SYLLABUS

DIPLOMA IN MECHANICAL ENGINEERING

FULL TIME, SANDWICH & PART TIME

Course Code: 1020/2020/3020

2015-2016

M - SCHEME

DIRECTORATE OF TECHNICAL EDUCATION

GOVERNMENT OF TAMILNADU

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

M SCHEME

(Implemented from the Academic year 2015 - 2016 onwards)

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Thiru G.Gopu
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DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY

(SEMESTER SYSTEM)

(Implemented from 2015- 2016)

M – 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 and the Diploma Courses offered through MGR Film Institute, Chennai.*

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 Diploma in Engineering (sandwich) 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 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 15 weeks duration of study with 35 hrs. /Week for Regular Diploma Programme and 18hrs/ week (21 hrs. / Week I year) for Part-Time Diploma Programmes.

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 2015 – 2016 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, TamilNadu.

(Or)

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

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examination recognized as equivalent to the above by the Board of Secondary Education, TamilNadu.

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 TamilNadu affiliated to the TamilNadu Higher Secondary Board with eligibility for university Courses of study or equivalent examination, & Should have studied the following subjects.

Sl. No	Courses	H.Sc Academic	H.Sc Vocational	
		Subjects Studied	Subjects Studied	
			Related subjects	Vocational subjects
1.	All the Regular and Sandwich Diploma Courses	Maths, Physics & Chemistry	Maths / Physics / Chemistry	Related Vocational Subjects Theory & Practical
2.	Diploma course in Modern Office 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 Practical 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 Modern Office 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, TamilNadu, 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

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. 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 and 75 marks are allotted for Board Examination.

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 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. Out of which the best one will be taken and the marks to be reduced to: 05 marks

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

Total **10 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** - **Compulsory** Covering all the 5 Units. (Board Examination-question paper-pattern).	End of 15th week	75	3 Hrs

 # - From the Academic year 2015-2016 onwards.

Question Paper Pattern for the Periodical Test :(Test - I & Test- II)

With no choice:

PART A type questions:	4 Questions X 2 mark	… … 8 marks
PART B type questions:	4 Questions X 3 marks	… … 12 marks
PART C type questions:	3 Questions X 10 marks	… … 30 marks

	Total	50 marks
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iii) Assignment **10 Marks**

For each subject Three Assignments are to be given each for 20 marks and the average marks scored should be reduced for 10 marks

All Test Papers and assignment notebooks after getting the signature with date from the students must be kept in the safe custody in the Department for verification and audit. It should be preserved for 2 Semesters and produced to the flying squad and the inspection team at the time of inspection/verification.

B. For Practical Subjects:

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

a)	Attendance	:	**5 Marks**
	(Award of marks as 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 Record for every completed exercise should be submitted in the subsequent Practical classes and marks should be awarded for 20 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 and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- The students have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.

- *All the marks awarded for assignment, Test and attendance should be entered in the Personal Log Book of the staff, who is handling the subject. This is applicable to both Theory and Practical subjects.*

10. Life and Employability Skill Practical:

The Life and Employability Skill Practical with more emphasis is being introduced in IV Semester for Circuit Branches and in V Semester for other branches of Engineering.
Much Stress is given to increase the employability of the students:

Internal assessment Mark **….. 25 Marks**

11. Project Work:

The students of all the Diploma Programmes **(except Diploma in Modern Office Practice)** 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, Tamilnadu. 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.**

a) Internal assessment mark for Project Work & Viva Voce:

Project Review I	…	**10 marks**
Project Review II	…	**10 marks**
Attendance	…	**05 marks** (award of marks same as theory subjects pattern)
Total	…	**25 marks**

Proper record to be maintained for the two Project Reviews, and It should be preserved for 2 Semesters and produced to the flying squad and the inspection team at the time of inspection/verification.

b) Allocation of Mark for Project Work & Viva Voce in Board Examination:

Viva Voce	…	30 **marks**
Marks for Report Preparation, Demo	…	35 **marks**
Total		**65 marks**

c) Written Test Mark (from 2 topics for 30 minutes duration): $

i) Environment Management	2 questions X 2 ½ marks	= 5 **marks**
iI) Disaster Management	2 questions X 2 ½ marks	= **5 marks**
		10marks

$ **-** Selection of Questions should be from Question Bank, by the External Examiner.

No choice need be given to the candidates.

Project Work & Viva Voce in Board Examination	--	**65 Marks**
Written Test Mark (from 2 topics for 30 minutes duration)	--	**10 Marks**
TOTAL	--	**75 Marks**

A neatly prepared PROJECT REPORT as per the format has to be submitted by individual during the Project Work & Viva Voce 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 subject* out of the total prescribed maximum marks including both the internal assessment and the Board Examination marks put together, subject to the condition that he/she secures at least a minimum of *30 marks out of 75 marks in the Board's Theory examinations and a minimum of 35 marks out of 75 marks in the Board Practical Examinations.*

14. Classification of successful candidates:

Classification of candidates who will pass out the final examinations from April 2018 onwards (Joined in first year in 2015-2016) 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 3/ 3½/ 4 years (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 of marks in all the

semesters put together and passes all the semesters except the I and II semesters in the first appearance itself and passes all the subjects within the stipulated period of study 3/ 3½/ 4 years (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 semesters put together and passes all the subjects within the stipulated period of study 3/ 3½ / 4 years (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 mentioned classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2018 /April 2019 onwards (both joined in First Year in 2015-2016)

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).

16. Seminar:

For seminar the total seminar 15 hours(15 weeks x 1hour) should be distributed equally to total theory subject per semester(i.e 15 hours divided by 3/4 subject). A topic from subject or current scenario is given to students. During the seminar hour students have to present the paper and submit seminar material to the respective staff member, who is handling the subject. It should be preserved for 2 Semesters and produced to the flying squad and the inspection team at the time of inspection/verification.

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Diploma in Mechanical Engineering

List of Equivalent Subjects for L - Scheme to M – Scheme

THIRD SEMESTER – WITH EFFECT FROM OCTOBER 2016

L-SCHEME		M-SCHEME	
Subject code	**Name of the Subject**	**Subject code**	**Name of Subject**
22031	Strength of Materials	32031	Strength of Materials
22032	Fluid Mechanics & Fluid Power	32043	Fluid Mechanics and Fluid Power
22033	Renewable Energy Sources	32073	Renewable Energy Sources and Energy Conservation
22034	Machine Drawing	32033	Machine Drawing
22035	Mechanical Testing & Quality Control Practical	32045	Strength of Materials and Fluid Mechanics Practical
22036	Fluid Power Practical	32045	Strength of Materials and Fluid Mechanics Practical
20001	Computer Applications Practical	32034	Computer Applications and CAD Practical

FOURTH SEMESTER – WITH EFFECT FROM APRIL 2017

L-SCHEME		M-SCHEME	
Subject code	**Name of the Subject**	**Subject code**	**Name of Subject**
22041	Manufacturing Technology – I	32032	Manufacturing Processes
22042	Thermal Engineering – I	32041	Heat Power Engineering
22043	Electrical Drives & Control	32044	Electrical Drives & Control
22044	Computer Aided Machine Drawing Practical	32034	Computer Applications and CAD Practical
22045	Manufacturing Technology – I Practical	32036	Lathe and Drilling Practical
22046	Metrology & Measurement and Machine Tool Testing Practical	32065	Machine Tool Testing and Maintenance Practical
22047	Electrical Drives & Control Practical	32047	Electrical Drives & Control Practical

FIFTH SEMESTER – WITH EFFECT FROM OCTOBER 2017

L-SCHEME		M-SCHEME	
Subject code	**Name of the Subject**	**Subject code**	**Name of Subject**
22051	Thermal Engineering – II	32052	Thermal and Automobile Engineering
22052	Manufacturing Technology – II	32042	Special Machines
Elective - I Theory			
22071	Total Quality Management	32071	Total Quality Management
22072	Modern Machining Processes	32042	Special Machines
22073	Power Plant Engineering	32052	Thermal and Automobile Engineering
22054	Design of Machine Elements	32051	Design of Machine Elements
22055	Thermal Engineering Practical	32056	Thermal and Automobile Engineering Practical
22056	Manufacturing Technology – II Practical	32046	Special Machines Practice
20002	Communication and Life Skills Practical **	30002	Life and Employability Skills Practical **

SIXTH SEMESTER – WITH EFFECT FROM APRIL 2018

L-SCHEME		M-SCHEME	
Subject code	**Name of the Subject**	**Subject code**	**Name of Subject**
22061	Industrial Engineering and Management	32061	Industrial Engineering and Management
22062	Computer Integrated Manufacturing	32062	Computer Aided Design and Manufacturing
Elective - II Theory			
22081	Automobile Engineering	32052	Thermal and Automobile Engineering
22082	Robotics	32082	Robotics
22083	Refrigeration and Air-conditioning	32083	Refrigeration and Air-conditioning
22084	Proto-Typing in Product Design		No Equivalent
22064	Computer Integrated Manufacturing Practical	32064	Computer Aided Design and Manufacturing Practical
22065	Process Automation Practical	32055	Process Automation Practical
Elective - II Practical			
22085	Automobile Engineering Practical	32056	Thermal and Automobile Engineering Practical
22086	Robotics Practical	32085	Robotics Practical
22087	Refrigeration and Air-conditioning Practical	32086	Refrigeration and Air-conditioning Practical
22088	Rapid Proto-Typing Practical		No Equivalent
22067	Project Work	32067	Project Work

ANNEXURE - I
M SCHEME
Implemented from 2015 – 2016

1020: DIPLOMA IN MECHANICAL ENGINEERING (FULL TIME)

CURRICULUM OUTLINE

THIRD SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial / Drawing	Practical	Total
32031	Strength of Materials	6	-	-	6
32032	Manufacturing Processes	6	-	-	6
32033	Machine Drawing	-	4	-	4
32034	Computer Applications and CAD Practical	-	-	6	6
32035	Foundry and Welding Practical	-	-	4	4
32036	Lathe and Drilling Practical	-	-	4	4
32037	Metrology and Metallography Practical	-	-	4	4
Seminar		1	-	-	1
TOTAL		**13**	**4**	**18**	**35**

FOURTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32041	Heat Power Engineering	6	-	-	6
32042	Special Machines	5	-	-	5
32043	Fluid Mechanics and Fluid Power	5	-	-	5
32044	Electrical Drives & Control	6	-	-	6
32045	Strength of Materials and Fluid Mechanics Practical	-	-	4	4
32046	Special Machines Practice	-	-	4	4
32047	Electrical Drives & Control Practical	-	-	4	4
Seminar		1	-	-	1
TOTAL		**23**	**-**	**12**	**35**

FIFTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32051	Design of Machine Elements	6	-	-	6
32052	Thermal and Automobile Engineering	6	-	-	6
32053	Process Planning and Cost Estimation	5	-	-	5
Elective - I Theory		5	-	-	5
32071	Total Quality Management				
32072	Press Tools				
32073	Renewable Energy Sources and Energy Conservation				
32055	Process Automation Practical	-	-	4	4
32056	Thermal and Automobile Engineering Practical	-	-	4	4
30002	Life and Employability Skills Practical **	-	-	4	4
Seminar		1			1
TOTAL		**23**	**-**	**12**	**35**

** Common to all Diploma Courses

SIXTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32061	Industrial Engineering and Management	6	-	-	6
32062	Computer Aided Design and Manufacturing	5	-	-	5
Elective - II Theory		5	--	-	5
32081	Mechanical Instrumentation				
32082	Robotics				
32083	Refrigeration and Air-conditioning				
32064	Computer Aided Design and Manufacturing Practical	-	-	6	6
32065	Machine Tool Testing and Maintenance Practical	-	-	4	4
Elective - II Practical		-	-	4	4
32084	Mechanical Instrumentation Practical				
32085	Robotics Practical				
32086	Refrigeration and Air-conditioning Practical				
32067	Project Work	-	-	4	4
Seminar		1	-	-	1
TOTAL		**17**	**-**	**18**	**35**

ANNEXURE - II
M SCHEME
Implemented from 2015 – 2016

1020: DIPLOMA IN MECHANICAL ENGINEERING (FULL TIME)

SCHEME OF EXAMINATION

THIRD SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32031	Strength of Materials	25	75	100	40	3
32032	Manufacturing Processes	25	75	100	40	3
32033	Machine Drawing	25	75	100	40	3
32034	Computer Applications and CAD Practical	25	75	100	50	3
32035	Foundry and Welding Practical	25	75	100	50	3
32036	Lathe and Drilling Practical	25	75	100	50	3
32037	Metrology and Metallography Practical	25	75	100	50	3

FOURTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32041	Heat Power Engineering	25	75	100	40	3
32042	Special Machines	25	75	100	40	3
32043	Fluid Mechanics and Fluid Power	25	75	100	40	3
32044	Electrical Drives & Control	25	75	100	40	3
32045	Strength of Materials and Fluid Mechanics Practical	25	75	100	50	3
32046	Special Machines Practice	25	75	100	50	3
32047	Electrical Drives & Control Practical	25	75	100	50	3

FIFTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32051	Design of Machine Elements	25	75	100	40	3
32052	Thermal and Automobile Engineering	25	75	100	40	3
32053	Process Planning and Cost Estimation	25	75	100	40	3
Elective - I Theory		25	75	100	40	3
32071	Total Quality Management					
32072	Press Tools					
32073	Renewable Energy Sources and Energy Conservation					
32055	Process Automation Practical	25	75	100	50	3
32056	Thermal and Automobile Engineering Practical	25	75	100	50	3
30002	Life and Employability Skills Practical **	25	75	100	50	3

** Common to all Diploma Courses

SIXTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32061	Industrial Engineering and Management	25	75	100	40	3
32062	Computer Aided Design and Manufacturing	25	75	100	40	3
Elective - II Theory		25	75	100	40	3
32081	Mechanical Instrumentation					
32082	Robotics					
32083	Refrigeration and Air-conditioning					
32064	Computer Aided Design and Manufacturing Practical	25	75	100	50	3
32065	Machine Tool Testing and Maintenance Practical	25	75	100	50	3
Elective - II Practical		25	75	100	50	3
32084	Mechanical Instrumentation Practical					
32085	Robotics Practical					
32086	Refrigeration and Air-conditioning Practical					
32067	Project Work	25	75	100	50	3

ANNEXURE- I
M SCHEME
Implemented from 2015 – 2016

3020: DIPLOMA IN MECHANICAL ENGINEERING (PART TIME)

CURRICULUM OUTLINE

THIRD SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32031	Strength of Materials	4			4
32032	Manufacturing Processes	3			3
20016	Engineering Graphics-I		4		4
32034	Computer Applications and CAD Practical			3	3
32035	Foundry and Welding Practical			4	4
TOTAL		**7**	**4**	**7**	**18**

FOURTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32041	Heat Power Engineering	4			4
32042	Special Machines	3			3
20026	Engineering Graphics-II		3		3
32037	Metrology and Metallography Practical			4	4
32036	Lathe and Drilling Practical			4	4
TOTAL		**7**	**3**	**8**	**18**

FIFTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32043	Fluid Mechanics and Fluid Power	4			4
32044	Electrical Drives & Control	3			3
32033	Machine Drawing		3		3
32045	Strength of Materials and Fluid Mechanics Practical			4	4
32047	Electrical Drives & Control Practical			4	4
TOTAL		**7**	**3**	**8**	**18**

SIXTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32051	Design of Machine Elements	4			4
32052	Thermal and Automobile Engineering	4			4
32053	Process Planning and Cost Estimation	3			3
32046	Special Machines Practice			3	3
32056	Thermal and Automobile Engineering Practical			4	4
TOTAL		**11**	**-**	**7**	**18**

SEVENTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32062	Computer Aided Design and Manufacturing	4			4
Elective-I Theory					
32071	Total Quality Management	3			3
32072	Press Tools				
32073	Renewable Energy Sources and Energy Conservation				
32055	Process Automation Practical			4	4
32064	Computer Aided Design and Manufacturing Practical			4	4
30002	Life and Employability Skills Practical **			3	3
TOTAL		**7**	**-**	**11**	**18**

EIGHTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32061	Industrial Engineering and Management	4			4
Elective-II Theory		4			4
32081	Mechanical Instrumentation				
32082	Robotics				
32083	Refrigeration and Air-conditioning				
32065	Machine Tool Testing and Maintenance Practical			4	4
Elective-II Practical				3	3
32084	Mechanical Instrumentation Practical				
32085	Robotics Practical				
32086	Refrigeration and Air-conditioning Practical				
32067	Project Work			3	3
TOTAL		**8**	**-**	**10**	**18**

ANNEXURE- II
M SCHEME
Implemented from 2015 - 2016

3020: DIPLOMA IN MECHANICAL ENGINEERING (PART TIME)

SCHEME OF EXAMINATION

THIRD SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32031	Strength of Materials	25	75	100	40	3
32032	Manufacturing Processes	25	75	100	40	3
20016	Engineering Graphics-I	25	75	100	40	3
32034	Computer Applications and CAD Practical	25	75	100	50	3
32035	Foundry and Welding Practical	25	75	100	50	3

FOURTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32041	Heat Power Engineering	25	75	100	40	3
32042	Special Machines	25	75	100	40	3
20026	Engineering Graphics-II	25	75	100	40	3
32037	Metrology and Metallography Practical	25	75	100	50	3
32036	Lathe and Drilling Practical	25	75	100	50	3

FIFTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32043	Fluid Mechanics and Fluid Power	25	75	100	40	3
32044	Electrical Drives & Control	25	75	100	40	3
32033	Machine Drawing	25	75	100	40	3
32045	Strength of Materials and Fluid Mechanics Practical	25	75	100	50	3
32047	Electrical Drives & Control Practical	25	75	100	50	3

SIXTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32051	Design of Machine Elements	25	75	100	40	3
32052	Thermal and Automobile Engineering	25	75	100	40	3
32053	Process Planning and Cost Estimation	25	75	100	40	3
32046	Special Machines Practice	25	75	100	50	3
32056	Thermal and Automobile Engineering Practical	25	75	100	50	3

SEVENTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32062	Computer Aided Design and Manufacturing	25	75	100	40	3
Elective-I Theory						
32071	Total Quality Management					
32072	Press Tools	25	75	100	40	3
32073	Renewable Energy Sources and Energy Conservation					
32055	Process Automation Practical	25	75	100	50	3
32064	Computer Aided Design and Manufacturing Practical	25	75	100	50	3
30002	Life and Employability Skills Practical **	25	75	100	50	3

EIGHTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32061	Industrial Engineering and Management	25	75	100	40	3
Elective-II Theory						
32081	Mechanical Instrumentation					
32082	Robotics	25	75	100	40	3
32083	Refrigeration and Air-conditioning					
32065	Machine Tool Testing and Maintenance Practical	25	75	100	50	3
Elective-II Practical						
32084	Mechanical Instrumentation Practical					
32085	Robotics Practical	25	75	100	50	3
32086	Refrigeration and Air-conditioning Practical					
32067	Project Work	25	75	100	50	3

ANNEXURE – I
M SCHEME
Implemented from 2015 – 2016

2020: DIPLOMA IN MECHANICAL ENGINEERING (SANDWICH)

CURRICULUM OUTLINE

THIRD SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32031	Strength of Materials	5			5
32032	Manufacturing Processes	4			4
32033	Machine Drawing		3		3
32043	Fluid Mechanics and Fluid Power	4			4
32034	Computer Applications and CAD Practical			6	6
32035	Foundry and Welding Practical			4	4
32036	Lathe and Drilling Practical			4	4
32045	Strength of Materials and Fluid Mechanics Practical			4	4
	Seminar	1			1
TOTAL		**14**	**3**	**18**	**35**

FOURTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32042	Special Machines	3			3
32046	Special Machines Practical			3	3
32091	Industrial Training – I #				NA
	Seminar	1			1
TOTAL		**4**		**3**	**7**

Examination will be conducted after completion of the training

FIFTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32041	Heat Power Engineering	5			5
32044	Electrical Drives & Control	5			5
32053	Process Planning and Cost Estimation	4			4
Elective - I Theory		4			4
32071	Total Quality Management				
32072	Press Tools				
32073	Renewable Energy Sources and Energy Conservation				
32037	Metrology and Metallography Practical			4	4
32047	Electrical Drives & Control Practical			4	4
32055	Process Automation Practical			4	4
30002	Life and Employability Skills Practical **			4	4
	Seminar	1			1
TOTAL		**19**		**16**	**35**

** Common to all Diploma Courses

SIXTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32051	Design of Machine Elements	5			5
32052	Thermal and Automobile Engineering	5			5
32061	Industrial Engineering and Management	4			4
32062	Computer Aided Design and Manufacturing	5			5
Elective - II Theory		4			4
32081	Mechanical Instrumentation				
32082	Robotics				
32083	Refrigeration and Air-conditioning				
32056	Thermal and Automobile Engineering Practical			4	4
Elective - II Practical				3	3
32084	Mechanical Instrumentation Practical				
32085	Robotics Practical				
32086	Refrigeration and Air-conditioning Practical				
32064	Computer Aided Design and Manufacturing Practical			4	4
	Seminar	1			1
TOTAL		**24**		**11**	**35**

SEVENTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
32065	Machine Tool Testing and Maintenance Practical			3	3
32067	Project Work			3	3
32092	Industrial Training II #				NA
	Seminar	1			1
TOTAL		**1**		**6**	**7**

Examination will be conducted after completion of the training

ANNEXURE – II
M SCHEME
Implemented from 2015 – 2016

2020: DIPLOMA IN MECHANICAL ENGINEERING (SANDWICH)

SCHEME OF EXAMINATION

THIRD SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32031	Strength of Materials	25	75	100	40	3
32032	Manufacturing Processes	25	75	100	40	3
32033	Machine Drawing	25	75	100	40	3
32043	Fluid Mechanics and Fluid Power	25	75	100	40	3
32034	Computer Applications and CAD Practical	25	75	100	50	3
32035	Foundry and Welding Practical	25	75	100	50	3
32036	Lathe and Drilling Practical	25	75	100	50	3
32045	Strength of Materials and Fluid Mechanics Practical	25	75	100	50	3

FOURTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32042	Special Machines	25	75	100	40	3
32046	Special Machines Practical	25	75	100	50	3
32091	Industrial Training – I #	25	75	100	50	3

Examination will be conducted after completion of the training

FIFTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32041	Heat Power Engineering	25	75	100	40	3
32044	Electrical Drives & Control	25	75	100	40	3
32053	Process Planning and Cost Estimation	25	75	100	40	3
Elective - I Theory		25	75	100	40	3
32071	Total Quality Management					
32072	Press Tools					
32073	Renewable Energy Sources and Energy Conservation					
32037	Metrology and Metallography Practical	25	75	100	50	3
32047	Electrical Drives & Control Practical	25	75	100	50	3
32055	Process Automation Practical	25	75	100	50	3
30002	Life and Employability Skills Practical **	25	75	100	50	3

** Common to all Diploma Courses

SIXTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32051	Design of Machine Elements	25	75	100	40	3
32052	Thermal and Automobile Engineering	25	75	100	40	3
32061	Industrial Engineering and Management	25	75	100	40	3
32062	Computer Aided Design and Manufacturing	25	75	100	40	3
Elective - II Theory		25	75	100	40	3
32081	Mechanical Instrumentation					
32082	Robotics					
32083	Refrigeration and Air-conditioning					
32056	Thermal and Automobile Engineering Practical	25	75	100	50	3
Elective - II Practical		25	75	100	50	3
32084	Mechanical Instrumentation Practical					
32085	Robotics Practical					
32086	Refrigeration and Air-conditioning Practical	25	75	100	50	3
32064	Computer Aided Design and Manufacturing Practical	25	75	100	50	3

SEVENTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Board Examination	Total		
32065	Machine Tool Testing and Maintenance Practical	25	75	100	50	3
32067	Project Work	25	75	100	50	3
32092	Industrial Training II #	25	75	100	50	3

Examination will be conducted after completion of the training

Board Examination - Question paper pattern

Common for all theory subjects except Machine Drawing and Design of Machine Elements

PART A ***- (1 to 8) 5 Questions are to be answered out of 8 questions for 2 marks each.*****(Question No. 8 will be the compulsory question and *can be asked from any one of the units)(From each unit maximum of two 2 marks questions alone can be asked)***

PART B ***- (9 to 16)5 Questions are to be answered out of 8 questions for 3 marks each.*** **(Question No. 16 will be the compulsory question and *can be asked from any one of the units) (From each unit maximum of two 3 marks questions alone can be asked)***

PART C ***- (17 to 21) Five Questions will be in the Either OR Pattern. Students have to answer these five questions. Each question carries 10 marks. (Based on the discretion of the question setter, he/she can ask two five mark questions (with sub division A & sub division B) instead of one ten marks question if required)***

Any tables required should be mentioned in the question paper. Steam table, Design Data Book, Mollier chart, Psychometric Chart etc..

