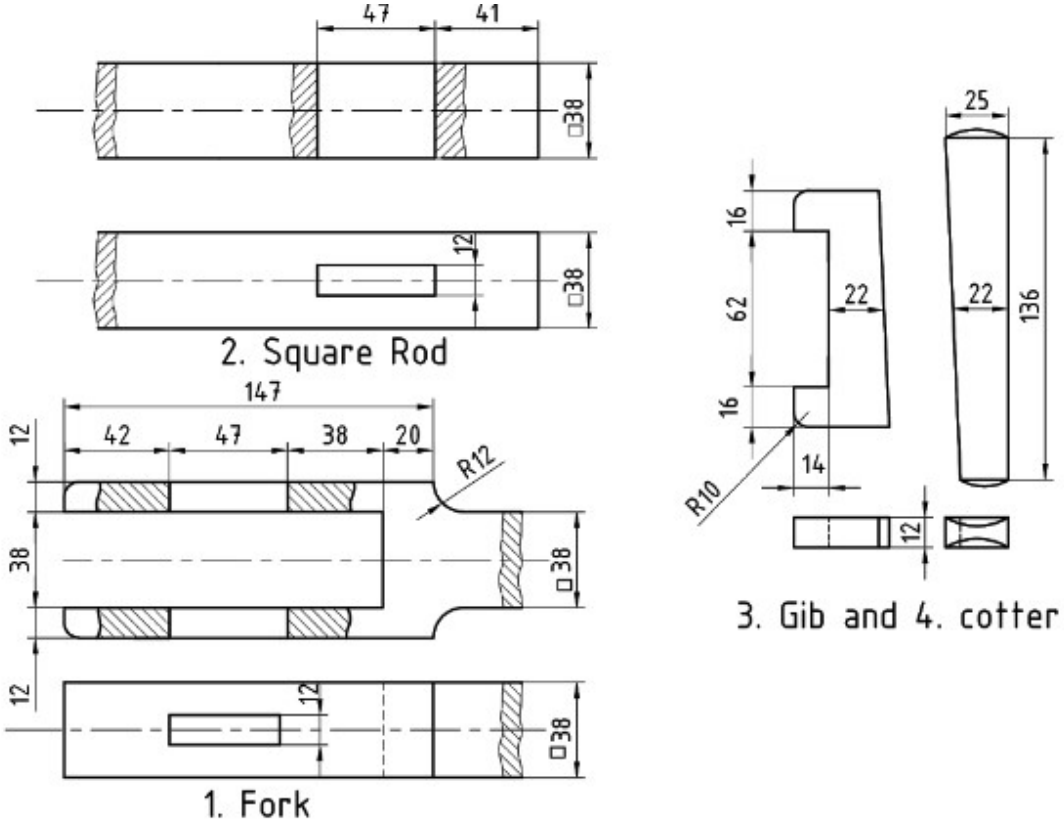
Exercise No. 2. Bearing Block



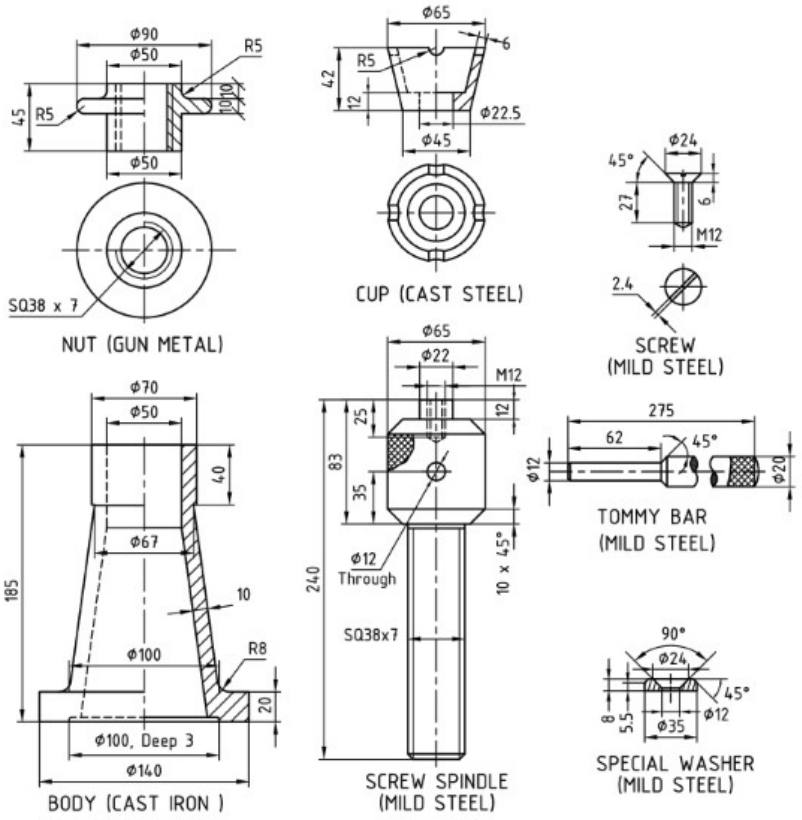
Exercise No. 3. Bushed bearing



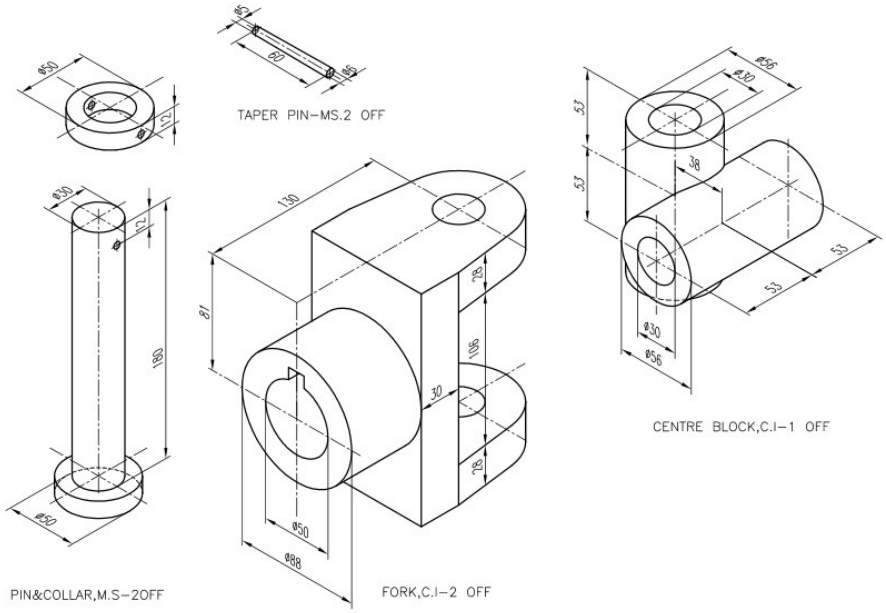
Exercise No. 4. Gib and Cotter joint



Exercise No. 5. Screw Jack



Exercise No. 6. Universal Coupling



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