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

III SEMESTER

32031 – STRENGTH OF MATERIALS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32031

Semester : III

Subject Title : **STRENGTH OF MATERIALS**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	**Instructions**		**Examination**			
	Hours / Week	**Hours / Semester**	**Marks**			**Duration**
Strength of Materials	6	90	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	**Topics**	**Hours**
I	STATICS OF PARTICLE AND FRICTION	17
II	MECHANICAL PROPERTIES, SIMPLE STRESSES AND STRAINS	17
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	17
IV	SHEAR FORCE AND BENDING MOMENT DIAGRAMS, THEORY OF SIMPLE BENDING	16
V	TORSION AND SPRINGS	16
	TEST AND REVISION	7
	Total	**90**

RATIONALE:

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

OBJECTIVES

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

STRENGTH OF MATERIALS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**STATICS OF PARTICLES:**	17
	Introduction – Force - effects of a force - system of forces - resultant of force - Principle of transmissibility - parallelogram law of forces - triangular law - resultant of several forces acting on a particle - polygon law - resolution of a force into rectangular components – resultant of a system of forces acting on a particle using rectangular components - equilibrium of particles.	
	External and internal forces - moment of a force - Varignon's theorem - moment of a couple - equivalent couples - addition of couples - resolution of a force into a force and a couple - Free body diagram - Necessary and sufficient conditions for the equilibrium of rigid bodies in two dimension - Support reaction - types of support - removal of two dimensional supports - Simple problems only.	

FRICTION:

Introduction - Definition - Force of friction - Limiting friction - Static friction - Dynamic friction - Angle of friction - co-efficient of friction - Laws of static and dynamic friction.

II DEFORMATION OF METALS **17**

Mechanical properties of materials: Engineering materials – Ferrous and non-ferrous materials **-** Definition of mechanical properties - Alloying elements-effect of alloying element - Fatigue, fatigue strength, creep – temperature creep – cyclic loading and repeated loading – endurance limit.

Simple stresses and strains: Definition – Load, stress and strain – Classification of force systems – tensile, compressive and shear force systems – Behaviour of mild steel in tension up to rupture – Stress – Strain diagram – limit of proportionality – elastic limit – yield stress – breaking stress – Ultimate stress – percentage of elongation and percentage reduction in area – Hooke's law – Definition – Young's modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity. Linear strain – Deformation due to tension and compressive force – Simple problems in tension, compression and shear force.

Definition – Lateral strain – Poisson's ratio – volumetric strain – bulk modulus – volumetric strain of rectangular and circular bars – problems connecting linear, lateral and volumetric deformation – Elastic constants and their relationship - Problems on elastic constants - Definition – Composite bar – Problem in composite bars subjected to tension and compression – Temperature stresses and strains – Simple problems – Definition – strain energy – proof resilience – modulus of resilience – The expression for strain energy stored in a bar due to Axial load – Instantaneous stresses due to gradual, sudden, impact and shock loads – Problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings.

III	**GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS**	**17**

Properties of sections: Definition – center of gravity and centroid - position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium-problems to determine the centroid of angle, channel, T and I sections only - Definition-centroidal axis-Axis of symmetry. Moment of Inertia – Statement of parallel axis theorem and perpendicular axis theorem. Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections-Definition-Polar moment of Inertia-radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections.

Thin Shells: Definition – Thin and thick cylindrical shell – Failure of thin cylindrical shell subjected to internal pressure – Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems – change in dimensions of a thin cylindrical shell subjected to internal pressure – problems – Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure – simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems.

IV	**SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING**	**16**

Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment – types of loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (udl) – Determination of Maximum bending moment in cantilever beam and simply supported beam when they are subjected to point load and uniformly distributed load.

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

V THEORY OF TORSION AND SPRINGS 16

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.

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

Text Books:

1) Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi.
2) Strength of Materials, S. Ramamrutham, 15th Edn 2004, DhanpatRai Pub. Co., New Delhi.

Reference Books:

1) Strength of Materials, R.K. Bansal,, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
2) Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 9780070668959,
3) Strength of Materials, B K Sarkar, I Edition, 2003 Tata Mcgraw hill, New Delhi.
4) Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2nd Edition, 2007

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

III SEMESTER

32032 – MANUFACTURING PROCESSES

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32032

Semester : III

Subject Title : **MANUFACTURING PROCESSES**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	**Instructions**		**Examination**			
Manufacturing Processes	**Hours / Week**	**Hours / Semester**	**Marks**			**Duration**
	6	90	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	**Topics**	**Hours**
I	FOUNDRY TECHNOLOGY	17
II	WELDING TECHNOLOGY	17
III	FORMING TECHNOLOGY	17
IV	THEORY OF METAL CUTTING & LATHE	16
V	DRILLING & METROLOGY	16
	TEST AND REVISION	7
	TOTAL	**90**

RATIONALE:

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

OBJECTIVES:

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

MANUFACTURING PROCESSES

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**Foundry Technology**	17

Patterns: Definition – types of pattern – solid piece – split piece - loose piece – match plate - sweep - skeleton – segmental – shell – pattern materials – pattern allowances.

Moulding: Moulding sand – constituents – types – properties of moulding sand – moulding sand preparation – moulding tools - moulding boxes – types of moulds – green sand mould – dry sand mould – loam mould – methods of moulding – moulding machines – jolting – squeezing – sand slinger construction and working principle.

Cores: Essential qualities of core – materials – core sand preparation – core binders – core boxes - CO_2 process core making – types of core.

Metallurgy :– Introduction - Iron-carbon diagram.

Melting furnaces: Blast furnace – Cupola furnace – crucible furnace – types – pit furnace – coke fired – oil fired – electric furnace – types – direct arc – indirect arc – induction furnace – working principles.

Casting: Shell mould casting – investment casting – pressure die casting – hot chamber die casting – cold chamber die casting – gravity die casting – centrifugal casting – continuous casting - defects in casting – causes and remedies.

II Welding Technology **17**

Arc Welding: Definition – arc welding equipment – electrode types – filler and flux materials - arc welding methods – metal arc - Metal Inert gas (MIG) - Tungsten inert gas (TIG) - Submerged arc - Electro slag welding – resistance welding – spot welding – butt welding – seam welding – Plasma arc welding – Thermit welding – Electron beam welding – Laser beam welding – friction welding – ultrasonic welding – Induction welding - working principle – applications – advantages and disadvantages.

Gas welding: Oxy-acetylene welding – advantages - limitations - gas welding equipment - Three types of flames – welding techniques – filler rods. – Flame cutting – soldering – brazing – difference between soldering and brazing.

Types of welded joints – merits and demerits of welded joints – 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.

III Forming Technology **17**

Forging: Hot working, cold working – advantages of hot working and cold working– hot working operations – rolling, forging, smith forging, drop forging, upset forging, press forging – roll forging.

Press Working: Types of presses - mechanical and hydraulic presses - press tools and accessories - press working operations - bending operations - angle bending - channel bending – curling – drawing - shearing operations - blanking, piercing, trimming – notching – lancing.

Powder Metallurgy: Methods of manufacturing metal powders – atomization, reduction and electrolysis deposition – compacting – sintering – sizing – infiltration – mechanical properties of parts

made by powder metallurgy – design rules for the power metallurgy process.

IV	**Theory of metal cutting:** Introduction – orthogonal cutting – oblique cutting - single point cutting tool – nomenclature – types of chips – chip breakers – cutting tool materials – properties – tool wears – factors affecting tool life – cutting fluids – functions – properties of cutting fluid. **Centre Lathe:** Introduction - specifications – simple sketch – principal parts – head stock – back geared type – all geared type – feed mechanism - tumbler gear mechanism – quick change gear box – apron mechanism – work holding device – three jaw chuck – four jaw chuck – centres - faceplate – mandrel – steady rest – follower rest – machining operations done on lathe - straight turning – step turning - taper turning methods: form tool – tailstock set over method – compound rest method – taper turning attachment – knurling - Thread cutting – Facing – Boring – chamfering –grooving – parting-off – eccentric turning - cutting speed – feed - depth of cut - metal removal rate. **Semi-Automatic Lathes:** Types of semi-automatic lathes – capstan and turret lathes – Geneva indexing mechanism – bar feeding mechanism - difference between turret and capstan – work holding devices – tool holders.	**16**
V	**Drilling and Metrology** **Drilling Machines:** Drills - flat drills - twist drills – nomenclature of twist drill - types of drilling machines - bench type - floor type - radial type - gang drill – multi spindle type -principle of operation in drilling - methods of holding drill bit - drill chucks - socket and sleeve –drilling operation – reaming - counter sinking - counter boring - spot facing – tapping - deep hole drilling. **Metrology:** Definition – need of inspection – precision – accuracy – sensitivity - magnification – repeatability – calibration – comparator – Advantages – requirements – mechanical comparator – optical comparator – electrical comparator –	**16**

pneumatic comparator – Principles – advantages and disadvantages.

Measuring instruments: Construction and principles only - Steel rule – Callipers: outside calliper – inside calliper – jenny calliper – Combination set – Feeler gauge – Pitch screw gauge – Vernier calliper – Digital calliper – Vernier height gauge – Micrometer – Inside micrometer – Thread micrometer – Slip gauges – requirement – Indian standard – care and use - Sine bar – types – uses – limitations – Working principle of clinometers, autocollimator, angle dekkor.

Text Books:

1) Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya - IIth Edition - Media Promoters & Publishers Pvt. Ltd., Seewai Building `B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
2) Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi - 110002

Reference Books:

1) Manufacturing process – Begeman - 5th Edition -McGraw Hill, New Delhi 1981.
2) Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
3) Workshop Technology – Raghuwanshi - Khanna Publishers. Jain & Gupta,
4) Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi 110 006 - 2006
5) Production Technology - P. C. SHARMA - Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 - 2006
6) Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008. – 2001.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

III SEMESTER

32033 – MACHINE DRAWING

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32033

Semester : III

Subject Title : **MACHINE DRAWING**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours /Week	Hours/ Semester	Marks			Duration
Machine Drawing	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	Sectional Views	5
II	Limits, Fits and Tolerances	5
III	Surface Texture	5
IV	Keys, Screw threads and Threaded fasteners	5
V	Assemble drawing	33
	TEST AND REVISION	7
	Total	60

RATIONALE:

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:

- Appreciate the need for sectional view and types of sections.
- Draw sectional views using different types of sections.
- Explain the use of threaded fasteners and the types of threads.
- Compare hole basis system with shaft basis system.
- Select different types of fits and tolerance for various types of mating parts.
- Appreciate the importance of fits and tolerance.

MACHINE DRAWING

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**SECTIONAL VIEWS** Review of sectioning – Conventions showing the section – symbolic representation of cutting plane- types of section – full section, half section, offset section, revolved section, broken section, removed section – section lining.	5
II	**LIMITS, FITS AND TOLERANCES** Tolerances – Allowances – Unilateral and Bilateral tolerances. Limits – Methods of tolerances – Indication of tolerances on linear dimension of drawings – Geometrical tolerances – application – Fits – Classifications of fits – Selection of fits – examples	5
III	**SURFACE TEXTURE** Surface texture – importance – controlled and uncontrolled surfaces – Roughness – Waviness – lay – Machining symbols	5
IV	**KEYS, SCREW THREADS AND THREADED FASTENERS** Types of fasteners – temporary fasteners – keys – classification of keys – Heavy duty keys – light duty keys. Screw thread – Nomenclature – different types of thread profiles – threads in sections – threaded fasteners – bolts – nuts – through bolt – tap bolt, stud bolt – set screw – cap screws – machine screws – foundation bolts	5

V MANUAL DRAWING PRACTICE **33**

Detailed drawings of following machine parts are given to students to assemble and draw the Elevations / Sectional elevations / Plan / and Side views with dimensioning and bill of materials

1. Sleeve & Cotter joint
2. Knuckle joint
3. Screw Jack
4. Foot step bearing
5. Plummer Block
6. Universal Coupling
7. Simple Eccentric
8. Machine Vice
9. Protected type flanged coupling
10. Swivel bearing.

Books:

1) Machine Drawing, P.S. Gill, Katsan Publishing House, Ludiana
2) A Text book of Engineering Drawing, R.B. Gupta, Satya Prakasan, Technical India Publications, New Delhi
3) Mechanical Draughtsmanship, G.L. Tamta, Dhanpat Rai & Sons, Delhi
4) Geometrical and Machine Drawing, N.D. Bhatt, Cheroter book stalls, Anand, West Railway
5) Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi

BOARD EXAMINATIONS
Question Pattern

Time: 3 Hrs **Max Marks : 75**

Note: All the questions will be answered in drawing sheet only

PART A: (7 x 5 = 35)

Theory questions: (1 TO 8)

Two questions from each unit (I to IV) will be asked.

Answer any seven questions from the given eight questions.

PART B: 40 Marks (Either A or B.)

Answer any one question by selecting either A or B.

9. A. Assemble and Draw any two views and bill of materials.

(OR)

B. Assemble and Draw any two views and bill of material

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

III SEMESTER

32034 – COMPUTER APPLICATIONS AND CAD PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32034

Semester : III

Subject Title : COMPUTER APPLICATIONS AND CAD PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
Computer Applications and CAD practical	Hours / Week	Hours / Semester	Marks			Duration
	6	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

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

- Use the different facilities available in the word processor
- Analyze the data sheet
- Create and manipulate the database
- Prepare PowerPoint presentation
- Practice on CADD commands in making 2D Drawings.
- Draw assembled drawings using CADD.
- Draw sectional views using different types of sections.

PART – A: COMPUTER APPLICATIONS (30 Hrs)

WORD PROCESSING

Introduction – Menus – Tool bar – Create – Edit – Save – Alignment – Font Size – Formatting – Tables – Fill Colors – Page Setup - Preview – Water marking – Header – Footer – Clip art.

Exercises

1. Create a news letter of three pages with two columns text. The first page contains some formatting bullets and numbers. Set the document background colour and add 'confidential' as the watermark. Give the document a title which should be displayed in the header. The header/ footer of the first page should be different from other two pages. Also, add author name and date/ time in the header. The footer should have the page number.

2. Create the following table using align, border, merging and other attributes.

DIRECTORATE OF TECHNICAL EDUCATION **e-governance particulars**					
Register Number	**June**	**July**	**August**	**September**	**Cumulative %**
16304501					
16304502					
16304503					
16304504					
16304505					

SPREADSHEET

Introduction – Menus – Tool bar – Create – Edit – Save – Formatting cells – Chart wizard – Fill Colors – Creating and using formulas – Sorting – Filtering.

Exercises

3. Create a table of records with columns as Name and Donation Amount. Donation amount should be formatted with two decimal places. There should be at least twenty records in the table. Create a conditional format to highlight the highest donation with blue colour and lowest donation with red colour. The table should have a heading.

4. Prepare line, bar and pie chart to illustrate the subject wise performance of the class for any one semester.

DATABASE

Introduction – Menus – Tool bar – Create – Edit – Save – Data types – Insert – Delete – Update – View – Sorting and filtering – Queries – Report – Page setup – Print.

Exercises

5. Prepare a payroll for employee database of an organization with the following details: Employee Id, Employee name, Date of Birth, Department and Designation, Date of appointment, Basic pay, Dearness Allowance, House Rent Allowance and other deductions if any. Perform simple queries for different categories.

6. Design a pay slip for a particular employee from the above database.

PRESENTATION

Introduction – Menus – Tool bar – Create – Edit – Save – Slide transition – Insert image – Hyper link – Slide numbers – View slide show with sound – Photo album – Clip art.

Exercises

7. Make a presentation with atleast 10 slides. Use different customized animation effects on pictures and clip art on any four of the ten slides.

PART – B: CAD (60 Hrs)

INTRODUCTION

Introduction – History of CAD – Applications – Advantages over manual drafting – Hardware requirements – Software requirements – Windows desktop – CAD screen interface – menus – Tool bars – How to start CAD – How to execute command – types of co-ordinate systems – Absolute – Relative – Polar.

DRAWING AIDS AND EDITING COMMANDS

Creating objects (2D) – 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 –LT scale – Matching properties – Editing with grips – Pedit – Ddedit – Mledit.

BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS

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, viewres – Real time zoom. Inquiry groups – calculating area – Distance – Time – Status of drawing – Using calculator.

CAD EXERCISES

Detailed drawings of following machine parts are to be given to students. Draw the assembled views (two views only) and bill of materials.

The elevation / sectional elevation / plan / sectional plan / side view with dimensioning.

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

Reference Books:

1) Inside AutoCAD - D. Raker and H. Rice - BPB Publications, NewDelhi

2) Engineering Drawing and Graphics + AutoCAD – K.Venugopal, - New Age International Publications

3) AutoCAD with Applications - Sham Tickoo - Tata Mcgraw Hill**.**

Board of Examination

<u>Note:</u> All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise in each PART.

All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

ALLOCATION OF MARKS

PART - A			**:**	**25 marks**
	Editing / Creation	-	10	
	Formatting	-	10	
	Printout	-	5	
PART - B			**:**	**45 marks**
	Drafting	-	20	
	Assembly	-	10	
	Dimensioning	-	10	
	Printout	-	5	
Viva-voce			**:**	**05 marks**
Total			**:**	**75 marks**

LIST OF EQUIPMENT

1. Personal computer – 30 Nos.
2. Printer – 1 No.
3. Required Softwares :

Office Package, CAD Package – Sufficient to the strength.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

III SEMESTER

32035 – FOUNDRY AND WELDING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32035

Semester : III

Subject Title : FOUNDRY AND WELDING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	**Instructions**		**Examination**			
	Hours/ Week	**Hours/ Semester**	**Marks**			**Duration**
Foundry and Welding Practical	4	60	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

OBJECTIVES:

- 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 different welding defects.
- Appreciate the safety practices used in welding.
- Prepare a record of work for all the exercises.

Foundry Section

1. Introduction of tools and equipment
2. Types of patterns
3. Types of sand
4. Preparation of sand moulds
5. Core sands, preparation of cores

Exercises:

Prepare the green sand mould using the following patterns.

Solid pattern

1. Stepped pulley

Split pattern

2. Bent Pipe with core print
3. T-pipes with core print
4. Tumbles

Loose Piece Pattern

5. Dovetail

Core preparation

6. Core preparation for Bent pipe / T-pipe

Welding Section

1. Introduction of Safety in welding shop
2. Introduction to hand tools and equipment
3. Arc and gas welding equipment
4. Types of joints

Exercises :

Make the following welding joint / cutting.

Arc welding (Raw Material: 25 mm x 6mm MS flat)

1. Lap joint
2. Butt joint
3. T- joint

Gas Welding (Raw Material: 25mm x 3mm Ms flat)

4. Lap joint

Gas cutting: (GI/MS Sheet - 3mm thickness)

5. Profile cutting – circular profile

Spot welding: (GI/MS Sheet)

6. Lap joint

BOARD EXAMINATION

Note: All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section.

All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

Detailed allocation

Foundry		**: 35 marks**
Preparation of sand	- 10	
Ramming and vent holes	- 15	
Gate cutting / Finish	- 10	
Welding		**: 35 marks**
Edge preparation	- 10	
Welding / Cutting	- 15	
Joint strength / Finish	- 10	
Viva-voce		**: 05 marks**
Total		**: 75 marks**

LIST OF EQUIPMENT

Welding:

1. Arc welding booth	-	2 No's with welding transformer
2. Gas welding unit	-	1 Set (Oxygen and acetylene cylinder)
3. Flux	-	Sufficient quantity
4. Electrode	-	Sufficient quantity
5. Welding rod	-	Sufficient quantity
6. Welding shield	-	5 Nos.
7. Gas welding goggles	-	5 Nos.
8. Leather Glows 18''	-	10 Sets.
9. Chipping hammer	-	10 Nos.
10. Spot welding machine	-	1 No.
11. Personal protective equipment	-	Sufficient quantity
12. Fire safety equipment	-	Sufficient quantity

Foundry:

1. Moulding board	-	15 Nos.
2. Cope box	-	15 Nos.
3. Drag box	-	15 Nos.
4. Core box	-	10 Nos.
5. Shovel	-	5 Nos.
6. Rammer set	-	15 Nos.
7. Slick	-	15 Nos.
8. Strike-off bar	-	15 Nos.
9. Riddle	-	5 Nos.
10. Trowel	-	15 Nos.
11. Lifter	-	15 Nos.
12. Cleaning Brush	-	20 Nos.
13. Vent rod	-	15 Nos.
14. Draw spike	-	15 Nos.
15. Gate cutter	-	15 Nos.
16. Runner & riser	-	15 Nos. each
17. Patterns	-	Sufficient quantity

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

III SEMESTER

32036 – LATHE AND DRILLING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32036

Semester : III

Subject Title : Lathe and Drilling Practical

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Lathe and Drilling Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

- Identify the parts of a lathe.
- Identify the work holding devices.
- Set the tools for various operations.
- Operate the lathe and machine a component using lathe.
- Identify the parts of drilling machine.
- Perform the various drilling operations.
- Identify the various tools and its holding devices.
- Identify the work holding devices.
- Prepare the record of work for the exercises.

Lathe section:

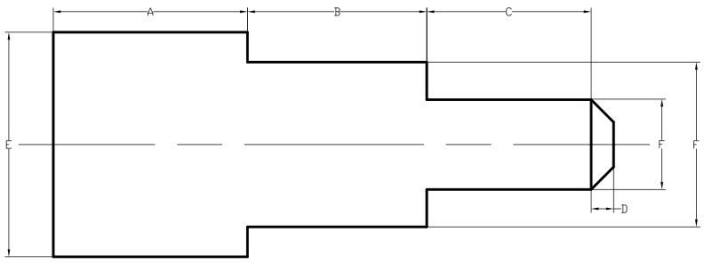
1. Introduction of safety in operating machines.
2. Study of lathe and its parts.
3. Types of tools used in lathe work.
4. Study of work holding devices and tool holding devices.

5. Setting of work and tools.
6. Operation of lathe.
7. Practice on a lathe.
8. Types of measuring instruments and their uses.

Exercises:

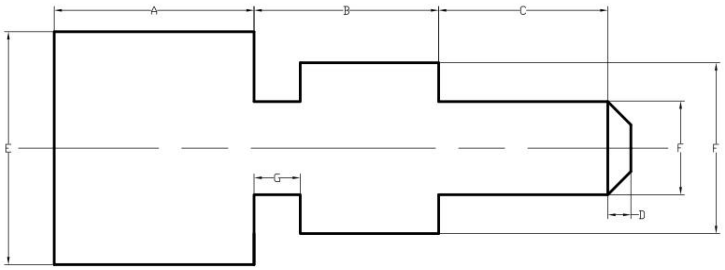
Make the following jobs in the lathe. Raw material □32 mm M.S. Rod

1. Facing, Step turning & Chamfering



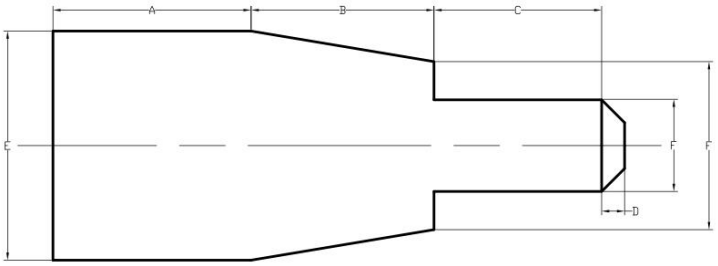
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Step turning & Groove cutting



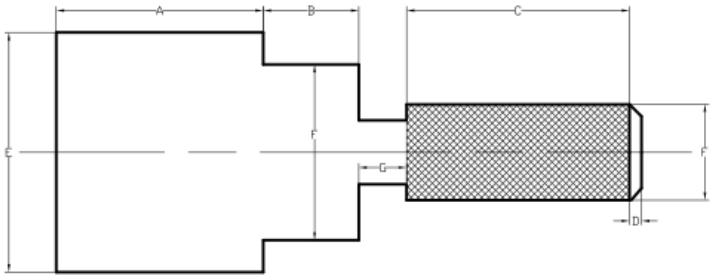
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Step turning & Taper turning



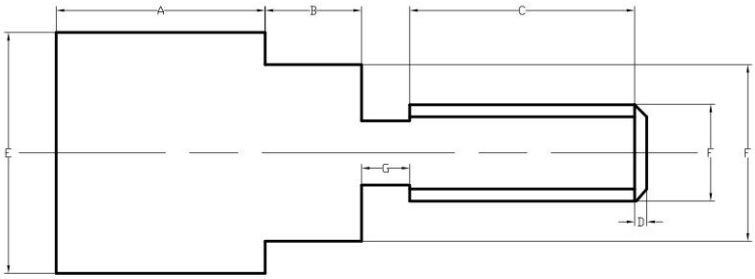
Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Step turning & Knurling



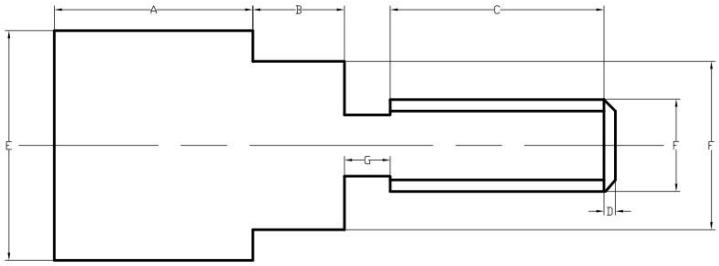
Dimensions			
Sl.No	Part Name	Actual	Obtained

5. Step turning & Thread cutting (L.H.)



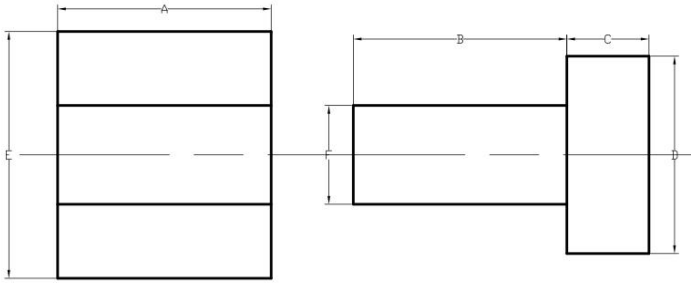
Dimensions			
Sl.No	Part Name	Actual	Obtained

6. Step turning & Thread cutting (R.H)



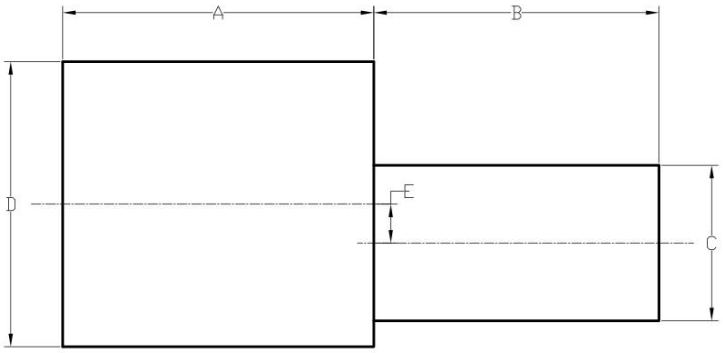
Dimensions			
Sl.No	Part Name	Actual	Obtained

7. Bush: Turning & Drilling



Dimensions			
Sl.No	Part Name	Actual	Obtained

8. Eccentric turning



Dimensions			
Sl.No	Part Name	Actual	Obtained

Drilling section:

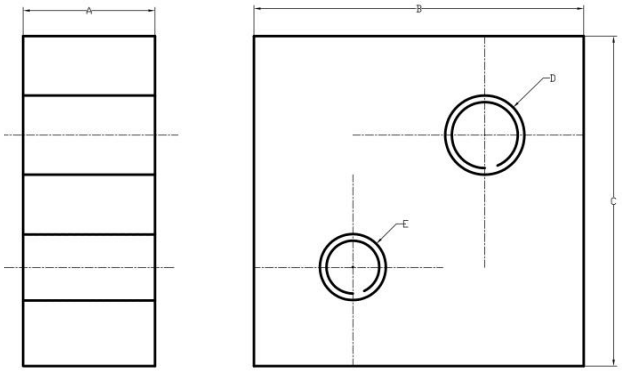
1. Introduction of safety in operating machines.
2. Study of drilling machines and its parts.
3. Study the types of tools used.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools.
6. Operation and practice.
7. Types of measuring instruments and their uses.

Exercises:

Make the following jobs in the drilling machine.

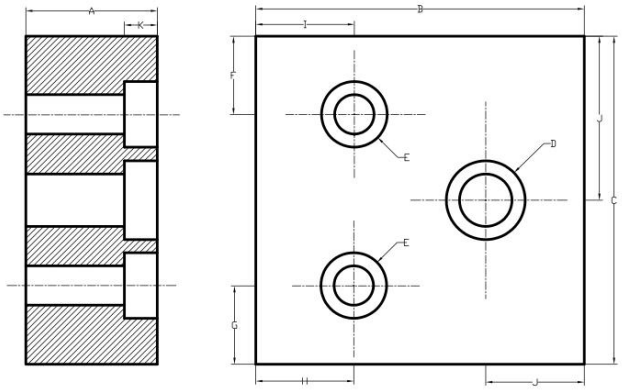
Raw material 50mm X 50mm X 20 mm thick M.S. Flat

1. Drilling & Tapping



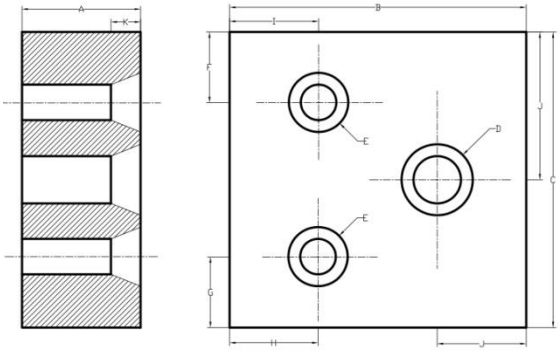
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Drilling & Counter boring



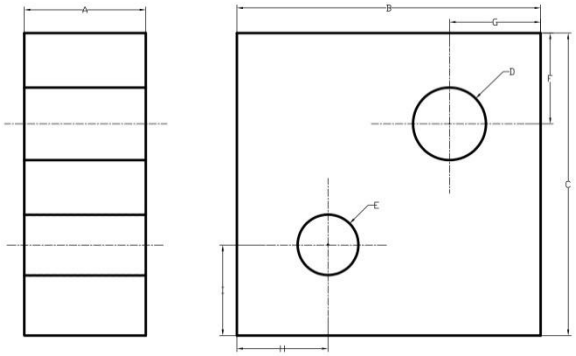
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Drilling & Counter sinking



Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Drilling and Reaming – Radial drilling machine



Dimensions			
Sl.No	Part Name	Actual	Obtained

BOARD EXAMINATION

Note: All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

Lathe	**:**	**45 marks (2hours)**
Procedure / Preparation	10	
Machining / Dimensions	25	
Surface Finishing	10	
Drilling	**:**	**25 marks (1 hour)**
Procedure / Marking	10	
Dimensions	10	
Surface Finishing	5	
Viva-voce	**:**	**05 marks**
Total	**:**	**75 marks**

LIST OF EQUIPMENT

Lathe Section

1. Lathe (Minimum 4 ½')	-	13 Nos.
2. All geared lathe	-	2 Nos.
3. 4 Jaw / 3 Jaw Chucks	-	Required Numbers
4. Chuck key	-	Required Numbers
5. Spanner	-	Sufficient quantity
6. Cutting Tools	-	Sufficient quantity
7. Pitch gauge	-	5 Nos.
8. Thread gauge	-	5 Nos.
9. Vernier Caliper	-	5 Nos.
10. Snap gauges	-	Sufficient quantity
11. Steel Rule (0-150)	-	Sufficient quantity
12. Calipers (Inside / Outside / Jenny)	-	Sufficient quantity
13. Dial Gauge with Magnetic Stand	-	Sufficient quantity
14. Marking Gauge	-	Sufficient quantity
15. Safety Glass	-	15 Nos.

Drilling Section

1. Upright drilling machine	-	2 Nos.
2. Radial drilling machine	-	1 No.
3. Drill bit & Tap set	-	Sufficient quantity
4. Reaming bit	-	Sufficient quantity
5. Counter sinking bit	-	Sufficient quantity
6. Counter boring bit	-	Sufficient quantity
7. Plug gauges	-	Sufficient quantity
8. Vernier Height Gauge	-	1 No.
9. Surface plate	-	2 Nos.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

III SEMESTER

32037 – METROLOGY AND METALLOGRAPHY PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32037

Semester : III

Subject Title : METROLOGY & METALLOGRAPHY PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Metrology & Metallography Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

- Familiarize about measuring techniques of Metrology instruments.
- Select the range of measuring tools.
- Obtain accurate measurements.
- Determine the least count of measuring instruments.
- Study the working principle of Microscope.
- Specimen preparation of ferrous and non-ferrous metals.
- Grinding, polishing and mounting of specimen.
- Non-destructive testing of metals for cracks.
- Crack detection – Visual inspection, Die penetration method
- Prepare the record of work for the exercises.

METROLOGY SECTION:

- Introduction to linear measurement.
- Introduction to angular measurement.

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

Exercises:

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

METALLOGRAPHY SECTION:

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

Exercises:

1. Find the grain structure of the given specimen using the Metallurgical Microscope.
2. Prepare a specimen to examine the micro structure of the Ferrous and Non-ferrous metal.

3. Detect the cracks in the specimen using Visual Inspection and ring test.
4. Detect of cracks in specimen using Die penetration test.
5. Detect the cracks in specimen using Magnetic particle test.

BOARD EXAMINATION

Note: All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

Detailed allocation

Metrology Section		**45**
Procedure / Least Count	15	
Reading / Calculation	20	
Result	10	
Matallography Section		**25**
Procedure	10	
Preparation and observation	10	
Result	5	
Viva voce		**5**
Total		**75**

LIST OF EQUIPMENTS

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32041 – HEAT POWER ENGINEERING

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32041

Semester : IV

Subject Title : HEAT POWER ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Heat Power Engineering	6	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES	17
II	THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION	17
III	AIR COMPRESSORS AND GAS TURBINES	17
IV	FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS	16
V	STEAM BOILERS AND PERFORMANCE OF BOILERS	16
	TEST AND REVISION	7
	Total	90

RATIONALE:

The knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation and steam properties and performance of Boilers are vital.

OBJECTIVES

- Explain a basics of systems, laws of thermodynamics and thermodynamic processes.
- Explain different types of Air Cycles.
- Explain the fuels ands combustion.
- Explain a air compressors and gas turbines.
- Explain a formation and properties of steam and steam calorimeters.
- Explain a steam boilers and performance of boilers.

HEAT POWER ENGINEERING

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES** **Introduction:-** 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 – types - law of conservation of energy – thermodynamic system – types – 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. **Perfect gases: -** laws of perfect gases – Boyle's, Charle's, Joule's, Regnault's and Avogadro's laws – General Gas Equation - Characteristic gas equation – relation between specific heats and gas constant – Universal gas constant –Change in Internal Energy-enthalpy – change in enthalpy – entropy.	17

Thermodynamic processes:- Constant volume, Constant pressure, Constant temp.(isothermal) ,Isentropic (reversible adiabatic) and, Polytropic Processes – p-V and T-s diagrams, work done , change in internal energy , heat transfer , change in enthalpy, change in entropy for above processes – Simple problems – hyperbolic ,Free expansion and throttling processes(Description only) .

Steady flow system: – control volume – steady flow energy equation – assumptions – Engineering applications.

II THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION 17

Air cycles: – air standard efficiency – reversible and irreversible processes – assumptions in deriving air standard efficiency – Carnot cycle – Otto cycle – Diesel cycle - Comparison of ideal and actual p-v diagrams of Otto and Diesel cycles – Simple problems

Fuels & Combustion:

Classifications of fuels - merits and demerits – requirements of a good fuel – Octane number – detonation - Pre-ignition – Cetane number – Diesel knock – comparison of detonation and diesel knock - fuel additives – Stages of Combustion – Delay period – Variables affecting delay period – Methods of generating air swirl in diesel engine combustion chambers – Types of combustion chambers – combustion equations – stoichiometric air required for complete combustion of fuels – excess air – products of combustion – analysis of exhaust gases - calorific value of fuels.

III AIR COMPRESSORS AND GAS TURBINES 17

Air Compressors:- Uses of compressed air – classifications of Air compressor – reciprocating compressor - single stage reciprocating compressor – compression processes – clearance volume and its effects – volumetric efficiency – multi stage compression – merits and demerits – Two stage compressor with imperfect cooling- with perfect inter cooling – rotary compressors – Roots blower - vane blowers – centrifugal and axial flow air compressors – simple problems.

Gas turbines – uses - classifications – merits and demerits -

constant pressure combustion gas turbine – gas turbine with intercooler, reheater, regenerator - effects – closed cycle gas turbines - merits and demerits – jet propulsion - turbojet engines – turbo propeller engines – ramjet – Working principle - merits and demerits –Rocket engines – applications of rockets.

IV FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS **16**

Steam - Properties – formation of steam – saturation temperature – enthalpy of water – enthalpy of evaporation – conditions of steam – dryness fraction – enthalpy of wet, dry and superheated steam - advantages of superheated steam – p-v diagram - T-H diagram – T-S diagram - H-S diagram – P-H diagram – critical conditions of water – specific volume of water and steam – density of steam – external work done during evaporation – internal latent heat – internal energy of steam – entropy of water and steam – steam tables - Mollier chart.

Expansion process of Steam: Constant Volume process – Constant Pressure Process – Constant Temperature process – Hyperbolic Process – Isentropic process – Polytrobic process – Throttling process. – Simple problems.

Steam Calorimeter: Determination of dryness fraction of steam – bucket calorimeter - combined separating and throttling calorimeters.

V STEAM BOILERS AND PERFORMANCE OF BOILERS **16**

Steam Boilers: Introduction - Classification of boilers – comparison of fire tube and water tube boilers – high pressure boilers – advantages of high pressure boilers - Lamont and BHEL high pressure boilers – boiler mountings and accessories - function - construction and working – comparison of mountings and accessories – feed water treatment – internal and external treatments - starting boiler from cold condition – safety precautions in boiler operation – causes of Indian boiler act.

Performance of boilers: Evaporation rate - actual, equivalent and factor of evaporation – boiler efficiency – factors influencing boiler

efficiency - boiler power – Simple problems – boiler plant - efficiency of economizer and super heater – Simple problems - boiler trial – heat losses in a boiler- heat balance sheet – Simple problems

Text Book:

1) Thermal Engg, R.K .Rajput , ,8th Edition, Laxmi publications, Pvt Ltd , New Delhi.
2) Applied Thermodynamics ,P.K. Nag, ,2nd Edition,TATA Mcgraw - Hill Publishing Company,
3) New Delhi .
4) Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition,S.Chand&Co,NewDelhi

Reference Books:

1) Thermal Engineering ,P.LBallaney , 24th Edition ,Khanna Publishers, New Delhi.
2) Thermal Engineering ,B.K. Sarkar , 3rd Edition , DhanpatRai& Sons New Delhi .
3) Applied Thermodynamics, Domkundwar and .P.Kothandaraman, 2ndEdition, Khanna publishers, New Delhi.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32042 – SPECIAL MACHINES

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32042

Semester : IV

Subject Title : SPECIAL MACHINES

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours /Week	Hours/ Semester	Marks			Duration
Special Machines	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	Manufacturing of Plastic Components and Composite Manufacturing	14
II	Reciprocating Machines and Broaching Machine	14
III	Milling Machines and Gear Generating Processes	14
IV	Abrasive Process and Non- Conventional Machining Processes	13
V	CNC Machine and Its Components	13
	TEST AND REVISION	7
	Total	**75**

RATIONALE:

In the process of manufacturing we should possess adequate and through knowledge about the working of conventional as well as non conventional machines.

The topics included aim to inculcate in the students the skills of metal cutting, milling, grinding, CNC machines and other machining processes which are very much essential for a technician to at promptly and with precision.

OBJECTIVES:

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

SPECIAL MACHINES

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**MANUFACTURING OF PLASTIC COMPONENTS**	14
	Plastic Components: Types of plastics - Engineering plastics – thermosets – composite - structural foam, elastomers - polymer alloys and liquid crystal polymers. Factors Influencing the Selection Of Plastics - Mechanical properties – degradation - wear resistance - frictional properties - special properties –processing – cost **Processing of Plastics:** Extrusion-general features of single screw extrusion -twin screw extruders. Injection moulding types: Plunger type - Reciprocating screw injection - details of injection mould - structural foam injection mould - sandwich moulding - gas injection moulding - injection moulding of thermosetting materials - calendaring and rotational moulding. Design consideration for plastic components.	

Composite manufacturing: Introduction – characteristics of composite manufacturing - constituents – Glass fibers manufacturing process – hand laminating process – autoclave processing – filament winding – pultrusion process – liquid composite process – working principles by schematic diagram only – advantages – disadvantages.

II RECIPROCATING MACHINES **14**

Planer: Introduction - description of double housing planer – specifications -principles of operation – drives - quick return mechanism - feed mechanism - work holding devices and special fixtures - types of tools - operations.

Shaper: Introduction – specifications – principles of operations standard shaper – quick return mechanism - crank and slotted link – hydraulic shaper - feed mechanism - work holding devices – fixture - operations.

Slotter: Introduction – specifications - method of operation - Whitworth quick return mechanism - feed mechanism - work holding devices - types of tools.

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

III MILLING MACHINES AND GEAR GENERATING PROCESSES **14**

Milling Machines: Types - column and knee type – plain - universal milling machine - vertical 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 - woodruff milling cutter - fly cutter - nomenclature of cylindrical milling cutter. Milling operations: straddle milling - gang milling - vertical milling attachment.

Indexing plate – differential indexing - simple indexing – compound indexing – simple problems.

Generating Process: gear shaper - gear hobbing - principle of operation only. Gear finishing processes: burnishing – shaving - grinding and lapping - gear materials.

IV ABRASIVE PROCESS AND NON- CONVENTIONAL MACHINING PROCESSES **13**

Abrasive Process: Types and classification – specifications - rough grinding – pedestal grinders - portable grinders - belt grinders - precision grinding - cylindrical grinder - centerless grinders – surface grinder - tool and cutter grinder - planetary grinders - principles of operations - grinding wheels – abrasives - natural and artificial diamond wheels - types of bonds - grit, grade and structure of wheels - wheel shapes and sizes - standard marking systems of grinding wheels - selection of grinding wheel - mounting of grinding wheels - Dressing and Truing of wheels - Balancing of grinding wheels.

Non-Conventional Machining Processes: Construction, working and applications of Ultrasonic machining - chemical machining - electro chemical grinding - electrical discharge machining - plasma arc machining - LASER machining - Advantages – Disadvantages.

V CNC MACHINE AND ITS COMPONENTS **13**

CNC Machines: Numerical control – definition – working principle of a CNC system – Features of CNC machines - advantage of CNC machines – difference between NC and CNC – Construction and working principle of turning centre – Construction and working principle of machining centre – machine axes conventions turning centre and machining centre – Coordinate measuring machine – construction and working principle.