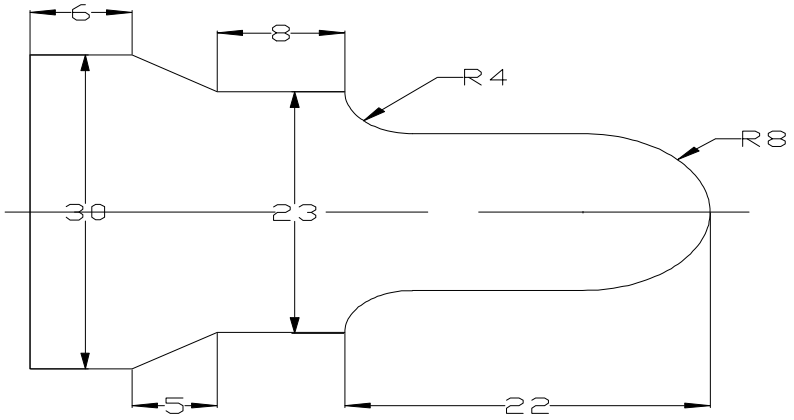
PART B: CNC Programming and Machining

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.

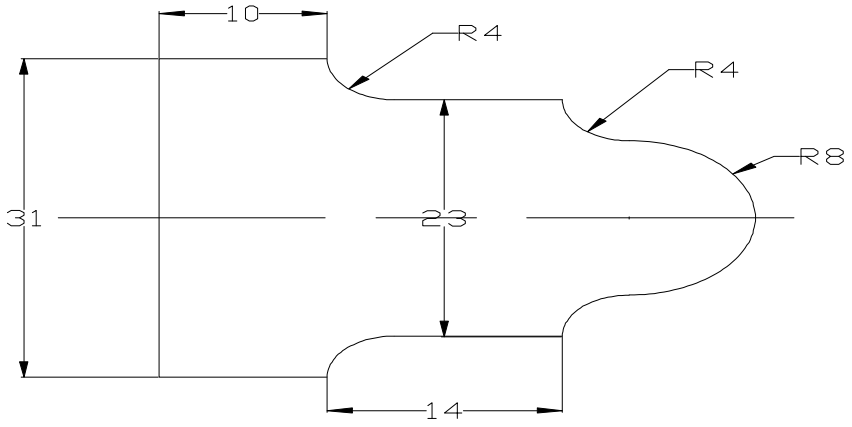
Note: Create and edit the part program in the simulation software for verification of the part program. Enter / tranfer the program to make the component in the CNC machine.