Components of CNC machine: Slide ways – requirement – types – friction slide ways and antifriction slide ways - linear motion bearings – recirculation ball screw – ATC – tool magazine – feedback devices – linear and rotary transducers – Encoders - in process probing - tool material – tool inserts.

Text Book:

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

Reference Book:

1. Production Technology, HMT, Edn. 18, published by Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.
2. Manufacturing process, Myro N Begman, , Edn. 5, Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.
3. Workshop Tech Vol I,II, III, WAJ. Chapman, published by Viva Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
4. Production processes, NITTTR, published by 5, Tata McGraw Hill Publishing Co. Ltd., West Patel Nagar, New Delhi 110 008.
5. Principles of the manufacturing of Composite materials – Suong V Hoa, DES tech publication. Inc, 439, North Duke street, Lancaster, Pennsylvania – 17602 U.S.A.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32043 – FLUID MECHANICS AND FLUID POWER

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32043

Semester : IV

Subject Title : FLUID MECHANICS & FLUID POWER

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours /Week	Hours/ Semester	Marks			Duration
Fluid Mechanics and Fluid Power	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS	14
II	FLOW OF FLUIDS AND FLOW THROUGH PIPES	14
III	IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS	14
IV	PNEUMATIC SYSTEMS	13
V	HYDRAULIC SYSTEMS	13
	TEST AND REVISION	7
	Total	75

RATIONALE:

The main objective of this subject Fluid mechanics and Fluid power is to study the behavior of fluids under the condition of rest and motion. This chapter deals with

fluid pumps, turbines, hydraulic and pneumatic operation. The overall object is to impart knowledge of pumps, hydraulic and pneumatic operation of tools and equipments.

OBJECTIVES:

- Define the properties of Fluids.
- Explain the working of pressure measuring devices
- Explain continuity equation and Bernoulli's Theorem
- Assess the impact of frictional loss of head in flow through pipes
- Estimate the discharge through orifices
- Distinguish the working principles of pumps and turbines.
- Explain the working of centrifugal pumps and reciprocating pumps.
- Compare pneumatic system with hydraulic system
- Draw Pneumatic circuits for industrial application.
- State the properties of hydraulic Systems
- Develop hydraulic circuit for machine tools applications.

FLUID MECHANICS & FLUID POWER
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS**	**14**
	Introduction - Definition of fluid - Classification of Fluids - ideal and real fluids -Properties of a fluid – definition and units - Pressure-units of Pressure - Pressure head-atmospheric, gauge and absolute pressure – problems - Pascal's law- proof - applications of Pascal's law - Hydraulic press - Hydraulic jack - Pressure measurement - Piezometer tube - Simple U-tube manometer - Differential U-tube manometer - Inverted Differential manometer - Micro-manometer - Inclined tube micro-manometer - Mechanical Gauges -Bourdon's Tube Pressure Gauge - Diaphragm pressure gauge - Dead weight pressure gauge.	

II FLOW OF FLUIDS AND FLOW THROUGH PIPES **14**

Types of fluid flow - path line and stream line - mean velocity of flow - discharge of a flowing fluid - equation of continuity of fluid flow - energies of fluid - Bernoulli's theorem - statement, assumptions and proof - applications and limitations of Bernoulli's theorem - problems on Bernoulli's theorem – venturimeter - derivation for discharge - orifice meter - derivation for discharge - difference between venturimeter and orifice meter -problems on venturimeter and orifice meter - Pitot tube – description only – orifice –types – applications - hydraulic co-efficient - determining hydraulic co-efficient – problems - discharge through a small orifice discharging freely only - problems – experimental method of finding C_v, C_c and C_d - Flow through pipes - laws of fluid friction - hydraulic gradient line - total energy line - wetted perimeter - hydraulic mean radius - loss of head due to friction – Darcy - Weisbach equation and Chezy's formula –problems - minor losses (description only) - Power transmission through pipes - problems.

III IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS **14**

Impact of jet - on a stationary flat plate held normal to the jet and inclined to the direction of jet - Impact of jet on a flat plate moving in the direction of jet - Impact of jet on a series of moving plates or vanes - force exerted and work done by the jet - problems. Hydraulic turbines – classifications - Pelton wheel - components and working - speed regulation (theory only) - Francis and Kaplan turbines - components and working - draft tube - functions and types - surge tank - differences between impulse and reaction turbines.

Centrifugal Pumps – classifications - construction and working of single stage centrifugal pumps - components with types - theory only - multi stage pumps – advantages - priming – cavitation.

Reciprocating Pumps – classifications - construction and working of single acting and double acting reciprocating pumps - plunger and piston pumps - discharge of a reciprocating pump - theoretical power

required - coefficient of discharge – slip – problems - negative slip - indicator diagram – separation - air vessel (functions and working) - Special pumps - Jet pump - Turbine pump - Submersible pump.

IV PNEUMATIC SYSTEMS **13**

Pneumatic Systems **–** elements – filter – regulator - lubricator unit - pressure control valves - pressure relief valves - pressure regulation valves - directional control valves - 3/2 DCV - 5/2 DCV – 5/3 DCV flow control valves – throttle valves –shuttle valves – quick exhaust valves – ISO symbols of pneumatic components – pneumatic circuits – direct control of single acting cylinder – operation of double acting cylinder – operation of double acting cylinder with metering-in control - operation of double acting cylinder with metering-out control – use of shuttle valve in pneumatic circuits – use of quick exhaust valve in pneumatic circuits - automatic operation of double acting cylinder single cycle – multiple cycle – merits and demerits of pneumatic system - applications.

V HYDRAULIC SYSTEMS **13**

Hydraulic system – Merits and demerits – Service properties of hydraulic fluids Hydraulic accumulators – Weight of gravity type accumulator – Spring loaded type accumulator - Gas filled accumulator – Pressure intensifier – Fluid power pumps – External and internal gear pump, Vane pump, Radial piston pump – ISO symbols for hydraulic components – Hydraulic actuators – Cylinders and motors – Valves – Pressure control valves, Flow control valves and direction control valves – types – including 4/2 DCV and 4/3 DCV – their location in the circuit.

Hydraulic operation of double acting cylinder with metering-in and metering-out control – application of hydraulic circuits – Hydraulic circuit for - shaping machine - table movement in surface grinding machine and milling machine – comparison of hydraulic and pneumatic systems.

Text Books :

1) A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, - Edn.18, S.Chand & Co., Ram Nagar, New Delhi – 110 055, Ram Nagar, New Delhi

2) A Text Book of Fluid Mechanics and Hydraulic Machines – by, R. K Rajput and S.Chand & Co,Ram Nagar, New Delhi – 110 055.

Reference Books:

1) Hydraulic Machines, Jagadishlal, , Metropolitan Book Co. Pvt. Ltd., 1, Faiz Bazaar, New Delhi – 110 006.
2) Hydraulics,Andrew Parr (A Technician's and Engineer's Guide)
3) Fundamentals of pneumatic control Engineering -FESTO Manual
4) Fluid Mechanics and Hydraulic Machines,R. K. Bansal, Laxmi Publications Pvt.,Ltd,22,Golden House, Daryaganj, New Delhi – 110 002

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32044 – ELECTRICAL DRIVES AND CONTROL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32044

Semester : IV

Subject Title : ELECTRICAL DRIVES AND CONTROL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours /Week	Hours/ Semester	Marks			Duration
Electrical Drives and Control	6	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	DC CIRCUITS AND DC MACHINES	14
II	AC CIRCUITS AND AC MACHINES	14
III	STEPPER AND SERVO MOTORS & DRIVES	14
IV	POWER SUPPLIES AND LOGIC GATES	13
V	CONTROL ELEMENTS AND PLC	13
	TEST AND REVISION	7
	Total	**75**

RATIONALE:

The automation is being the order of the day to improve the production with high quality consciousness. Such automation involves electrically operated switches, sensors controlled through electrically driven motors and actuators. The subject aims in introducing the basic electrical DC and AC circuits and motors and also focuses

on the various special control devices like stepper, servo drives and its controlling elements.

OBJECTIVES:

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

ELECTRICAL DRIVES & CONTROL

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**DC CIRCUITS AND DC MACHINES**	**17**
	Definition- Electric current, voltage and resistance -Ohm's law and Kirchoff's law. Resistance in series and parallel and series, parallel – simple problems electromagnetism(definitions only) – magnetic flux, flux density magnetic field intensity, MMF, permeability, reluctance, Faraday's law of electromagnetic induction, electrical and mechanical units	
	DC generators – construction, principle of operation, types and application.	
	DC motors: - construction, principle of operation, types and application.	
	Necessity of starters: Three point, four point starters.	

II	**AC CIRCUITS AND AC MACHINES**	**17**

Fundamentals of AC voltage, and current – peak, average, RMS value of sine wave, frequency, time period, amplitude, power and power factor (definition only)- star and delta connection relationship between phase, line voltage and current in star and delta connections.

Transformer: Principle of operation and construction – EMF equation (no definition)- losses in Transformer – efficiency – application.

Alternator construction – principle of operation – types and applications.

AC machine: AC motors- Principle of operation of single phase capacitor start and universal motor induction motor- applications- Three phase induction motors – Squirrel cage and slip ring Induction motors (construction and working principle only) - application – speed control of 3Φ Induction motor -Necessity of starters – DOL and star/delta starter.

III	**STEPPER AND SERVO MOTORS & DRIVES:**	**17**

PMDC, Stepper motor- construction and working principle and applications - Servo motor – types: brushless servo motor, permanent magnet servo motor construction and applications.

Industrial drives- types, group drive, individual drive, multi motor drive, block diagram of Variable frequency drive , stepper motor drive: single stepping and half stepping. Servo drives.

Electrical safety: - importance of earthing - electric shock: first aid, precautions - causes of accident and their preventive measures. Energy conservation

IV	**POWER SUPPLIES AND LOGIC GATES**	**16**

Diode – terminals: anode and cathode, forward biasing and reverse biasing – use of diode in rectifiers – half wave and full wave – necessity of filters- Regulated power supplies: IC voltage regulators – SMPS, UPS and Inverters – General description and their applications.

Display devices – LED, 7 segment LED, LCD

Logic gates: Positive and negative logic, definition, symbol truth table, Boolean expression for OR, AND, NOT, NOR, NAND, EXOR AND EXNOR gates – Universal logic Gates: NAND, and NOR.

V CONTROL ELEMENTS AND PLC **16**

Fuses – selection of fuse – necessity of fuse- fuse switch units.

Sensors: Photo electric sensor, Inductive proximity sensors, Temperature sensors.

Switches: Push button switch, selector switch, limit switch, pressure switch,

temperature switch, float switch and reed switch.

Relays – NO, NC – usage- bimetallic thermal overload relays.

Contactors- usage – necessity of contactor- Solenoid type contactor

Circuit breakers – Miniature case Circuit breaker (MCCB) and Miniature Circuit

breaker (MCB), Oil Circuit breakers (OCB), Earth leakage circuit breaker (ELCB)

Features of PLC-PLC Block diagram- PLC scan - Fixed and modular PLC Ladder logic-NO, NC contacts-Coils-AND, OR.

Text Books:

1) A course in electrical engineering - B.L.Theraja - Multi Colour Edition, S Chand & Co, Reprint 2006
2) Control of Machines - S.K Bhattacharya, Brijinder Singh – New Age Publishers, Second Edition- Reprint 2010
3) Electronic Circuits & System- Analog and Digital – Y.N.Bapat - Tata Mc Graw Hill.

Reference Books:

1) Electrical Technology – Hughes - 8th Edition, Pearson Education.
2) Electronic Device and Circuits- An introduction – Allen Mottershed - Prentice Hall of India.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32045 – STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32045

Semester : IV

Subject Title : STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
Strength of Materials and Fluid Mechanics Practical	Hours/ Week	Hours/ Semester	Marks			Duration
	4	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

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

Strength of Materials Laboratory

Exercises

1.Test on Ductile Materials:

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

2. Hardness Test:

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

3. Torsion test:

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

4. Impact test:

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

5. Tests on springs of circular section:

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

6. Shear test:

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

Fluid Mechanics Laboratory

Exercises

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

BOARD EXAMINATION

Note: All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section.

All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

Detailed allocation

Strength of material lab			
Part A	**-**		**35 marks**
Observation	-	10	
Tabulation / Calculation	-	20	
Result / Graph	-	5	
Fluid mechanics lab			
Part B	**-**		**35 marks**
Observation	-	10	
Tabulation / Calculation	-	20	
Result / Graph	-	5	
Viva-voce	**-**		**05 marks**
Total	**-**		**75 marks**

LIST OF EQUIPMENTS

1. UTM 01
2. Rockwell's Hardness Testing Machine 01
3. Torsion testing machine 01
4. Impact testing machine 01
5. Spring testing arrangements 01
6. Shear testing machine 01
7. Vernier calliper 02
8. The Bernoulli's Apparatus 01
9. An Open tank fitted with a small orifice / an external mouth piece and a collecting tank with Piezometer 01
10. A Centrifugal pump having the discharge line with venturimeter / orifice meter arrangement 01
11. An arrangement to find friction factor of pipe 01
12. A reciprocating pump with an arrangement for collecting data to find out the efficiency and plot the characteristics curves. 01
13. A centrifugal pump with an arrangement for collecting tank to find out the efficiency and plot the characteristics curves. 01
14. A impulse turbine with an arrangement for calculating data to find out the efficiency 01
15. A reaction turbine with an arrangement for collecting data to find out the efficiency 01

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32046 – SPECIAL MACHINES PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32046

Semester : IV

Subject Title : **SPECIAL MACHINES PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

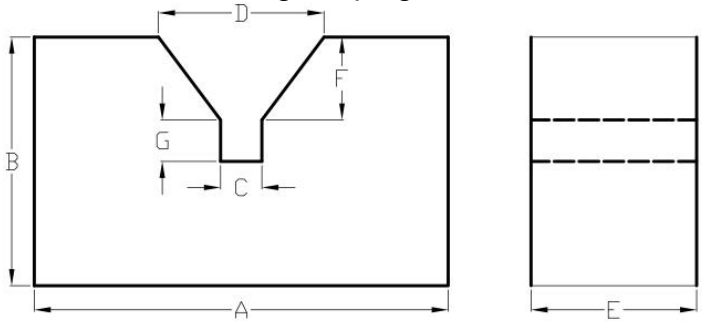
<table>
<tr><th>Subject</th><th colspan="2">Instructions</th><th colspan="4">Examination</th></tr>
<tr><td rowspan="3">Special Machines Practical</td><td>Hours /Week</td><td>Hours/ Semester</td><td colspan="3">Marks</td><td>Duration</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">60</td><td>Internal Assessment</td><td>Board Examination</td><td>Total</td><td rowspan="2">3 Hrs</td></tr>
<tr><td>25</td><td>75</td><td>100</td></tr>
</table>

OBJECTIVES:

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

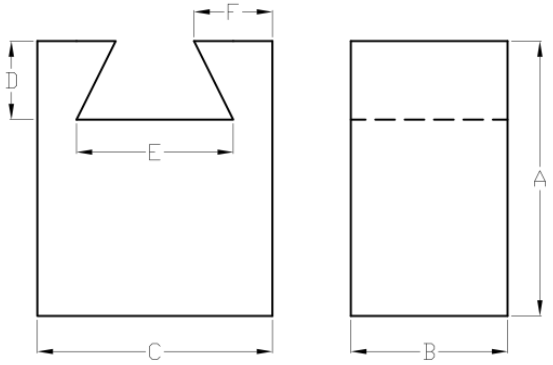
EXERCISES: **Raw Material: M.S. / C.I**

1. Make 'V' Block using shaping machine



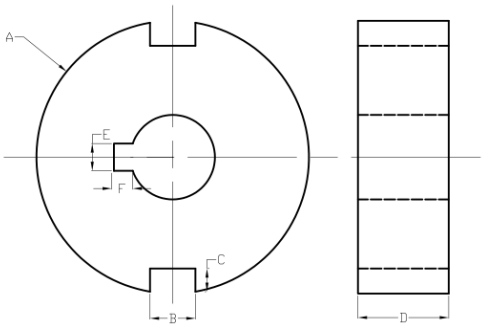
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Make dovetail using shaping machine



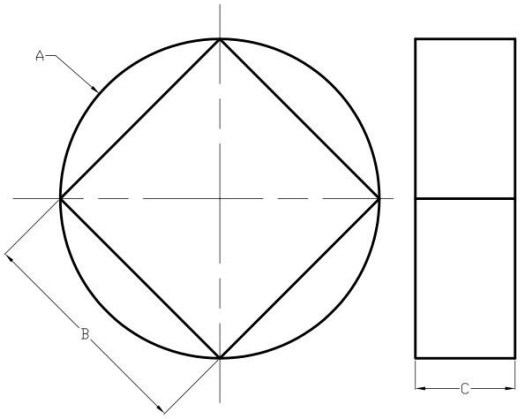
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Make groove cut using slotting machine



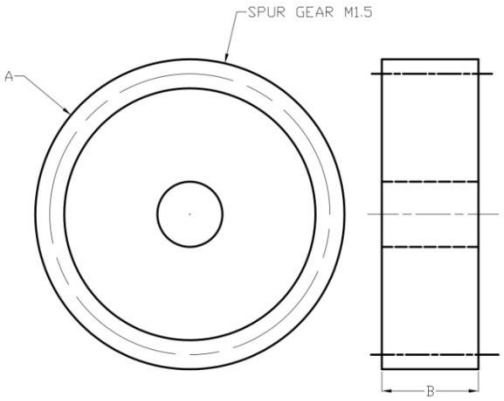
Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Make round to square in milling machine.



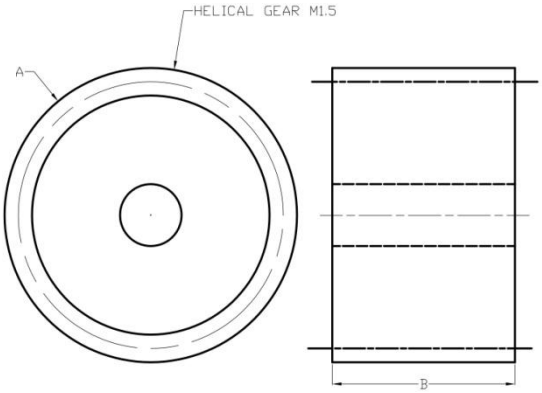
Dimensions			
Sl.No	Part Name	Actual	Obtained

5. Make Spur Gear using milling machine by Differential Indexing.



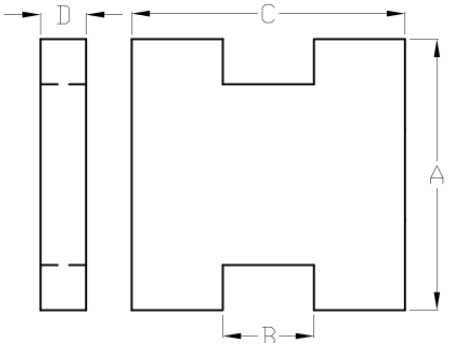
Dimensions			
Sl.No	Part Name	Actual	Obtained

6. Make Helical Gear using milling machine



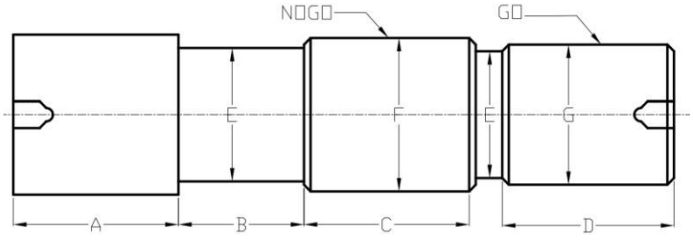
Dimensions			
Sl.No	Part Name	Actual	Obtained

7. Make slot cut using milling machine.



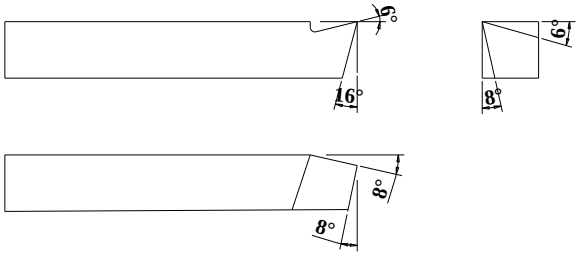
Dimensions			
Sl.No	Part Name	Actual	Obtained

8. Make Progressive type Plug gauge using Cylindrical Grinding machine



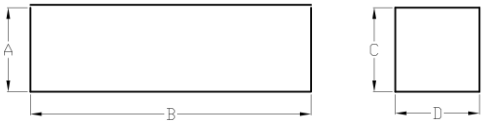
Dimensions			
Sl.No	Part Name	Actual	Obtained

9. Make a turning tool using Tool and Cutter Grinder



Dimensions			
Sl.No	Part Name	Actual	Obtained

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



Dimensions			
Sl.No	Part Name	Actual	Obtained

BOARD EXAMINATION

Note: All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book must be submitted for the examination.

ALLOCATION OF MARKS

Job preparation / Marking	15
Setting / Operations	30
Dimensions / Surface Finish	25
Viva voce	5
Total	**75**

LIST OF EQUIPMENTS

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32047 – ELECTRICAL DRIVES AND CONTROL PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32047

Semester : IV

Subject Title : ELECTRICAL DRIVES AND CONTROL PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Electrical Drives and Control Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

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

LIST OF EXPERIMENTS:

Part A:

1. Verification of Ohm's Law
2. Testing of DC starters – 3 point and 4 point starter
3. Load test on DC shunt motor
4. Testing of AC starters - DOL , star - Delta starter
5. Load test on single phase induction motor
6. Load test on three phase squirrel cage motor
7. Testing of relays, contactors, push buttons and limit switch
8. Connection and Testing of MCB, ELCB

Part B

9. Construction and testing of Half wave and Full wave rectifier.
10. Construction and testing of IC voltage regulator using IC 7805.
11. Verification of truth tables for logic gates.
12. Verification of universal gates.
13. Identification and testing of display devices- LED, 7 segment LED, Laser diode.
14. Testing of Stepper motor drive.
15. Testing of Servo motor drive.

BOARD EXAMINATION

Note: All the exercises are to be completed. One exercise from Part A and another one from Part B should be given for the Examination.

Part A:			**35**
	Circuit diagram	05	
	Connections & Readings	15	
	Calculations & Graph	15	
Part B:			**35**
	Circuit diagram	05	
	Connections & Readings	15	
	Execution	15	
	Viva Voce		**5**
Total			**75**

LIST OF EQUIPMENTS

Electrical Lab

1. DC ammeter 0-5A - 1no
2. DC ammeter 0-25A - 1no
3. DC voltmeter 0-30V - 1no
4. DC voltmeter 0-300V - 1no
5. Rheostat 10.8 ,8.5A - 1no
6. AC ammeter 0-5A - 1no
7. AC ammeter 0-10A - 2nos.
8. AC voltmeter 0-50V - 3nos
9. AC wattmeter 5A-10A - 3nos
   (0-750W,0-600V)
10. Loading rheostat 5A,230V - 1no
11. Tachometer 0-1000rpm - 1no
    (Analog type)
12. Variac 20A,250V - 2nos
    (Auto transformer)
13. 3 point starter 20A,220V - 1no
14. DOL starter 16A,415V - 1no
15. Star /Delta starter 20a,600V - 1no
16. Over load relay 1 to 2.5A - 1no
17. Air break contactors 20A,220V - 4nos
18. Push button 2A ,220V - 2nos
19. Limit switch 20A,220V - 1no
20. MCB 20A single pole - 1no
21. MCB 20A double pole - 1no
22. ELCB 2pole 20A,100mA - 1no
23. ELCB 4POLE 20A,100mA - 1no

Electronics Lab

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32051 – DESIGN OF MACHINE ELEMENTS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32051

Semester : V

Subject Title : DESIGN OF MACHINE ELEMENTS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Design of Machine Elements	6	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	Design of Joints And Fasteners	17
II	Design of shafts, couplings and keys	17
III	Design of friction drives (flat belt and v-belt)	17
IV	Design of bearings	16
V	Design of levers and spur gears	16
	REVISION AND TEST	7
	Total	90

RATIONALE:

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

OBJECTIVES:

- Design riveted joints, welded joints, sleeve and cotter joint and knuckle joint.
- Design eye bolts, cylinder cover studs.
- Design shafts, keys and couplings required for power transmission.
- Compare the different types of couplings.
- Design flat and V-belt for power transmission.
- Study the various types of bearings and their applications.
- Design journal bearings.
- Design spur gear used for power transmission.
- Design hand lever, foot lever and cranked lever.

DESIGN OF MACHINE ELEMENTS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**ENGINEERING MATERIALS, JOINTS AND FASTENERS**	17
	General Considerations in Machine Design. Engineering materials - Factors affecting selection of material – BIS designation of Ferrous materials – Preferred number - Factor of safety and allowable stress – Stresses: Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion - problem. Creep strain and Creep Curve- Fatigue, S-N curve, Endurance Limit - Stress Concentration – Causes & Remedies. Theories of Elastic Failures – Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory. **Joints**: Design of sleeve and cotter joint, knuckle joint and welded joint. **Fasteners:** Design of bolted joints - eye bolts.	
II	**DESIGN OF SHAFTS, KEYS AND COUPLINGS**	17
	Shafts: Design of shafts subjected to – twisting moment – bending moment – combined twisting and bending moments – fluctuating loads – design of shafts based on rigidity.	

Keys: Types of keys - design of sunk keys only - Effect of keyways on shaft-problems.

Couplings: Requirements of good couplings – types - design of - rigid protected type flange couplings - marine couplings – pin type flexible coupling (Description only).

III DESIGN OF FLAT BELTS AND V-BELTS **17**

Flat Belts: Types of belts - materials for belt -– types of belt drives – Speed ratio – effect of slip - length of flat belts –Tension Ratio $T1/T2=e^{\mu\theta}$- centrifugal tension - power transmitted – condition for maximum power - transmission – Initial Tension - problems - design procedure of flat belts - design of flat belt based on manufacturer's data only – problems.

V-Belts: V-belt drive - comparison with flat belt drive - designation of V-belts – length of belt - power transmitted – Design of V-belt using manufacturer's data only – Problem.

IV DESIGN OF BEARINGS **16**

Bearings: Classifications of bearings – sliding contact and rolling contact bearings - radial and thrust bearings - roller bearing – types - Designation of ball bearings - materials used for bearings - journal bearings - heat generated - heat dissipated - cooling oil requirement – problems - design of journal bearings –Problems.

Design based on approved data books only.

V DESIGN OF LEVERS AND SPUR GEARS **16**

Levers: Types of levers – applications - mechanical advantage – leverage - displacement ratio - design of-hand lever-foot lever-cranked lever - problems.

Spur gears: Gear drives - merits and demerits over belt drive – Classification of gears - gear materials - spur gear terminology - design of spur gears based on Lewis & Buckingham equation - Problems – speed reducer – types –(Approved data books only).

Text Book:

1) Machine Design, Pandya & Shah, Edn. 1995, Charotar Publishing House.
2) Machine Design, T. V. Sundararajamoorthy & N. Shanmugam, Revised Edition June-2003–Anuradha Publications, Kumbakonam.
3) Design Data Book – by PSG College of Technology, DPV Printers, Coimbatore.

Reference Book:

1) A text book of Machine Design, R.S. Khurmi & J.K.Gupta, Edn. 18,Eurosia Publishing House Pvt. Limited, New Delhi-110 055.
2) Machine Design Bandari,
3) Theory and Problems of Machine Design, Holowenko, Laughlin, Schaum's outline Series.

BOARD EXAMINATIONS

QUESTION PATTERN

Note:

1. Five questions will be asked, one question from each unit in either or pattern. All the five questions are to be answered.
2. Each question carries 15 marks. These questions may have sub-divisions also.
3. **P.S.G. DESIGN DATA BOOK IS PERMITTED.** (Required abstract pages of the P.S.G. Design Data Book Certified by the Chief Supdt. may be permitted.)

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32052 – THERMAL AND AUTOMOBILE ENGINEERING

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32052

Semester : V

Subject Title : THERMAL AND AUTOMOBILE ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Thermal and Automobile Engineering	6	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	THERMAL POWER PLANT, STEAM TURBINES & CONDENSERS, REFRIGERATION AND AIR CONDITIONING	17
II	IC ENGINES AND ITS COMPONENTS	17
III	AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM & FUEL FEED SYSTEMS	17
IV	AUTOMOBILE TRANSMISSION AND POWER TRAINS & CHASSIS	16
V	AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL	16
	REVISION AND TEST	7
	Total	90

RATIONALE:

Study of thermal power plant, turbines and condensers are required to know about the generation of electric power. The study about the Refrigeration and Air-conditioning are required. Automobile is one of the key areas of development in India facilitated by Multinational Companies. As Automobile is the Major sources of employing man power a thorough knowledge on Automobile Engine construction and its functioning is required with due consideration on pollution control.

OBJECTIVES:

- Explain the fundamental of thermal power plant and steam turbines and condensers..
- Explain the refrigeration and air conditioning.
- Explain the components of IC engines.
- Explain the performance tests on IC engines.
- Compare the modes of heat transfer and evaluate the heat transfer by various modes.
- Explain the cooling system and lubrication system of the IC engines.
- Explain the fuel feed system.
- Explain the transmission systems and power trains of automobile.
- Study about the Brake systems and electrical components
- Study the pollution and its standards.

THERMAL AND AUTOMOBILE ENGINEERING
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**THERMAL POWER PLANT, STEAM TURBINES & CONDENSERS, REFRIGERATION AND AIR CONDITIONING,** 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.	17

Basic steam power cycles – Carnot, Rankine and modified Rankine cycles – classification of steam turbine - Impulse and reaction turbines - Difference – necessity of compounding – Methods of compounding.

Steam condensers – elements of condensing plant – classification of condensers – jet condenser – surface condensers – Comparison of jet and surface condensers – sources of air in condenser – condenser vacuum – vacuum efficiency – condenser efficiency - mass of cooling water required – mass of air present – number of tubes – simple problems.

Refrigeration – Definition – COP – Unit of refrigeration - Vapour Compression system – Absorption system – Refrigerant – properties. Air-conditioning – Definition – Centralised air conditioning.

II IC ENGINES AND ITS COMPONENTS 17

Internal combustion engines

Classifications of I.C Engines – four stroke cycle petrol and diesel engines – two stroke cycle petrol and diesel engines - comparison of four stroke and two stroke engines.

Basic Engine Components:– Functions, types, materials and construction of – Cylinder block – Crankcase – Cylinder head – cylinder liners – Comparison of liners – Piston – piston rings – types of compression rings and oil control rings – piston pin – Connecting rod - Crankshaft – flywheel – Cam shaft –Valve and Valve mechanism – Types.

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 efficiencies – Specific fuel consumption – Morse test – procedure – heat balance sheet – simple problems**.**

III AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM & FUEL FEED SYSTEMS 17

Cooling systems – purpose – types – air and water cooling systems

– thermo siphon system - pump assisted water cooling systems – merits and demerits – troubles in cooling system.

Lubrication systems – purpose – types of lubricants – additives – Service rating of oil – types of lubricating systems - Full pressure system – oil pumps - oil filters – full flow and bypass filter systems - Troubles in lubrication system – causes and remedies..

Fuel Feed Systems:

Layout of fuel feed system of petrol engine – types of fuel feed systems – A.C. Mechanical fuel pump – S.U. Electrical fuel pump – fuel filter – Air cleaners - types – Carburetion – Classification of Carburetors – Simple carburetor – Solex Carburetor - Construction and operation – petrol injection – merits and demerits – DTSI – VTI – CCVTI – PGMFI – MPFI system description only.

IV AUTOMOBILE TRANSMISSION AND POWER TRAINS & CHASSIS **16**

Transmission And Power Trains:

General arrangement of power transmission system – front engine rear drive – rear engine rear drive – front engine front drive - four wheel drive – applications – clutch – function – components – Types - Single plate , multi plate and diaphragm spring clutch – fluid coupling – Clutch troubles and their causes.

Gear box – purpose – types of gear boxes – sliding mesh, constant mesh and synchromesh – floor shift gear changer – gear box troubles and their causes.

Drive line – propeller shaft – Universal joint – Cross type only – slip joint – final drive – function – types of gear arrangement – Hotch kiss drive – Torque tube drive – radius rod.

Differential – purpose – Construction and operation – Self locking and non slip differential – Differential troubles and their Causes – Semi floating, three quarter floating and full floating rear axles.

Automobile Chassis:

Front axle – Stub axle – Types – Steering system – Ackermann Principle of Steering – Wheel alignment – Factors – Camber ,

Caster , King pin inclination , Toe in and Toe out on turns - Steering linkages – Steering gears – Cam and double roller , recirculating ball type , Rack and Pinion – Steering troubles and causes – power steering – Necessity – types – Layout of any one type – Collapsible Steering system.

Suspension system – Functions – Leaf , coil and Torsion bar – Front suspension systems – independent front suspension – merits and demerits – types – rear end suspension – Air suspension - shock absorber – purpose – telescopic type construction and working.

V AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL **16**

Brake system – functions – classification of brakes – drum brakes – leading shoe and trailing shoe – Self energizing action – hydraulic brake – brake bleeding - Air assisted hydraulic brakes – Air brake – layout – disc brakes – construction and working – brake troubles and their causes – anti lock brake system. Wheels – types of wheels.

Battery – lead acid battery – Nickel alkaline battery – construction – battery rating – charging - testing – starting circuit - construction and operation of starter motor – starting motor drives – over running clutch and Bendix drive – construction and operation – solenoid switch - Charging circuit – alternator construction and operation – regulators – Dynamo.

Ignition system – Types – battery coil ignition system –High tension magneto – electronic ignition – Ignition system troubles and remedies.

Lighting system – circuit – Head light – Aiming and adjustment – sealed beam head lights – directional signal circuits – fluorescent lamp - Horn circuits – Wind screen wiper.

Pollution – Pollutants – source of pollutants – pollution control techniques for petrol and diesel engines emissions – controlling crank case emission (PCV) – controlling evaporative emission (VRS , VSS , VVR , ECS and EEC) – Treatment of exhaust gas (Catalytic converter , EGR) – introduction to automobile electronics

– radio interference – suppressors – audio, video systems.

Text Books :

1) Thermal Engg, R.K . Rajput , ,8th Edition, Laxmi publications Pvt Ltd , New Delhi.
2) Applied Thermodynamics ,P.K. Nag, ,2nd Edition, TATA Mcgraw - Hill Publishing Co, New Delhi .
3) Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition,S.Chand & Co,NewDelhi Automobile engineering vol- 1, vol – 2, Kirpal singh, Standard publishers distributors New Delhi.
4) Automobile Engineering, G.B.S.Narang, Khanna Publishers, New Delhi.
5) Automotive Mechanics, William H.crouse and Donald .L. Anglin, Tata Mc Graw – Hill Publishing Company Ltd, New Delhi.
6) The Automobile, Harbans Singh Reyat, S.Chand & Co Ltd, New Delhi

Reference Books:

1) Thermal Engineering ,P.L Ballaney , 24th Edition ,Khanna Publishers,New Delhi. Thermal Engineering ,B.K. Sarkar , 3rd Edition , Dhanpat Rai & Sons New Delhi .
2) Applied Thermodynamics, Domkundwar and C.PKothandaraman, 2nd Edition, Khanna publishers, New Delhi.
3) Vehicle and Engine technology. Vol. I,Heinz Heisler, , ELBS
4) Automotive Mechanics,Joseph Heitner, East –west Press (P) Ltd, New Delhi
5) Internal Combustion engines, M.L.Mathur & R.P.Sharma, Dhanpat Rai & Sons,

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32053 – PROCESS PLANNING AND COST ESTIMATION

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING
Course Code : 1020
Subject Code : 32053
Semester : V
Subject Title : PROCESS PLANNING AND COST ESTIMATION

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
PROCESS PLANNING AND COST ESTIMATION	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	PROCESS PLANNING	14
II	PROCESS SELECTION	14
III	WORK STUDY	14
IV	COST ESTIMATION	13
V	MACHINING TIME CALCULATIONS	13
	REVISION AND TEST	7
	Total	**75**

RATIONALE:

In the product manufacturing the process selection and planning are important. In this subject the work study, cost estimation and machining time calculations are discussed.

OBJECTIVES:

Understand the process planning.

Study the process selection.

Understand the work study and method study.

Study the cost estimation.

Study the machining time calculations.

PROCESS PLANNING AND COST ESTIMATION

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**Process Planning**	14
	Introduction - concept – Information required to do process planning - factors affecting process planning - process planning procedure - Make (or) Buy decision using Break Even Analysis - simple problems. Manual process planning - Introduction of Automated process planning and generator process planning - Advantage of computer aided process planning – Principle of line balancing - need for line balancing – Value Engineering – Definition - cost control Vs cost reduction - value analysis when to do - steps information needed - selection of product.	
II	**Process Selection**	14
	Process selection - technological choice - specific component choice - Process flow choice – Factors affecting process selection - machine capacity – analysis of machine capacity - process and equipment selection procedure - Determination of man, machine and material requirements - simple problems - selection of material – jigs - fixtures etc. - Factors influencing choice of	

machinery - selection of machinery - simple problems - preparation of operation planning sheet for simple components.

III Work Study **14**

Objectives of work study - Concept of work content – Techniques to reduce work content - method study – Procedure – Recording techniques used in method study - Micro motion study - Principles of motion economy - Therbligs - Simo chart - cycle graph - Chrono cycle graph - work measurement - Basic Procedures for the conduct of time study - calculation of standard time - simple problems – Ergonomics – definition – objectives – applications - working environment - work place layout - other areas.

IV Cost Estimation **13**

Introduction - Definition - Purpose of cost estimation - cost estimation Vs Cost accounting - components of cost – direct cost - indirect cost - overhead expenses - estimation of cost elements - set up time and economic lot size - tool change time - Inspection time - performance factor – overheads - different methods of apportioning overheads – Data required for cost estimating - Steps in making a cost estimate – problems - estimation of production cost of simple components such as coupling, shaft, crank etc. – problems.

V Machining Time Calculations **13**

Elements of metal machining - cutting speed - feed - depth of cut - procedure for assigning cutting variables - calculation of machining time for different lathe operations like - turning - facing - chamfering - parting - knurling and forming - Calculation of machining time for operations on drilling machine - machining time for shaping, planing, slotting, broaching and sawing operations - Machining time for face milling and slab milling operations - timing for thread cutting - estimation of total unit time - Procedure for doing the above machining calculations with formulae used - simple problems.

TEXT BOOKS:

1) Industrial Engineering & Management - O.P Khanna

2) Industrial Engineering & Production Management - Martand Telsang

REFERENCE BOOKS:

1) Production Engineering - P.C.Shrma.
2) Production and Costing - GBS Narang and V.Kumar
3) Mechanical Estimating and Costing - Banga & Sharma.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

ELECTIVE THEORY

32071 – TOTAL QUALITY MANAGEMENT

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32071

Semester : V

Subject Title : TOTAL QUALITY MANAGEMENT

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Total Quality Management	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	Basic Concepts of Total Quality Management	14
II	Continuous process improvement – Q-7 Tools	14
III	Statistical Fundamentals	14
IV	Control charts	13
V	Management Planning tools & Bench marking	13
	REVISION AND TEST	7
	Total	**75**

RATIONALE:

Quality and customer satisfaction in every product and every activity is the order of the day. As there is a shift from quality control to quality management in all activities, the concept Total Quality Management and the pillars of TQM are to be given to Engineers, who are designing products and production systems.

OBJECTIVES:

- Define quality and appreciate its signature.
- Explain the concept of TQM.
- Appreciate the use of principles of TQM to meet customer satisfaction.
- Solve problem using the Quality control tools.
- Apply Brainstorming and quality circle to solve problems.
- Use PDCA cycle for continuous improvement.
- Appreciate the benefits of implementing 5S concepts.
- Collect, classify and present the data.
- Determine the process capability of a manufacturing process.
- Practice on management planning tools.
- Use Bench Mark and JIT concepts.

TOTAL QUALITY MANAGEMENT

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT** Quality-Definitions - Dimensions of quality - Brainstorming and its objectives - Introduction to TQM – Characteristics – Basic concepts – Elements – Pillars – Principles - Obstacles to TQM implementation – Potential benefits of TQM – Quality council – Duties – Responsibilities – Quality statements – Vision – Mission – Quality policy statements – Strategic planning – Seven steps to strategic planning – Deming philosophy- Customer delight - ISO 9001:2008 Quality Management System requirements and implementation.	14
II	**CONTINUOUS PROCESS IMPROVEMENT – Q7 TOOLS** Input / Output process model – Juran Trilogy – PDCA (Deming Wheel) cycle – 5S Concepts – SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE – needs and objectives – effective implementation of 5S concepts in an organisation - Housekeeping – Kaizen. Seven tools of quality control (Q-7 tools) – Check sheet – Types of	14

check sheet – Histogram – Cause and effect diagram - Pareto diagram – Stratification Analysis – Scatter diagram-Graph/run charts – Control charts - Construction of above diagrams.

Quality circle - concept of quality circle - Organisation of Quality circle and objectives of Quality circle.

III STATISTICAL FUNDAMENTALS **14**

Types of Data – Collection of Data – Classification of Data – Tabular presentation of Data – Graphical representation of a frequency distribution – Comparison of Frequency distribution – Mean – Median – Mode – Comparison of measures of central tendency – Introduction to measures of dispersion – Sample – sampling - Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems.

IV CONTROL CHARTS **13**

Control chart – Types of control charts – Control chart for variables – Construction of X and R charts – control limits Vs specification limits – Process capability – Method of doing process capability Analysis – Measures of process capability – Problems.

Attributes – Control charts – P chart – np chart – c chart – u chart – Construction of above diagrams – Problems - Comparison between variable chart and Attribute chart.

V MANAGEMENT PLANNING TOOLS & BENCH MARKING **13**

Affinity diagram – Radar Diagram - Inter Relationship diagram (Inter Relationship diagram) – Tree diagram - Prioritization matrix – Matrix diagram – Decision tree – Arrow diagram – Matrix data analysis diagram - Construction of above diagrams.

Bench marking – Objectives of bench marking – Types – Bench marking process - Benefits of Bench marking – Pit falls of Bench marking-Just In Time(JIT) concepts and its objectives - Total Productive Maintenance(TPM) - Introduction, Objectives of TPM - steps in implementing TPM.

Text Book:

1) Total Quality Management, Date H.Besterfiled, Pearson Education Asia.
2) Total Quality Management, V.Jayakumar, Lakshmi Publications.(reprint 2005)
3) Training manual on ISO 9001 : 2000 & TQM, Girdhar J.Gyani, Raj Publishing House, Second Edition 2001
4) Quality Management, Howard Cuitlow, Tata Mc Graw Hill, 1998

Reference Book:

1) Total Quality Management, Oakiand.J.S. Butterworth Heinemann Ltd. Oxford 1989.
2) Quality Management – Concepts and Tasks- Narayana.V and Sreenivasan.N.S., New Age International 1996.
3) Total Quality Management for engineers, Zeiri. Wood Head Publishers. 1991.
4) Quality Planning and Analysis, Juran J.M and Frank M.Gryna Jr., TMH. India. 1982
5) ISO 9001, Brain Rethry, Productivity and Quality Publishing Pvt. Ltd. 1993.
6) Quality Auditing D.Mills, Chapman and Hall, 1993.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

ELECTIVE THEORY

32072 – PRESS TOOLS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32072

Semester : V

Subject Title : PRESS TOOLS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
Press Tools	5	75	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit	Topics	Hours
I	Press working fundamentals, operations, and machinery	14
II	Press & press tool accessories and cutting dies	14
III	Bending and forming dies	14
IV	Drawing dies and dies for secondary operations	13
V	Fine blanking tool and specialized press tool applications	13
	REVISION AND TEST	7
	Total	**75**

RATIONALE:

Press working plays a vital role in the metal forming process. The study about the operations in the press work is important method of manufacturing.

OBJECTIVES:

- Explain the fundamentals of press working, to be familiar with the various press working operations and machines.
- Appreciate the safety practices in press working operations.
- Explain with the various press and press tool accessories
- Compare the different types of Die construction.
- Explain the various bending, forming and other miscellaneous press working operations.
- Demonstrate about the construction and operation of the different bending dies.
- Define the various drawing and other related processes
- Explain the construction and operating principle of drawing and combination dies.
- Explain the basic concepts and the advantages of fine blanking process
- Demonstrate the construction and working principle of various fine blanking dies.
- Appreciate the concepts of SMED and quick die changes and its advantages in bringing down the press set up time.
- Troubleshoot in various press tools.