CNC Turning Machine Material: M.S / Aluminium / Acrylic fibre / Plastic

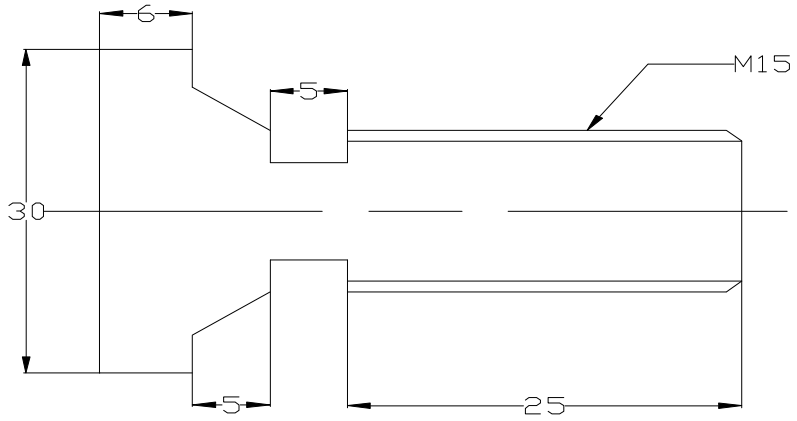
1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.



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

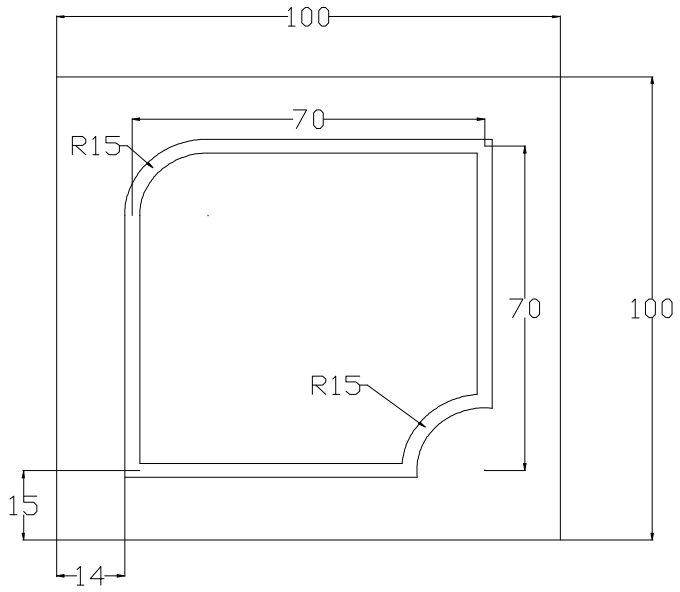


3. Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.