PRESS TOOLS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**PRESS WORKING FUNDAMENTALS, OPERATIONS, AND MACHINERY :** Shearing Theory-Critical stages of shearing, Features of a punched hole, features of the slug, burr. Clearance - Effects of Optimum, Excessive and Insufficient clearances, Clearance for blanking and Piercing, Land and Angular Clearance. Cutting Force – Methods to reduce cutting force, stripping force. Press working operations - Blanking, Piercing, Cutting off, Parting off,	14

	perforating, embossing, coining, bending, forming, drawing, curling, bulging, extrusion, swaging, trimming, and shaving. Safety in press working. Presses - Common types of Presses, Main parts of a typical power press, OBI Press, Specification of presses, Comparison of Mechanical, hydraulic and Pneumatic presses. Single action, double action and triple action presses. Press operating parameters – Tonnage, shut height, stroke, shut height adjustment, strokes per minute, die space. Special purpose presses – Press brake, transfer press, multi slide machine.	
II	**PRESS & PRESS TOOL ACCESSORIES AND CUTTING DIES** Press Feeding Mechanisms - Uncoilers, Straighteners and recoilers, Hand feed, hitch/grip feed, Roll feed, Hopper feeds, dial feeds, chutes, slides, magazine feeds. Ejection mechanism – Ejection by Gravity, air ejection, mechanical ejection, semi automatic and automatic ejection, Mechanical hands, ejection by next part. Parts and functions of a press tool - Punches, Dies, Stoppers, Trigger stops, Strippers – Fixed and Travelling, Gauges, Pilots-Methods of piloting, shanks -Strip layout, Economy factor. Cutting Dies - Construction and working of Blanking tool, Piercing tool, Progressive tool, Compound tool. Commercially available die components – Die sets, die set attachment devices, punches, die buttons, retainers, springs, fluid springs, die cushion and its types.	**14**
III	**BENDING AND FORMING DIES:** Bending of sheet metal – Bending theory, neutral axis, metal movement, spring back, methods of overcoming spring back. Bending Operations – Bending, flanging, hemming, curling, seaming, and corrugating. Types of Bending dies (construction and working principle) – V bending and its types, edge bending, U bending. Bending operations done using press brake. Forming dies – Construction and working principle of solid form dies, pad form dies, curling dies, embossing dies, coining dies, swaging dies, bulging dies, crimping, tube forming. Assembly dies - Riveting,	**14**

	tab stake, upset stake, crimping.	
IV	**DRAWING DIES AND DIES FOR SECONDARY OPERATIONS** Drawing operations – Shallow drawing, deep drawing. Analysis of cup drawing - Stages of drawing. Variables of drawing - Bending and straightening variables, friction variables, compression variables, stretch forming variables, analysis of draw speed. Draw dies & its construction and working principle – Conventional draw die, inverted draw die, redrawing and reverse drawing dies, drawing of square or rectangular shapes. Blank holders, blank holding pressure and its importance, air vents, drawing inserts, draw beads. Drawing with flexible tooling – Marform process, Hydro form process. Drawing defects, causes and remedies. Dies for secondary operations - Construction and working principle of Semi piercing dies, shear form dies, dies for formed contours, notching die, shaving die, side piercing die.	**13**
V	**FINE BLANKING TOOL AND SPECIALISED PRESS TOOL APPLICATIONS** Fine blanking - Definition and Applications of fine blanking, Working principle of fine blanking tool, V Ring, function of V ring. Comparison of fine blanking with blanking. Clearance and press force calculations. Fine Blanking Machines - Working principle, Ram movement, Mechanical drives, hydraulic drives, Machine force, Ring indenter force, counter force. Fine blanking tools - Compound die tooling system with sliding punch, compound die tooling with fixed punch. Specialized Press Tool Applications - Construction, advantage and applications of advanced multistage tooling, unit tooling, angular piercing tools, CNC turret press. Principle of Quick Die Change (QDC) – need and advantages. Single Minute Exchange of Dies (SMED) – concept need and advantages. Factors Affecting Tool Service Life - Introduction, Elements of Tool performance, Procedure for investigation of tool failure, Trouble shooting in press tools, effect of heat treatment on service life of tools.	**13**

Text Books:

1) Donald F. Eary. & Edward A. Reed, “Techniques of Press working sheet metal”, Prentice-Hall,Inc.,
2) Donaldson, “Tool Design”, Tata McGraw-hill Book Company.
3) Eugene ostergaard.D, “Advanced die making”, McGraw-Hill Book Company.

Reference Books:

1) Dr.John G.Nee, “Fundamentals of Tool Design”, Society of Manufacturing Engineers.
2) ASTME, "Tool Engineers Hand Book", McGraw-hill Book Company. .
3) Paquin.J.R, “Die design fundamentals”, Industrial Press Inc,.
4) Eugene ostergaard.D, “Basic die making”, McGraw-hill Book company,.
5) Ivana Suchy, “Hand book of Die Design”, McGraw-Hill Book company.
6) American Society of Metals – Hand book – Volume 4 (Forming)

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

ELECTIVE THEORY

32073 – RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32073

Semester : V

Subject Title : RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
Renewable Energy Sources and Energy Conservation	Hours /Week	Hours/ Semester	Marks			Duration
	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	FUNDAMENTALS OF ENERGY, WIND ENERGY	14
II	SOLAR ENERGY,APPLICATION,STORAGE	14
III	SOLAR PHOTOVOLTAIC SYSTEM AND DESIGN,OCEN,TIDAL,WAVE ENERGY	14
IV	BIO-ENERGY	13
V	ENERGY CONSERVATION TECHNIQUES AND ENERGY AUDIT	13
	REVISION AND TEST	7
	TOTAL	**75**

RATIONALE:

Electrical Energy requirement is the major crisis and hence any saving in Electrical energy is equivalent to production of Electrical Energy. Saving can be achieved by the utilization of Renewable Energy Sources.

OBJECTIVES:

- Study about the fundamentals of Energy.
- Study of construction and principle of Wind energy, Solar energy, Tidal energy and Bio energy.
- Understand the PV design and its components.
- Understand the energy management and auditing techniques.
- Study the energy conservation process.

RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**FUNDAMENTALS OF ENERGY**	**14**
	Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources- energy for sustainable development.	
	WIND ENERGY	
	Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems- components of conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage–Application of wind energy-Safety and environmental aspects.	

II SOLAR ENERGY **14**

Introduction – Solar radiation at the earth's surface-Solar Radiation measurements-Estimation of average solar Radiation.

Solar energy collectors- Classifications-Flat plate collectors - Concentrating collectors-performance parameter-tracking system-compound parabolic concentrator-parabolic trough concentrators-concentrator with point focus-heliostats-comparisons of various collectors-efficiency of collector-selection of collector for various applications.

Solar Thermal Application: Solar water heaters-Solar industrial heating system – Solar Refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces-Solar greenhouse-Solar Distillation-Solar pond Electric power plant-Distributed Collector- Solar thermal Electric power plant.

Solar thermal energy storage: sensible storage-latent heat storage-thermo chemical storage.

III Solar photovoltaic System and Design: **14**

Solar photovoltaic a brief history of PV,PV in silicon: basic principle, crystalline PV; reducing cost and raising efficiency, thin film PV, other innovative technologies, electrical characteristics of silicon PV cells and modules, grid connected PV system, cost of energy from PV ,Environmental impact and safety.

System design of solar photovoltaic system: Load analysis-solar array Design-Battery Design-Simple formulas. System design procedure. Case Studies: Designing solar home lighting system - Designing stand alone solar PV Power plant - Designing solar PV water pumping system - Only arriving load capacity - solar array sizing - Battery sizing - Inverter capacity and mountings.

Ocean energy, Tidal & Wave energy

Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilisation – basic principle of tidal power – components and operations of tidal power plant – Energy and Power forms of waves – Wave energy conversion devices.

IV	**BIO – ENERGY**	**13**
	Introduction – photo synthesis – usable forms of bio mass, their composition and fuel properties-Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – biomass liquification – biomass to ethanol production – Biogas production from waste Biomass – types of bio gas plants - applications – Bio diesel production – Biomass energy programme in India.	
V	**Energy Management and Audit, Conservation:** Definition, Energy audit - need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments Energy Conservation Techniques- Need and importance of energy conservation -Principles of energy conservation- Methods of energy conservation-Cogeneration and its application-Combined cycle system-Concept of energy management-Study of different energy management techniques like-Analysis of input-Reuse and recycling of waste. Economic approach of Energy Conservation-Costing of utlities like steam, compressed air, electricity and water-Ways of improving boiler efficiency-Thermal insulation, Critical thickness of insulation-Waste heat recovery systems, their applications, criteria for installing unit-An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.	**13**

Text Books:

1) Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.
2) Non Conventional Energy Sources and Utilisation - R.K. Rajput - S.Chand & Company Ltd., 2012.
3) Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986.

4) Non-Conventional Energy Resources - B.H.Khan - Tata Mc Graw Hill, 2nd Edn, 2009.
5) Industrial energy conservation- D. A. Ray- Pergaman Press
6) Energy resource management- Kirpal Singh Jogi- Sarup and sons

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32055 – PROCESS AUTOMATION PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32055

Semester : V

Subject Title : PROCESS AUTOMATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	**Instructions**		**Examination**			
	Hours/ Week	**Hours/ Semester**	**Marks**			**Duration**
Process Automation Practical	4	60	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

OBJECTIVES:

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

Exercises

Pneumatics Lab.

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

Hydraulics Lab.

1. Direct operation of double acting cylinder.
2. Direct operation of hydraulic motor.
3. Speed control of double acting cylinder metering-in and metering-out control.

PLC Lab.

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

Board of Examination

Note: All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise from Pneumatics Lab. or Hydraulics lab. and one from PLC lab.

All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

Allocation of Marks

Part A: Pneumatics/Hydraulics lab by lot	- 35 marks
Part B: One question from PLC lab.	- 35 marks
Viva-voce	- 05 marks
Total	**- 75 marks**

LIST OF EQUIPMENTS

1. Pneumatic Trainer Kit – 2Nos
   (All Cylinders, Control Valves, Limit switches and other accessories)
2. Hydraulics Trainer Kit – 1No.
   (All Cylinders, Control Valves, Limit switches and other accessories)
3. PLC kit. – 2 Nos.
4. Computer with software – 5 Nos.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32056 – THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32056

Semester : V

Subject Title : THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Thermal and Automobile Engineering Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

- Determine the flash and fire point of oil by using open & closed cup apparatus
- Determine the absolute viscosity by using redwood & saybolt viscometer
- Draw the valve timing diagram of petrol or diesel engines.
- Draw the port timing diagram of petrol or diesel engines.
- Conduct performance test on petrol or diesel engines.
- Prepare a heat balance sheet petrol or diesel engines
- Prepare a Morse test on a petrol or diesel engines
- Identify the various tools and their applications used in Automobile.
- Dismantle and assemble fuel injection pump & fuel injectors.
- Dismantle and assemble of power transmission and differential unit.
- Dismantle and assemble steering gear box.
- Testing and charging of batteries. Overhauling of starter motor, alternator & dynamo.

List of Experiments:

PART-A

1) Determine flash and fire point of the given oil by using open cup apparatus and closed cup apparatus.
2) Determine the absolute viscosity of the given lubricating oil by using Redwood viscometer / say bolt viscometer.
3) Draw a Port timing diagram of two stroke petrol / diesel Engines.
4) Draw a Valve time diagram for four stroke petrol / diesel engines.
5) To conduct a load test on a petrol / diesel Engines.
6) To conduct a Morse test on multi cylinder petrol / diesel engines.
7) To conduct a Heat balance test on a Four Stroke Petrol (or) Diesel engines.

PART-B

1) Dismantling, assembling of pressure plate, clutch plate and steering gear box.
2) Dismantling, inspecting and assembling of gear box and find out the gear ratios.
3) Dismantling, inspecting and assembling of final drive and differential units. Adjusting of backlash and correct tooth contact of crown and pinion of differential unit.
4) Removing camshaft, replacing timing gears, removing valves and adjusting valve clearance.
5) Removing, servicing and replacing Solex carburettor (OR) MPFI system.
6) Dismantling and assembling of inline fuel injection pump (OR) CRDI system and Injectors
7) Test a battery with specific gravity test and charge the battery with constant ampere/ voltage method. Dismantling, overhauling and assembling of starter motor and alternator (OR) dynamo.

Board of Examination

Note: All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise in each PART.

All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

Allocation of Marks

Part A	**:**		**35 Marks**
Observation / Tabulation	-	10	
Reading / Calculation	-	15	
Result / Graph / Diagram	-	10	
Part –B	**:**		**35 Marks**
Dismantling	-	10	
Procedure / Observation	-	15	
Assembly	-	10	
Viva-Voce	**:**		**05 Marks**
Total	**:**		**75 Marks**

LIST OF EQUIPMENTS

THERMAL PRACTICAL

1. Open cup apparatus to determine Flash and fire points – 2 No
2. Close cup apparatus to determine Flash and fire points – 2 No
3. Redwood viscometer – 2 No
4. Saybolt viscometer – 2 No
5. 4 stroke cycle petrol / diesel engine Model – 2 No
6. 2 stroke cycle petrol / diesel engine Model – 2 No
7. Petrol / Diesel engine of any make with following arrangements – 2 No
   - Load test arrangement
   - Heat balance test arrangement
8. Multi cylinder petrol engine of any make with Morse test setup – 1 No

AUTOMOBILE PRACTICAL

1. Automobile Mechanic's tools-Complete Set - 2 Set
2. 4 stroke petrol engine- with all accessories - 1No
3. 4 stroke Diesel engine- with all accessories - 1 No
4. Internal circlip plier, bearing puller - 1 No
5. Feeler gauge to check valve clearance, hammer and accessories - 1 No
6. SOLEX carburetor - 1 No
7. MPFI. - 1 No
8. Inline Fuel Injection Pump - 1 No
9. CRDI - 1 No
10. Injectors. - 1 No
11. Clutch set arrangement with tools - 1 No
12. Complete gear box with tools - 1 No
13. Complete steering arrangement - 1 No
14. Differential unit with axles - 1 No
15. Battery - 1 No
16. Battery Charger - 1 No
17. Battery Testing unit (Specific gravity) - 1 No
18. Starter Motor - 1 No
19. Alternator - 1 No
20. Dynamo - 1 No

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

30002 – LIFE AND EMPLOYABILITY SKILLS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING – SYLLABUS – M Scheme

(Being implemented from the Academic Year 2016-2017 onwards)

Course Name : **All Branches of Diploma in Engineering and Technology and Special Programmes**

Subject Code : **30002**

Semester : **IV /V**

Subject Title : **LIFE AND EMPLOYABILITY SKILLS PRACTICAL**

Teaching and Scheme of Examination: **No. of Weeks per Semester: 15 Weeks**

Subject	Instruction		Examination			
			Marks			
	Hours/ Week	Hours/ Semester	Internal assessment	Board Examination	Total	Duration
Life and Employability Skills	4 Hours	60 Hours	25	75	100	3 Hours

Topics and Allocation of Hours:

Sl. No.	Section	No. of Hours
1	**Part – A** Communication	30
2	**Part – B** Entrepreneurship, Project Preparation, Productivity, Occupational Safety, Health, Hazard, Quality Tools& Labour Welfare	20
3	**Part – C** Environment, Global Warming, Pollution	10
TOTAL		60

RATIONALE

Against the backdrop of the needs of the Industries, as wells as based on fulfilling the expectations of the Industries, the Diploma Level students have to be trained directly and indirectly in toning up their competency levels. Proficiency in Communication only, equips them with confidence and capacity to cope with the employment. Hence, there is a necessity to focus on these in the curriculum. At the end of the Course, the student is better equipped to express himself in oral and written communication effectively.

SPECIFIC INSTRUCTIONAL OBJECTIVES

1. Emphasize and Enhance Speaking Skills

2. Increase Ability to Express Views & Opinions

3. Develop and Enhance Employability Skills

4. Induce Entrepreneurship and Plan for the Future

5. Expose & Induce Life Skills for Effective Managerial Ability

LIFE AND EMPLOYABILITY SKILLS PRACTICAL

SYLLABUS

Unit	Topics	Activity	Hours
I	**Communication, Listening, Training, Facing Interviews, Behavioural Skills**	-- instant sentence making – say expressions/phrases-- self- introduction/another higher official in company – describe/explain product – frame questions based on patterns – make sentences based on patterns	**30**
II	**Entrepreneurship, Project Preparation, Marketing Analysis, Support & Procurement**	-- prepare an outline of a project to obtain loan from bank in becoming an entrepreneur – prepare a resume	**10**
III	**Productivity – comparison with developed countries, Quality Tools, Circles, Consciousness, Management, House Keeping**	-- search in the website -- prepare a presentation – discuss & interact	**05**
IV	**Occupational Safety, Health Hazard, Accident & Safety, First-Aid,Labour Welfare Legislation, Welfare Acts**	-- search in the website -- prepare a presentation – discuss & interact	**05**
V	**Environment, Global Warming, Pollution**	-- taking down notes / hints – answering questions -- fill in blanks the exact words heard	**10**

LEARNING STRUCTURE **100 Marks**

-- Focus more on Speaking & Listening Skills
-- Attention less on Reading & Writing Skills
-- Apply the skills in fulfilling the Objectives on Focused Topics

a) Listening **25 Marks**

1. Deductive Reasoning Skills (taking down notes/hints) **10**
2. Cognitive Skills (answering questions) **10**
3. Retention Skills (filling in blanks with exact words heard) **05**

b) Speaking Extempore/ Prepared **30 Marks**

1. Personality/Psychological Skills (instant sentence making) **05**
2. Pleasing & Amiable Skills (say in phrases/expressions) **05**
3. Assertive Skills (introducing oneself/others) **05**
4. Expressive Skills (describe/explain things) **05**
5. Fluency/Compatibility Skills (dialogue) **05**
6. Leadership/Team Spirit Skills (group discussion) **05**

c) Writing & Reading **20 Marks**

1. Creative & Reasoning Skills (frame questions on patterns) **05**
2. Creative & Composing Skills (make sentences on patterns) **05**
3. Attitude & Aim Skills (prepare resume) **05**
4. Entrepreneurship Skills (prepare outline of a project) **05**

d) Continuous Assessment (Internal Marks) **25 Marks**
(search,read, write down, speak, listen, interact & discuss)

1. Cognitive Skills (Google search on focused topics)
2. Presentation Skills& Interactive Skills (after listening, discuss)

Note down and present in the Record Note on any 5 topics **10 Marks**
Other activities recorded in the Record note **10 Marks**
Attendance **05 Marks**

INTERNAL MARKS **25 MARKS**

EXTERNAL MARKS AT END EXAMINATION **75 MARKS**

MODEL QUESTION

Time: 3 Hours **Maximum Marks: 75**

A. LISTENING **25 Marks**

1. Listen to the content and take down notes/hints 10
2. Listen to the content and answer the following questions. 10
3. Listen to the content and fill in the blanks the exact words heard. 05

B. SPEAKING **30 Marks**

1. Say in a sentence instantly on hearing the word(5 words, one after another). 05
2. Say any five expressions commonly used in communication. 05
3. Imagine, a consultant has come to your department.
   Introduce him to your subordinates. 05
4. Explain/describe the product you are about to launch in the market. 05
5. Speak with your immediate boss about the progress you have made. 05
6. Discuss within the group on the topic of focus in the syllabus. 05

C. WRITING & READING **20 Marks**

1. Frame new questions from the pattern given by changing sets of words with your own. 05

a.	When	do	you	return?
b.	How	is	his performance?	
c.	Where	has	the manager	gone?
d.	What	is	the progress	today?
e.	Why	are	the machines	not functioning?

2. Make sentences from the pattern given by changing sets of words with your own. 05

a.	The workers	are	on strike		
b.	The labourers	are paid	well	in this factory	
c.	There	is	a rest room	for the workers	
d.	These	are	the new products	launched	by our company
e.	Almost everyone	come	to the company	on motorbikes	

3. Prepare a resume for the post of Department Manager. 05

4. Prepare an outline of a project to obtain a loan. (Provide headings and subheadings) 05

I. Guidelines for setting the question paper:

A. LISTENING :

ONLY TOPICS related to
POLLUTION /
ENVIRONMENT /
GLOBAL WARMING are to be taken.
These topics are common for all the three types of evaluation.

B. SPEAKING :

1. WORDS of common usage
2. Fragments – expression of politeness, courtesy, cordiality
3. Introduce yourself as an engineer with designation or
   Introduce the official visiting your company/department

4. Describe/Explain the product/machine/department
5. Dialogue must be with someone in the place of work.
6. Group of six/eight
   Discuss the focused topic prescribed in syllabus

C. WRITING & READING:

1. Provide five different structures.
   Students are to substitute at least one with some other word/words
2. Provide five different structures.
   Students are to substitute at least one with some other word/words
3. Provide some post related to industries.
4. Outline of the project (skeleton/structure)
   Only the various headings and subheadings
   Content is not needed

II. Guidelines for recording the material on the Focused Topics in the Record note.

Write in the record note, **on any five topics**, from the list of topics given below. **10 Marks**
(5 topics x 10 marks = 50 marks. Thus, the **Average of 5 topics is 10 Marks)**

1. Productivity in Industries – Comparison with developed countries
2. Quality Tools, Quality Circles and Quality Consciousness
3. Effective Management
4. House Keeping in Industries
5. Occupational Safety and Hazard
6. Occupational Accident and First Aid

7. Labour Welfare Legislations
8. Labour Welfare Acts and Rights
9. Entrepreneurship
10. Marketing Analysis, Support and Procurement

LABORATORY REQUIREMENT:

1. An echo-free room
2. Necessary furniture and comfortable chairs
3. A minimum of two Computers with internet access
4.A minimum of two different English dailies
5. A minimum of Three Mikes with and without cords
6. Colour Television (minimum size – 29")
7. DVD/VCD Player with Home Theatre speakers
8. Smart board
9. Projector

Suggested Reading:

1. Production and Operations Management by S.N. Chary, TMH
2. Essentials of Management by Koontz &Weihrich, TMH
3. Modern Production / Operations Management by E.S. Buffa and R.K. Sarin, John Wiley & Sons
4. Production Systems: Planning, Analysis and Control by J.L.Riggs, 3rd ed., Wiley.
5. Productions and Operations Management by A.Muhlemann, J.Oakland and K.Lockyer, Macmillan
6. Operations Research - An Introduction by H.A.Taha, Prentice Hall of India
7. Operations Research by J.K.Sharma, Macmillan
8. Business Correspondence & Report Writing by R.C. Sharma and K.Mohan, TMH
9. How to prepare for Group Discussion & Interview (With Audio Cassette) by Prasad, TMH
10. Spoken English – A self-learning guide to conversation practice (with Cassette)
11. Introduction to Environmental Engineering by Mackenzie, L. Davis and A. David, Cornwell, McgrawHill, 3rd Ed.
12. Environmental Engineering by Peary, Rowe and Tchobanoglous, McgrawHill
13. Total Quality Management – An Introductory Text by Paul James, Prentice Hall
14. Quality Control and Applications by Housen&Ghose
15. Industrial Engineering Management by O.P. Khanna

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32061 – INDUSTRIAL ENGINEERING AND MANAGEMENT

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implemented from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32061

Semester : VI

Subject Title : Industrial Engineering and Management

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	**Instructions**		**Examination**			
Industrial Engineering and Management	**Hours/ Week**	**Hours/ Semester**	**Marks**			**Duration**
	6	90	**Internal Assessment**	**Board Examination**	**Total**	3 Hours
			25	75	100	

Topics and Allocation of Hours:

UNIT NO.	**TOPIC**	**HOURS**
I	PLANT ENGINEERING AND PLANT SAFETY	17
II	WORK STUDY, METHOD STUDY AND WORK MEASUREMENT	17
III	PRODUCTION PLANNING AND QUALITY CONTROL	17
IV	PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR:	16
V	FINANCIAL AND MATERIAL MANAGEMENT	16
	REVISION AND TEST	7
	TOTAL	**90**

RATIONALE:

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

OBJECTIVES:

- To study the different types of layout.
- To study the safety aspects and its impacts on an organization.
- To study different work measurement techniques.
- To study production planning and control and its functions.
- To study basic and modern management techniques.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control system.
- To study about organization and it's behavior.

INDUSTRIAL ENGINEERING AND MANAGEMENT

DETAILED SYLLABUS

Contents: Theory

UNIT	NAME OF THE TOPIC	HOURS
I	**PLANT ENGINEERING AND PLANT SAFETY**	**17**
	Plant Engineering : Plant – Selection of site of industry – Plant layout – Principles of a good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance.	
	Plant Safety: Importance –accident-causes and cost of an accident-accident proneness-prevention of accidents-Industrial disputes-settlement of Industrial disputes-Collective bargaining, conciliation, Mediation, arbitration-Indian Factories Act 1948 and its provisions related to health, welfare and safety.	

II	**WORK STUDY, METHOD STUDY AND WORK MEASUREMENT**	**17**

Work Study: Productivity – Standard of living – method of improving productivity

– Objectives – Importance of good working conditions.

Method Study: Definition – Objectives – Selection of a job for method study –Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man machine chart, String diagram and flow diagram.

Work Measurement: Definition – Basic procedure in making a time study – Employees rating factor – Application of time allowances – Rest, Personal, Process, Special and Policy allowances – Calculation of standard time – Problems – Basic concept of production study – Techniques of work measurement-Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS).

III	**PRODUCTION PLANNING AND QUALITY CONTROL**	**17**

Production Planning and Control: Introduction – Major functions of production planning and control – Pre planning – Methods of forecasting – Routing and scheduling – Dispatching and controlling – Concept of Critical Path Method (CPM)-Description only. Production – types-Mass production, batch production and job order production- Characteristics – Economic Batch Quantity (EBQ) – Principles of product and process planning – make or buy decision.

Quality Control: Definition – Objectives – Types of inspection – First piece, Floor and centralized inspection – Advantages and disadvantages. Quality control – Statistical quality control – Types of measurements – Method of variables – Method of attributes – Uses of X, R, p and c charts – Operating Characteristics curve (O.C curve) – Sampling inspection – single and double sampling plan – Concept of ISO 9001:2008 Quality Management System Registration Certification procedure – Benefits of ISO to the organization.

IV	**PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR:**	**16**

Principles of Management: Definition of management – Administration - Organization – F.W. Taylor's and Henry Fayol's Principles of Management – Functions of Manager – Directing – Leadership -Styles of Leadership – Qualities of a good leader – Motivation – Positive and negative motivation --Modern management techniques- Just In Time – Total Quality Management (TQM) – Quality circle – Zero defect concept – 5S Concept-Management Information Systems – Strategic management – SWOT Analysis --Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) –Supply Chain Management (SCM) – Activity Based Management (ABM) – Global Perspective – Principles and brief describtion.

Personnel Management: Responsibility of human resource management – Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training – Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages – Wage fixation – Type of wage payment – Halsey's 50% plan, Rowan's plan and Emerson's efficiency plan – Problems.

Organizational behavior: Definition – organization--Types of Organization – Line, Staff,Taylor's Pure functional types – Line and staff and committee type –Organizational Approaches, individual behavior—causes—Environmental effect—Behavior and Performance, Perception-organizational implications.

V	**FINANCIAL AND MATERIAL MANAGEMENT**	**16**

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 – Problems.

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 – Introduction – Purchasing procedure – Store keeping – Bin card.

Text Books :

1) Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications (P) Ltd – 2004, 67/4 Madras House, Daryaganj, New Delhi – 110002.
2) Engineering Economics and Management, T.R. Banga & S.C. Sharma, McGraw Hill Editiion. 2 – 2001, New Delhi.
3) Herald Koontz and Heinz Weihrich,'Essentials of Management',McGraw Hill Publishing Company,Singapore International Edition.Latest

Reference Books :

1) Management, A global perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition.Latest.
2) Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
3) S.Chandran,Organizational Behaviours,Vikas Publishing House Pvt. Ltd. Latest
4) M.Govindarajan and S.Natarajan,Principles of Management,Prentce Hall of India Pvt.Ltd.New Delhi.Latest.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32062 – COMPUTER AIDED DESIGN AND MANUFACTURING

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32062

Semester : VI

Subject Title : COMPUTER AIDED DESIGN AND MANUFACTURING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
Computer Aided Design and Manufacturing	Hours / Week	Hours / Semester	Marks			Duration
	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	COMPUTER AIDED DESIGN	14
II	COMPUTER AIDED MANUFACTURING	14
III	CNC PROGRAMMING, RAPID PROTOTYPING	14
IV	COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT	13
V	CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, AUGMENTED REALITY.	13
	REVISION AND TEST	7
	Total	**75**

RATIONALE:

As per the latest requirements in the Industries this enables to learn the assistance of computer in the field of design and manufacturing areas. It's able to learn the latest manufacturing concepts of in the shop floors and manufacturing methods like RPT. They are able to know about the CNC programming techniques are included.

OBJECTIVES:

- Understand the concept and requirement of the integration of the design and manufacturing.
- Acquire knowledge about the computer assistance in the design process and analysis.
- Understand the concepts of manufacturing with computer assistance in the shop floor.
- Understand the principle of latest manufacturing machines like RPT.
- Acquire the knowledge in the material handling equipment and robot.
- Understand the Computer Integrated Manufacturing and FMS.
- Study of Concurrent Engineering and its tools and Augmented Reality.

COMPUTER AIDED DESIGN AND MANUFACTURING
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**COMPUTER AIDED DESIGN**	14
	Computer Aided Design: Introduction – definition – Shigley's design process – Ohsuga Model - CAD activities – benefits of CAD - CAD software packages.	
	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 – OpenGL - IGES – DXF.

Finite Element Analysis: Introduction – Development - Basic steps – Advantage.

II COMPUTER AIDED MANUFACTURING **14**

Computer Aided Manufacturing: Introduction - Definition – functions of CAM – benefits of CAM.

Group technology: Part families - Parts classification and coding - coding structure – Optiz system, MICLASS system and CODE System.

Process Planning: 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).

III CNC PROGRAMMING, RAPID PROTOTYPING **14**

CNC PART PROGRAMMING: 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. Types - Stereo lithography (STL) – Fused deposition model (FDM) – Selective laser sintering SLS) - three dimensional printing (3D) – Rapid tooling.

IV	**COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT** **CIM:** Introduction of CIM – concept of CIM - evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM. **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. **AGV**: Introduction – AGV - working principle – types – benefits. **ROBOT:** Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical grippers – vacuum grippers - Industrial applications of Robot**:** Characteristics - material transfer and loading – welding - spray coating - assembly and inspection.	13
V	**CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, AUGMENTED REALITY.** **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.	13

Text Books :

1) CAD/CAM/CIM , R.Radhakrishnan, S.Subramanian, New Age International Pvt. Ltd.
2) CAD/CAM , Mikell P.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.

Reference Books:

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32081 – MECHANICAL INSTRUMENTATION

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32081

Semester : VI

Subject Title : MECHANICAL INSTRUMENTATION

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Mechanical Instrumentation	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	TYPES OF MEASUREMENT, MEASUREMENT OF *ERROR*	15
II	DISPLACEMENT MEASUREMENT- PRESSURE MEASUREMENT	15
III	TEMPERATURE MEASUREMENT- FLOW MEASUREMENTS	15
IV	MISCELLANEOUS MEASUREMENT	15
V	CONTROL SYSTEMS	15
	REVISION AND TEST	7
	TOTAL	**75**

RATIONALE:

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

OBJECTIVES

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

MECHANICAL INSTRUMENTATION

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	Types of measurement, classification of instruments - Static terms and characteristics - Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity. Dynamic characteristics - Speed of response, Fidelity and Dynamic errors, overshoot**.** Measurement of *error* - Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors Transducers **:** Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive.	**14**
II	**Displacement Measurement:** Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, Selection & application of displacement transducer. Optical measurement scale andencoders **Pressure Measurement:** Low pressure gauges- McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge. High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type	**14**
III	**Temperature Measurement:** Non-electrical methods - Bimetal, Liquid in glass thermometer and Pressure thermometer. Electrical methods - RTD, Platinum resistance thermometer, Thermistor, Thermoelectric methods - elements of thermocouple, Seebek series, law of Intermediate metals, thermo emf measurement.	**14**

Flow Measurements: Variable area meter - Rota meter, Variable velocity meter – Anemometer, Special flow meter - Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter ,Turbine meter ,Vortex shedding flow meter

IV Miscellaneous Measurement: **13**

Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone.

Humidity measurement –Hair hygrometer, Sling psychrometer, Liquid level measurement – direct and indirect methods.

Force & Shaft power measurement - Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. Speed measurement -Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter & timer, Slipping Clutch Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope, Strain Measurement - Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types (foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes.

V Control Systems : **13**

Block diagram of automatic control system, closed loop system, open loop system, feedback control system, feed forward control system, servomotor mechanism.

Comparison of hydraulic, pneumatic, electronic control systems, Control action: Proportional, Integral, derivative, PI, PD, PID. Applications of measurements and control for setup for boilers, airconditioners, motor speed control.

Text Books:

1) Mechanical Measurements &Control-D.S.Kumar-Metropolitan Publications, New Delhi.
2) Mechanical & Industrial Measurements-R.K.Jain-Khanna Publications, NewDelhi,

3) Mechanical Measurements &Instrumentation-A.K.Sawhney-Dhanpat Rai & Sons, NewDelhi.
4) Measurement Systems-E. O. Doebelin-Tata McGraw Hill Publications.
5) Mechanical Measurement &Control-R.V. Jalgaonkar-Everest Publishing House, Pune

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32082 – ROBOTICS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32082

Semester : VI

Subject Title : ROBOTICS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Robotics	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	14
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS	14
III	SENSORS AND MACHINE VISION	14
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	13
V	ROBOT APPLICATIONS IN MANUFACTURING	13
	REVISION AND TEST	7
	Total	**75**

RATIONALE:

Rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to

implement flexible manufacturing systems where Robotic technology plays major role. Hence study of robotic technology is very essential.

OBJECTIVES:

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

ROBOTICS

DETAILED SYLLABUS

Theory contents:

Unit	Name of the Topic	Hours
I	**FUNDAMENTALS OF ROBOT TECHNOLOGY** Introduction – **History of robot** - Definitions-Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End effecter, Driving system, Controller and Sensors. Mechanical arm – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope, Work Volume – Effect of structure on Control ,Work envelop and Work volume. Introduction to PUMA robot.	14
II	**ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS** Robot controller – Configuration - Four types of controls – Open loop and closed loop controls – Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability. Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – Stepper motors, DC Servo motors and AC Servo motors – Salient features – Applications and Comparisons of Drives. End effecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Two fingered and	14

Three fingered Grippers, Internal and External Grippers – End Of Arm Tooling (EOAT)- Selection and Design considerations.

III SENSORS AND MACHINE VISION **14**

Requirements of Sensors – **Sensor devices used in robot work cell** - Principles and applications of the following types of sensors – Position sensors: Piezo-electric sensors, LVDT, Resolvers, Optical encoders and Pneumatic position sensors – Range sensors – Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical proximity sensors – Touch sensors: Binary sensors, Analog sensors – Wrist sensors – Slip sensors. Machine vision system – Camera – Frame grabber – Sensing and digitizing image data – Signal conversion – Image storage – Lighting techniques – Image processing and analysis – Data reduction: Edge detection, Feature extraction and object recognition – Applications – Inspection, Identification, Visual serving and navigation.

IV ROBOT KINEMATICS AND ROBOT PROGRAMMING **13**

Forward kinematics, Inverse kinematics and differences – Forward kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom – Deviations. – Robot dynamics – Static analysis - Robot programming – Teach pendant programming – Lead through programming – Robot programming languages – VAL Programming – Motion commands, Sensor commands, End effecter commands and Simple programs.

V ROBOT APPLICATIONS IN MANUFACTURING **13**

Robot applications – Material handling – Press loading and unloading – Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembling – Finishing – Automatic Guided Vehicle – Adopting robots to workstations – Requisite robot characteristics and Non requisite robot characteristics – Stages in selecting robots for industrial applications – Safety considerations for robot operations – Robotics in the future and characteristics task– Economical analysis of robots – Social implications.

Text Books:

1) Industrial Robotics – Technology, Programming and Applications, .P.Groover, MC Graw Hill, 2001

Reference Books:

1) Robotics Control, Sensing, Vision and Intelligence, Fu.K.S.Gonzalz.R.C., and Lee C.S.G, McGraw-Hill Book Co., 1987
2) Robotics for Engineers,Yoram Koren, McGraw-Hill Book Co., 1992
3) Robotics and Image Processing, Janakiraman.P.A, Tata McGraw-Hill,1995

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32083 – REFRIGERATION AND AIRCONDITIONING

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2016-2017 onwards)

Course Name : Diploma in Mechanical Engineering

Course Code : 1020

Subject Code : 32083

Semester : VI

Subject Title : Refrigeration and Air-Conditioning

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Refrigeration and Air-Conditioning	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS	14
II	VAPOUR COMPRESSION & ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS	14
III	REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION	14
IV	PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS	13
V	COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES	13
	REVISION AND TEST	7
	Total	**75**

RATIONALE:

Hence the study of refrigeration principles, system and its effectiveness are essential. Comfort is the basic requirement of customers and machines through air-conditioning and hence learning the concept of air-conditioning and methods of air-conditioning facilitates quality design of air conditioners.

OBJECTIVES:

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

REFRIGERATION AND AIR-CONDITIONING

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS**	**14**
	Thermodynamic state of a pure substance, modes of heat transfer – laws of heat transfer - mechanisms of production of cold - unit of refrigeration –types of refrigeration - reversed Carnot cycle - C.O.P of heat engine-heat pump- refrigerating machine – principle of working of open and closed air system of refrigeration – advantages and disadvantages – and its application of air cycle-problems Compressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors- condensers-principle of working and	

constructional details of air cooled and water cooled condensers, evaporative condensers- advantages and disadvantages - natural and forced draught cooling towers.

Evaporators- natural circulation and forced circulation type – principle of working constructional details.

II VAPOUR COMPRESSION REFRIGERATION SYSTEM ,VAPOUR ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS **14**

Principle of working of vapour compression system – analysis of vapour compression cycle using T-s diagram and p-H diagram- refrigerating effect- compression work - C.O.P - effect of superheating and under cooling – effect of evaporative pressure and condenser pressure-problems – liquid vapour refrigeration heat exchangers - advantages and disadvantages of superheating and under cooling – use of flash chamber and accumulator.

Simple absorption system – Electrolux system - solar absorption refrigeration system- absorption system comparison with mechanical refrigeration system.

Refrigerators for above 2 K- Philips Refrigerator--Giffered McMohan refrigerator- refrigerators for below 2 K - Magnetic refrigeration systems.

III REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION **14**

Capillary tube-automatic expansion valve-thermostatic expansion valve-electronic expansion valve-solenoid valve-evaporator pressure regulator –suction pressure regulator-classification of refrigerants-selection of a refrigerant-properties and applications of following refrigerants SO_{2} , CH_{4} ,F_{22}, and NH_{3} –CFCs refrigerants- equivalent of CFCs refrigerants (R-123a,R-143a,R-69S)- blends of refrigerants(R400 and R500 Series) - lubricants used in refrigeration and their applications.

Slow freezing –quick freezing- cold storage-frozen storage-freeze drying –dairy refrigeration –ice cream cabinets-ice making – water

cooler, milk cooler, bottle cooler-frost free refrigeration.

IV PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS **13**

Psychrometry properties - adiabatic saturation of air by evaporation of water- psychometric chart and its uses – psychometric processes – sensible heating and cooling - humidifying and heating - dehumidifying and cooling - adiabatic cooling with humidification - total heating or cooling processes -sensible heat factor - by pass factor – adiabatic mixing – evaporative cooling - problems – governing optimum effective temperature – comfort chart-design consideration.

Equipment for air conditioning and insulation factors – air purification – temperature control – humidity control – dry and wet filters- centrifugal dust collector – air washer humidifier – dehumidifier - fans and blowers – grills and registers – summer and winter air conditioning, window and split air conditioners –– properties of ideal insulator, types of insulating materials .

V COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES **13**

Different heat sources – conduction heat load – radiation load of sun – occupants load – equipment load - infiltration air load – miscellaneous heat sources –fresh air load - problems.

Classification of duct systems - Duct design – equal friction method – velocity reduction method – problems. Chilled water Systems -Air handling Units.

Energy conservation and design decisions - heat reclaim – thermal storage – ice builder – ice harvester – variable refrigerant flow (VRF) – variable primary flow (VPF).

Text books :

1) Refrigeration and air conditioning, P.L . Ballaney, Khanna Publishers, 2B, North Market, Naisarak, New Delhi 110 006.
2) Refrigeration and air conditioning, V.K. Jain,
3) Industrial Refrigeration Hand Book, Wilbert F. Steocker

Reference Books:

1) A course in refrigeration and air conditioning , Domkundwar,
2) Principles of refrigeration, Dossat ,
3) Home refrigeration and air conditioning, Audels, Theo.Audel & Co. publisher, 199 Edn.49, West 23rd Street, New York. - 1998
4) Refrigeration and air conditioning, C.P Arora,
5) Cryogenic systems Randell Fd Barron.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32064 – COMPUTER AIDED DESIGN AND MAUFACTURING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32064

Semester : VI

Subject Title : COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
Computer Aided Design and Manufacturing Practical	**Hours/ Week**	**Hours/ Semester**	**Marks**			**Duration**
	6	90	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

OBJECTIVES:

- Study of parametric modeling.
- Understand the part modeling and assembly of parts
- Create the views of the solid model and parts list.
- Study the working principle of CNC machines
- Study the datum points and offsets.
- Differentiate incremental System with absolute system
- Study the simulation software package.
- Write program and simulate in the Lathe software and Milling software.
- Prepare a part program, edit and execute in CNC Turning centre.
- Prepare a part program, edit and execute in CNC Machining centre.
- Produce components in the CNC Turning centre and CNC Machining centre.

PART A: Solid modeling (30 Hrs.)

Introduction

Part modelling - Datum Plane – constraint – sketch – dimensioning – extrude – revolve – sweep – blend – protrusion – extrusion – rib – shell – hole – round – chamfer – copy – mirror – assembly – align – orient.

Exercises

3D Drawing

1. Geneva Wheel
2. Bearing Block
3. Bushed bearing
4. Gib and Cotter joint
5. Screw Jack
6. Connecting Rod

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

PART B: CNC Programming and Machining (45 Hrs.)

Introduction:

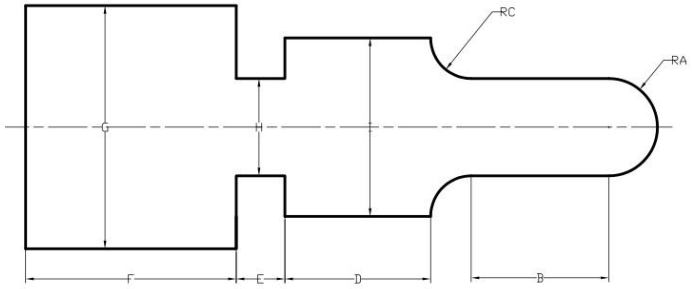
1. Study of CNC lathe, milling.
2. Study of international standard codes: G-Codes and M-Codes
3. Format – Dimensioning methods.
4. Program writing – Turning simulator – Milling simulator, IS practice – commands menus.
5. Editing the program in the CNC machines.
6. Execute the program in the CNC machines.

Exercises

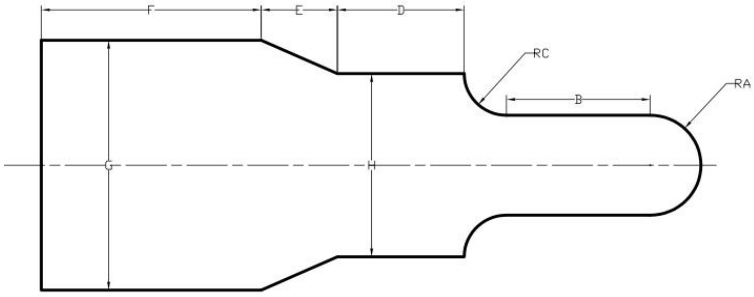
Note: Print the part program from the simulation software and make the component in the CNC machine.

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

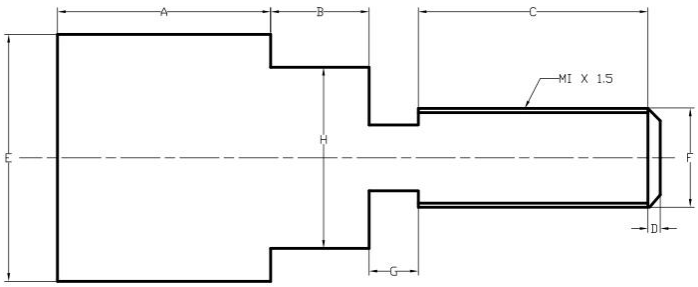
1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.



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

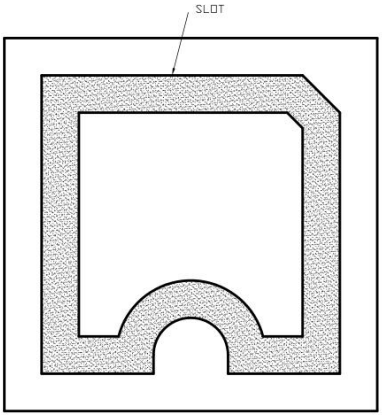


3. Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.