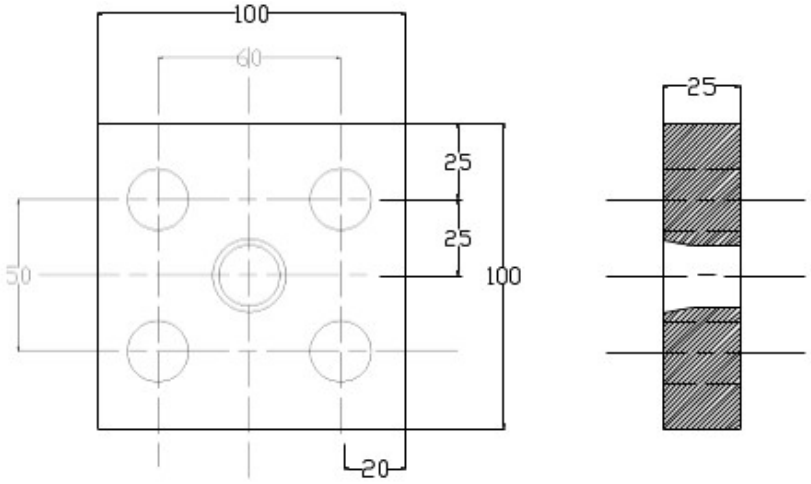


CNC Milling Machine Material: M.S / Aluminum / acrylic fibre / plastic

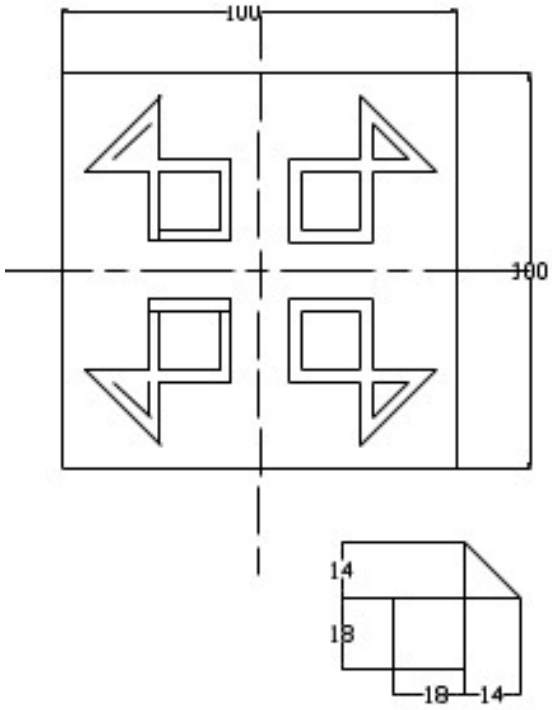
4. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.



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 (For 30 students)

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.

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021652

Semester : VI

Subject Title : Heavy Vehicle Engineering Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021652 Heavy Vehicle Engineering Practical	5	80	25	100*	100	3 Hrs.

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

RATIONALE:

For the decades a shortage of truck technicians existed throughout the world. The job opportunities and rates of pay in the trucking industry are increased. Good truck technicians are in high demand. The skill required of the truck technician is that of being a lifelong learner to keep abreast of the fast-changing technology of this industry. Considering the above factors this subject is introduced.

OBJECTIVES:

Students are able to

- Explain the basic truck classifications.
- Describe the safety warnings in the work area.
- List some common tools used in heavy truck repair.
- Define the role of a battery in a vehicle electrical system.
- Identify and practice with the components of a charging system.
- Troubleshoot truck electrical circuit components to list the causes and failure.
- Understand the operation and maintenance of the clutch linkage system.

- Describe the automatic transmissions.
- Describe the components and operation of steering systems.
- Define the Brakes systems and list the symptoms, causes and remedies.
- Learn the usage of wheel aligner

4021652 HEAVY VEHICLE ENGINEERING PRACTICAL

Exercise:

1. Check the charging system of a heavy vehicle. List the causes of charging system failure.
2. Check the starting system of a vehicle. Prepare the list of problem occurs and mention the possible causes, tests and remedies.
3. Check the head light of a vehicle for i) adjustment, ii) replacement and iii) bulb replacement.
4. Check the windshield wiper of a vehicle. List the symptoms, causes and remedy.
5. Inspect the clutch linkage system and clutch of a heavy vehicle. List the failure and possible causes and remedy/adjustment.
6. Inspect the standard transmission of a heavy vehicle. Carry out the preventive maintenance inspection on standard transmission.
7. Inspect the drive shaft of a heavy vehicle. List the failure and possible causes and remedy/adjustment.
8. Inspect the power steering system of a heavy vehicle. . List the failure and possible causes and remedy/adjustment.
9. Check, measure and adjust the caster, chamfer, king pin inclination, toe-in and toe-out using Wheel alignment.
10. Inspect the suspension system of a heavy vehicle. Carry out the preventive maintenance inspection.
11. Check the air disc brake system of a heavy vehicle. List the symptoms, causes and remedy.
12. Check the hydraulic brake system of a heavy vehicle. List the symptoms, causes and remedy.

BOARD EXAMINATION

Note:

- All the exercises should be completed before the Board Examinations. 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.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
1	Procedure	10
2	Inspection / Diagnostic report	30
3	Symptoms and Causes report	25
4	Remedies / Maintenance report	25
5	Viva-voce	10
Total		100

LIST OF EQUIPMENT / TOOLS/MACHINERY'S REQUIRED

(for a batch of 30 students)

Sl. No.	Machines / Tools / Equipments	Quantity
1.	Battery Charging and testing kit	1 No.
2.	Heavy Vehicle	1 No.
3.	Transmission System Kit	1 No.
4.	Power Steering System kit	1 No.
5.	Wheel alignment kit	1 No.
6.	Air brake system kit	1 No.
7.	Differential kit	1 No.
8.	Suspension system kit	1 No.
9.	Hydraulic brake system Kit	1 No.
10.	Special tools – Sufficient quantity	Sufficient quantity
11.	Consumables	Sufficient quantity

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021653

Semester : VI

Subject Title : Heating Ventilation and Air Conditioning Systems Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4021653 Heating Ventilation and Air Conditioning Systems Practical	5	80	25	100*	100	3 Hrs.

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

Rationale

All the automobile are vehicles are equipped with Air Conditioning. Hence the fundamental knowledge of air Conditioning is most essential for an automobile. This course will help in understanding the principle of Refrigeration, Air-Conditioning and Psychrometry properties and also understanding the duct and ventilation design.

Objectives

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

- To understand the components of the automotive air-conditioning and their functions
- To understand the recent developments in this field
- To present a problem oriented in-depth knowledge of Automotive air conditioning
- To conduct various tests in Automotive air conditioning systems.
- To learn the layout of bus air-conditioning and its electric layout.
- To study about the refrigerant and practice leakage tests.
- To know the different sensors used in the HVAC system of automobile vehicles.

4021653 HEATING VENTILATION AND AIR CONDITIONING SYSTEMS PRACTICAL

Experiments:

PART A

1. Determine the refrigerating effect, C.O.P and the compressor capacity of open type system with any one expansion device. (Thermostatic expansion valve / Capillary tube / Automatic Expansion Valve)
2. Determine the capacity of a window air conditioner.
3. To evaluate the condition of the car air conditioner by using electrical measurements with (a)Thermostatic expansion valve (b) Magnetic clutch (c) Heater
4. Conduct Leak tests in a vehicle air conditioning system, detect the failures and suggest the remedies. Conduct the Refrigerant Charge Test.
5. Conduct the car A/c performance check. Identify the causes and its remedies.
6. Conduct the flush test to remove the contaminants of refrigeration system.

PART B

1. Draw the layout of a bus air conditioning system. Inspect, identify the maintenance requirements as per the service manual.
2. List the components of a car air-conditioning system. Identify the common issues, possible causes and suggest remedies.
3. Draw the circuit diagram to identify the sensors in the HVAC system of a vehicle. Write the diagnostic procedures for sensors.
4. Study the all-electric vehicle air conditioner. Study the refrigerant used in vehicle air conditioning.
5. Study the different types of evaporators. Serpentine evaporator, Plat & Fin Laminated Evaporator.
6. Study the A/c wiring circuit layout. Identify the protection devices to control.

Reference

1. Automotive Air Conditioning Training Manual, Automotive & Industrial Refrigerant Service Equipment, Ariazone.
2. Automotive Heating & Air conditioning Techbook, Mike Stubblefied, John H Haynes, Haynes Publications Inc.
3. HVAC system (Auto A/c) diagnostics manuals.
4. Hand Book of Airconditioning and Refrigeration, Shan K Wang, McGraw-Hill

BOARD EXAMINATION

Note:

- All the exercises/experiments in both sections should be completed. Two exercises/experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises/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 machineries / equipment before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
PART A		
1	Procedure / Observation	10
2	Calculation / Failures	30
3	Result / Remedies	10
PART B		
4	Procedure / Explanation	10
5	Inspection / Diagnostic report	20
6	Remedies / Maintenance report	10
7	Viva-voce	10
Total		100

LIST OF EQUIPMENT / TOOLS / MACHINERY'S REQUIRED

(For a batch of 30 students)

Sl. No.	Machines / Tools / Equipment	Quantity
1.	Vapour Compression refrigeration test rig	1 No.
2.	Window air-conditioner test rig	1 No.
3.	Cooling tower arrangement	1 No.
4.	Car Air conditioning system test rig	1 No.
5.	Bus air conditioning kit	1 No.
6.	Sensors in the HVAC system of vehicle	1 No.
7.	Compressors used in Air conditioning system	1 No.
8.	Evaporators used in Air conditioning system	1 No.
9.	Vehicle A/c wiring circuit	1 No.
10.	Refrigeration charging system kit	1 No.
11.	Tools and spanners	Sufficient quantity
12.	Measuring and testing tools	Sufficient quantity
13.	Special tools	Sufficient quantity
14.	Consumables	Sufficient quantity

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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021660

Semester : VI

Subject Title : Project Work and Internship

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020660 Project Work and Internship	6	96	25	100*	100	3 Hrs.

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

RATIONALE:

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

OBJECTIVES:

- Implement the theoretical and practical knowledge gained through the curriculum into an application suitable for a real practical working environment preferably in an industrial environment.
- Implement the planned activity as a team.
- Take appropriate decisions on collected information.
- Carryout cooperative learning through synchronous guided discussions within the class in key dates, asynchronous document sharing and discussions, as well as to prepare collaborative edition of the final project report.

Project Work 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:

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

*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.