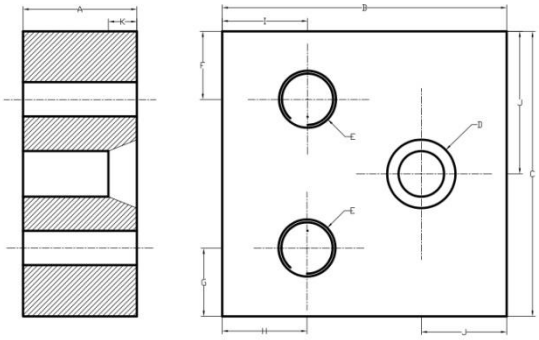


CNC Milling Machine **Material:** M.S / Aluminum / acrylic fibre / plastic

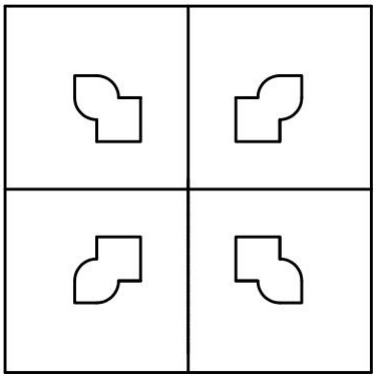
4. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.



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.



Reference:

CNC Programming & Operations, Sankar, Sathish and Balamurugan – Micro Publications, Tiruchy.

BOARD EXAMINATION

Note: All exercises should be completed. Two exercises should be carried out by selecting one exercise in each section. The printouts must be kept along with the examination paper.

Allocation of marks for Board Examination

PART –A: SOLID MODELING			**35**
Part modelling	:	15	
Assembly	:	10	
Printout	:	10	
PART-B: CNC PROGRAMING			**35**
Program editing and creation	:	15	
Component manufacturing	:	10	
Finish	:	10	
Viva voice	**:**		**5**
Total	**:**		**75**

LIST OF EQUIPMENTS

1. Personal computer - 30 Nos.
2. CNC programming software - Sufficient to the strength.
   (Lathe and Milling)
3. Modelling package - Sufficient to the strength.
   (Solid works / Pro-E / Catia / Unigraphics / Autocad etc…)
4. CNC Turning Machine - 1 No.
5. CNC Milling Machine - 1 No.
6. Laser Printer - 1 No.
7. Consumables - Sufficient quantity.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32065 – MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32065

Semester : VI

Subject Title : MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
Machine Tool Testing and Maintenance Practical	**Hours/ Week**	**Hours/ Semester**	**Marks**			**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

OBJECTIVES:

1. Study of Indian Standard Test charts.
2. Set up instrument for machine tool testing.
3. Observe the machine tool alignment and results.
4. Observe the manufacturing accuracy of machine tools.
5. Study the maintenance of the machine components.
6. Study the trouble shooting procedures and methods.
7. Prepare the record of work for all the exercises.

MACHINE TOOL TESTING

- Conduct geometrical test on machines with permissible deviations.
- Study the testing instruments and calibration to the standards.
- Prepare a test chart for the various tests and mention the errors.

Part A: Machine Tool Alignment

EXERCISES

1. Conduct the following test for the lathe machine and prepare a test chart.

   Check the level of slideways.

   Check the straightness of carriage movement.

   Check the parallelism of tailstock movement to carriage movements.

   Check the run-out of the spindle.

   Check the parallelism of the axis of the outside of tailstock sleeve to carriage movement.

2. Conduct the following test for the shaping machine and prepare a test chart.

   Check the flatness of table top face.

   Check the parallelism of table top face to its transverse movement.

   Check the parallelism of table top face to the ram movement.

   Check the parallelism of T-slot of top face to the ram movement.

   Check the squareness of table side face to its transverse movement.

3. Conduct the following test for the drilling machine and prepare a test chart.

   Check the level of the machine.

   Check the flatness of the table surface.

   Check the run-out of the internal taper of the spindle.

   Check the straightness of the pillar and squareness of the spindle axis.

   Check the squareness of the table surface to the vertical movement of the spindle housing

4. Conduct the following test for the surface grinding machine and prepare a test chart.

   Verify the levelling of slideways.

   Verify the straightness of slideways in a horizontal plane.

   Verify the flatness of the table surface.

   Verify the parallelism of the table surface.

   Check the run-out of the wheel spindle nose.

5. Conduct the following test for the milling machine and prepare a test chart.

   Check the straightness of the vertical movement of the knee.

   Check the squareness of the table surface to the column ways for knee.

   Check the flatness of the table surface.

   Check the parallelism of the table surface to its movement.

   Check the run-out of the internal taper of the spindle.

6. Conduct the following test for the slotting machine and prepare a test chart.

   Check the flatness of the table top face.

   Check the run-out of the central locating bore.

   Check the parallelism of table surface to its movement in longitudinal direction.
   Check the squareness of the longitudinal and transverse movements of table.

   Check the squareness of ram movement to the table surface in the transverse direction.

Part B: Maintenance

Dismantle, inspect and assemble the following machine components.

1. Lead screw and nut
2. Tailstock
3. Bench vice
4. Three jaw chuck
5. Four jaw chuck
6. Drill chuck

BOARD EXAMINATION

Note: Examinations will be conducted in both Part A and Part B. Students should be given exercises by selecting one exercise from each part by lot.

All the exercises should be given in the question paper and students are allowed to select by a lot

Machine Tool Alignment		**45**
Procedure / Drawing	15	
Geometrical test	20	
Result & Test Chart	10	
Maintenance		**25**
Dismantling	10	
Trouble shooting procedure	10	
Assembling / Report	5	
Viva-voce		**5**
TOTAL		**75**

LIST OF EQUIPMENTS

Machine

1. Lathe machine - 1 No.
2. Shaping machine - 1 No.
3. Drilling machine - 1 No.
4. Surface grinding machine - 1 No.
5. Milling machine - 1 No.
6. Slotting machine - 1 No.

Tools

7. Dial gauge - 5 Nos.
8. Magnetic stand - 5 Nos.
9. Surface gauges - 5 Nos.
10. Spirit level - 5 Nos.
11. Spanners (DE/Ring/Box) - Sufficient quantity
12. Screw drivers - Sufficient quantity
13. Allen screw sets - Sufficient quantity
14. Hammer - Sufficient quantity
15. Test mandrels - Sufficient quantity
16. Squares / Blocks - Sufficient quantity

Machine components

17. Lead screw and nut - 1 No.
18. Tailstock - 1 No.
19. Bench vice - 1 No.
20. Three jaw chuck - 1 No.
21. Four jaw chuck - 1 No.
22. Drill chuck - 1 No.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE PRACTICAL - II

32084 – MECHANICAL INSTRUMENTATION PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32084

Semester : VI

Subject Title : MECHANICAL INSTRUMENTATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Mechanical Instrumentation Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

- Handle various instruments
- Analyze the result of calibration of thermister
- Interpret calibration curve of a rotameter
- Evaluate the stress induced in a strain gauge
- Test and calibration of a thermocouple
- Draw the calibration curves of rotameter and thermister
- Measure various parameters using instruments
- Study of control system with the help of suitable practical application by arranging
- Know the measurement and control laboratory and study the specifications of measuring Instruments /devices.

EXERCISES

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

BOARD EXAMINATION

Duration: 3hrs **Max marks:75**

All the exercises should be given and students are allowed to select an exercise by lot.

ALLOCATION OF MARKS

Block Diagram	15
Reading and graph	35
Execution of circuit	20
Viva voce	5
TOTAL	**75**

LIST OF EQUIPMENTS

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE PRACTICAL - II

32085 – ROBOTICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32085

Semester : VI

Subject Title : ROBOTICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Robotics Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Objectives

- Study of Robot / Study of robot simulation software
- To study the components required.
- To study the techniques of programming
- Study of machine vision system
- Prepare a record of work done.

Exercises

1. Position recording using Cartesian co-ordinate system - (No. of positions to be specified - 9)
2. Position recording using Polar co-ordinate system - (No. of positions to be specified- 9)
3. Pick and place the objects - No. of objects to be specified- 6)
4. Pick and stack the objects - (No. of objects to be specified- 6)
5. Spray painting practice - (Area to be specified - 300mm x 300mm)
6. Spot welding practice - (No. of spots to be specified - 9)

7. Arc welding practice – (Length of weld to be specified)
8. Assembling practice - (Simple assembling)
9. Profile cutting practice - (Complicated profile – combination of lines and arcs)
10. Machine loading and unloading practice with time delay - (No. of times to be specified- 9)

BOARD EXAMINATIONS

Duration: 3hrs **Max marks:75**

All the exercises should be given and students are allowed to select an exercise by lot.

Allocation Marks

Procedure / Algorithm	15
Create and edit the program	25
Execution	20
Result / Finish	10
Viva-Voce	05
Total	**75**

LIST OF EQUIPMENTS

Computer with Accessories	:	15 Nos.
Compatible Software	:	Sufficient quantity
Hardware	:	6 Axis Robot / Separate device for the individual task. Teach Pendant control or PC based control through Software.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE PRACTICAL - II

32086 – REFRIGERATION AND AIRCONDITIONING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32086

Semester : VI

Subject Title : Refrigeration and Air-Conditioning Practical

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Refrigeration and Air-Conditioning Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:

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

PART- A

1. BASIC REFRIGERATION WORKSHOP OPERATION

(a) Copper and steel tubing

To study the various sizes of copper and steel tubing.

To study the various tools used for operations.

To become familiar with various operations on copper and steel tubing–Flaring, Swaging.

(b) Soldering methods used in R& A.C

2. TO STUDY THE CONSTRUCTION FEATURES OF THE FOLLOWING:

(a) Domestic refrigerators (b) Water coolers (c) Window Air Conditioner

(d) Split Type Air-Conditioner

3. PROPER METHODS OF SETTING AND ADJUSTING OF

(a) Thermostats

(b) Low pressure and high pressure cut-outs

(c) Thermostatic expansion valve

(d) Automatic Expansion Valve

PART-B

TEST PROCEDURES

1. To determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with Thermostatic expansion valve, Capillary tube, Automatic Expansion Valve
2. To determine the C.O.P of sealed system by using electrical measurements

   To determine the capacity of a window air conditioner.

   To determine the efficiency of a cooling tower.

   Wiring of refrigerator, water cooler, desert cooler, room air conditioner –packaged air conditioner, panel board etc.

SERVICE PROCEDURES

1. To change refrigerant into service cylinder from storage cylinder.
2. To evaluate the entire system
3. To Pump down the system
4. To Purge air from the system
5. To locate the leaks in a system.
6. To charge the system
7. To check the oil level in the compressor.
8. Tracing the common faults in R& A.C units and their remedies.

BOARD EXAMINATION

1. One Question from	Part A	:	25 Marks
2. One Question from	Part B	:	45 Marks
3. Viva voice		:	5 Marks
Total		:	75 Marks

LIST OF EQUIPMENTS

WORKING MODELS OF THE FOLLOWING WITH ARRANGEMENTS FOR CONDUCTING TESTS

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

WORKING MODEL OF THE FOLLOWING TO CONDUCT EXPERIMENTS

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

TOOLS:

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

SERVICE TOOLS:

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32067 – PROJECT WORK

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32067

Semester : VI

Subject Title : Project Work

.**TEACHING AND SCHEME OF EXAMINATIONS:**

No. of Weeks per Semester: 15 Weeks

Subject	Instruction		Examination		
	Hours/ Week	Hours/ Semester	Assessment Marks		
			Internal	Board Exam	Total
PROJECT WORK	4	60	25	75	100

Minimum Marks for Pass is 50 out of which minimum 35 marks should be obtained out of 75 marks in the board Examination alone.

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
- Get exposure on industrial environment and its work ethics.
- Understand what entrepreneurship is and how to become an entrepreneur.
- Learn and understand the gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key dates, asynchronous document sharing and discussions, as well as to prepare collaborative edition of the final project report.
- Understand the facts and importance of environmental management.
- Understand and gain knowledge about disaster management

INTERNAL ASSESSMENT:

The internal assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Detail of assessment	Period of assessment	Max. Marks
First Review	6th week	10
Second Review	12th week	10
Attendance	Entire semester	5
Total		**25**

EVALUATION FOR BOARD EXAMINATION:

Details of Mark allocation	Max Marks
Marks for Report Preparation, Demo, Viva-voce	65
Marks for answers of 4 questions which is to be set by the external examiner from the given question bank consisting of questions in the following two topics Disaster Management and Environmental Management. Out of four questions two questions to appear from each of the above topics i.e. 2 questions x 2 topics = 4 questions 4 questions x 2 ½ marks = 10 Marks	10
Total	**75**

DETAILED SYLLABUS

ENVIRONMENTAL & DISASTER MANAGEMENT

1. ENVIRONMENTAL MANAGEMENT

Introduction – Environmental Ethics – Assessment of Socio Economic Impact – Environmental Audit – Mitigation of adverse impact on Environment – Importance of Pollution Control – Types of Industries and Industrial Pollution.

Solid waste management – Characteristics of Industrial wastes – Methods of Collection, transfer and disposal of solid wastes – Converting waste to energy – Hazardous waste management Treatment technologies.

Waste water management – Characteristics of Industrial effluents – Treatment and disposal methods – Pollution of water sources and effects on human health.

Air pollution management – Sources and effects – Dispersion of air pollutants – Air pollution control methods – Air quality management.

Noise pollution management – Effects of noise on people – Noise control methods.

2. DISASTER MANAGEMENT

Introduction – Disasters due to natural calamities such as Earthquake, Rain, Flood, Hurricane, Cyclones etc – Man made Disasters – Crisis due to fires, accidents, strikes etc – Loss of property and life..

Disaster Mitigation measures – Causes for major disasters – Risk Identification – Hazard Zones – Selection of sites for Industries and residential buildings – Minimum distances from Sea – Orientation of Buildings – Stability of Structures – Fire escapes in buildings - Cyclone shelters – Warning systems.

Disaster Management – Preparedness, Response, Recovery – Arrangements to be made in the industries / factories and buildings – Mobilization of Emergency Services - Search and Rescue operations – First Aids – Transportation of affected people – Hospital facilities – Fire fighting arrangements – Communication systems – Restoration of Power supply – Getting assistance of neighbors / Other organizations in Recovery and Rebuilding works – Financial commitments – Compensations to be paid – Insurances – Rehabilitation.

LIST OF QUESTIONS

1. ENVIRONMENTRAL MANAGEMENT

1. What is the responsibility of an Engineer-in-charge of an Industry with respect to Public Health?
2. Define Environmental Ethic.
3. How Industries play their role in polluting the environment?
4. What is the necessity of pollution control? What are all the different organizations you know, which deal with pollution control?
5. List out the different types of pollutions caused by a Chemical / Textile / Leather / Automobile / Cement factory.
6. What is meant by Hazardous waste?
7. Define Industrial waste management.
8. Differentiate between garbage, rubbish, refuse and trash based on their composition and source.

9. Explain briefly how the quantity of solid waste generated in an industry could be reduced.
10. What are the objectives of treatments of solid wastes before disposal?
11. What are the different methods of disposal of solid wastes?
12. Explain how the principle of recycling could be applied in the process of waste minimization.
13. Define the term 'Environmental Waste Audit'.
14. List and discuss the factors pertinent to the selection of landfill site.
15. Explain the purpose of daily cover in a sanitary landfill and state the minimum desirable depth of daily cover.
16. Describe any two methods of converting waste into energy.
17. What actions, a local body such as a municipality could take when the agency appointed for collecting and disposing the solid wastes fails to do the work continuously for number of days?
18. Write a note on Characteristics of hazardous waste.
19. What is the difference between municipal and industrial effluent ?
20. List few of the undesirable parameters / pollutants anticipated in the effluents from oil refinery industry / thermal power plants / textile industries / woolen mills / dye industries / electroplating industries / cement plants / leather industries (any two may be asked)
21. Explain briefly the process of Equalization and Neutralization of waste water of varying characteristics discharged from an Industry.
22. Explain briefly the Physical treatments "Sedimentation" and "Floatation" processes in the waste water treatment.
23. Explain briefly when and how chemical / biological treatments are given to the waste water.
24. List the four common advanced waste water treatment processes and the pollutants they remove.
25. Describe refractory organics and the method used to remove them from the effluent.
26. Explain biological nitrification and de-nitrification.
27. Describe the basic approaches to land treatment of Industrial Effluent.
28. Describe the locations for the ultimate disposal of sludge and the treatment steps needed prior to ultimate disposal.
29. List any five Industries, which act as the major sources for Hazardous Air Pollutants.
30. List out the names of any three hazardous air pollutants and their effects on human health.
31. Explain the influence of moisture, temperature and sunlight on the severity of air pollution effects on materials.
32. Differentiate between acute and chronic health effects from Air pollution.
33. Define the term Acid rain and explain how it occurs.
34. Discuss briefly the causes for global warming and its consequences

35. Suggest suitable Air pollution control devices for a few pollutants and sources.
36. Explain how evaporative emissions and exhaust emissions are commonly controlled.
37. What are the harmful elements present in the automobile smokes? How their presence could be controlled?
38. What is the Advantage of Ozone layer in the atmosphere? State few reasons for its destruction.
39. Explain the mechanism by which hearing damage occurs.
40. List any five effects of noise other than hearing damage.
41. Explain why impulsive noise is more dangerous than steady state noise.
42. Explain briefly the Source – Path – Receiver concept of Noise control.
43. Where silencers or mufflers are used ? Explain how they reduce the noise.
44. Describe two techniques to protect the receiver from hearing loss when design / redress for noise control fail.
45. What are the problems faced by the people residing along the side of a railway track and near to an Airport? What provisions could be made in their houses to reduce the problem?

2. DISASTER MANAGEMENT

1. What is meant by Disaster Management? What are the different stages of Disaster management?
2. Differentiate Natural Disasters and Man made Disasters with examples.
3. Describe the necessity of Risk identification and Assessment Surveys while planning a project.
4. What is Disasters recovery and what does it mean to an Industry?
5. What are the factors to be considered while planning the rebuilding works after a major disaster due to flood / cyclone / earthquake? (Any one may be asked)
6. List out the public emergency services available in the state, which could be approached for help during a natural disaster.
7. Specify the role played by an Engineer in the process of Disaster management.
8. What is the cause for Earthquakes? How they are measured? Which parts of India are more vulnerable for frequent earthquakes?
9. What was the cause for the Tsunami 2004 which inflicted heavy loss to life and property along the coast of Tamilnadu ? Specify its epicenter and magnitude.
10. Specify the Earthquake Hazard Zones in which the following towns of Tamilnadu lie: (a) Chennai (b) Nagapattinam (c) Coimbatore (d) Madurai (e) Salem.
11. Which parts of India are experiencing frequent natural calamities such as (a) heavy rain fall (b) huge losses due to floods (c) severe cyclones
12. Define basic wind speed. What will be the peak wind speed in (a) Very high damage risk zone – A, (b) High damage risk zone, (c) Low damage risk zone.

13. Specify the minimum distance from the Sea shore and minimum height above the mean sea level, desirable for the location of buildings.
14. Explain how the topography of the site plays a role in the disasters caused by floods and cyclones.
15. Explain how the shape and orientation of buildings could reduce the damages due to cyclones.
16. What is a cyclone shelter ? When and where it is provided ? What are its requirements ?
17. What Precautionary measures have to be taken by the authorities before opening a dam for discharging the excess water into a canal/river ?
18. What are the causes for fire accidents ? Specify the remedial measures to be taken in buildings to avoid fire accidents.
19. What is a fire escape in multistoried buildings ? What are its requirements ?
20. How the imamates of a multistory building are to be evacuted in the event of a fire/Chemical spill/Toxic Air Situation/ Terrorist attack, (any one may be asked).
21. Describe different fire fighting arrangements to be provided in an Industry.
22. Explain the necessity of disaster warning systems in Industries.
23. Explain how rescue operations have to be carried out in the case of collapse of buildings due to earthquake / blast / Cyclone / flood.
24. What are the necessary steps to be taken to avoid dangerous epidemics after a flood disaster?
25. What relief works that have to be carried out to save the lives of workers when the factory area is suddenly affected by a dangerous gas leak / sudden flooding ?
26. What are the difficulties faced by an Industry when there is a sudden power failure? How such a situation could be managed?
27. What are the difficulties faced by the Management when there is a group clash between the workers? How such a situation could be managed?
28. What will be the problems faced by the management of an Industry when a worker dies because of the failure of a mechanical device due to poor maintenance? How to manage such a situation ?
29. What precautionary measures have to be taken to avoid accidents to labourers in the Industry in a workshop / during handling of dangerous Chemicals / during construction of buildings / during the building maintenance works.
30. Explain the necessity of medical care facilities in an Industry / Project site.
31. Explain the necessity of proper training to the employees of Industries dealing with hazardous products, to act during disasters.
32. What type of disaster is expected in coal mines, cotton mills, Oil refineries, ship yards and gas plants?
33. What is meant by Emergency Plan Rehearsal? What are the advantages of such Rehearsals?
34. What action you will take when your employees could not reach the factory site because of continuous strike by Public Transport workers?

35. What immediate actions you will initiate when the quarters of your factory workers are suddenly flooded due to the breach in a nearly lake / dam, during heavy rain?
36. What steps you will take to avoid a break down when the workers union of your Industry have given a strike notice?
37. List out few possible crisis in an organization caused by its workers? What could be the part of the middle level officials in managing such crisis?
38. What types of warning systems are available to alert the people in the case of predicted disasters, such as floods, cyclone etc.
39. Explain the necessity of Team work in the crisis management in an Industry / Local body.
40. What factors are to be considered while fixing compensation to the workers in the case of severe accidents causing disability / death to them?
41. Explain the legal / financial problems the management has to face if safely measures taken by them are found to be in adequate.
42. Describe the importance of insurance to men and machinery of an Industry dealing with dangerous jobs.
43. What precautions have to be taken while storing explosives in a match/ fire crackers factory?
44. What are the arrangements required for emergency rescue works in the case of Atomic Power Plants?
45. Why residential quarters are not constructed nearer to Atomic Power Plants?

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SANDWICH DIPLOMA COURSE-INDUSTRIAL TRAINING

32091 Industrial Training I (Report writing & Viva Voce)

32092 Industrial Training II (Report writing & Viva Voce)

1. Introduction

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

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

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

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

I SEM	II SEM	III SEM	IV SEM	V SEM	VI SEM	VII SEM

Institutional Study

Industrial Training

2. Attendance Certification

Every month students have to get their attendance certified by industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

3. Training Reports

The students have to prepare two types of reports:

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

3.1 Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave,

Holidays etc). The concern Industrial supervisor is to check periodically these progress reports.

3.2 Comprehensive Training Report

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

a. Scheme of Evaluation

1.1 Internal Assessment Marks

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

1.2 Board Examination

Presentation about Industrial Training	: 20 marks
Comprehensive Training Report	: 30 marks
Viva-voce	: 25 marks
Total	: 75 marks

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