SYLLABUS

DIPLOMA IN PRODUCTION ENGINEERING

FULL TIME

Course Code: 1025

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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Directorate of Technical Education
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Ettayapuram – 628 902

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Lecturer/Production Engineering
Government Polytechnic College,
Coimbatore-641 014

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Thiagarajar Polytechnic College,
Salem-636 005

Mr. Joshoa Gnanasekar B.E., M.S
HOD/Production Engineering,
CSI Polytechnic College,
Salem-636 007

Mr.B.Vijayakumar M.E.,
Senior Manager(Production)
LG Balakrishnan Brothers Ltd
Coimbatore-641 006

Mr.V.Sakthivel B.E,
Deputy General Manager,
Roots Multiclean Ltd
Pollachi-642 110

Dr.K.Kannan M.E., Ph.D
Assistant Professor/Production Engg.
PSG College of Technology
Coimbatore-641 004

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

c. Part Time (4 years)

The course for the 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 (Award of marks as same as Theory subjects)	:	**5 Marks**
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 Production Engineering

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

THIRD SEMESTER - W.E.F OC '16

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*
22533	Engineering Metallurgy	32541	Engineering Metallurgy
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 – W.E.F. AP '17

L-SCHEME		M-SCHEME	
Subject code	**Name of the Subject**	**Subject code**	**Name of Subject**
22041	Manufacturing Technology – I*	32032	Manufacturing Processes*
22142	Heat Power Engineering ***	32141	Thermal 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*
22146	Heat Power Engineering Practical***	32145	Thermal Engineering and IC Engines Practical***
22047	Electrical Drives & Control Practical	32047	Electrical Drives & Control Practical

FIFTH SEMESTER – W.E.F. OC '17

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*
22052	Manufacturing Technology – II*	32042	Special Machines*
Elective - I Theory			
22571	SPC & Total Quality Management	32071	Total Quality Management*
22072	Modern Machining Processes*	32572	Modern Machining Processes
22573	Industrial Robotics	32573	Industrial Robotics
22054	Design of Machine Elements*	32051	Design of Machine Elements*
22555	Metrology And Machine Tool Testing Practical	32555	Metrology And Machine Tool Testing Practical
22056	Manufacturing Technology – II Practical*	32046	Special Machines Practical*
20002	Communication and Life Skills Practical **	30002	Life and Employability Skills Practical **

SIXTH SEMESTER – W.E.F. AP '18

L-SCHEME		M-SCHEME	
Subject code	**Name of the Subject**	**Subject code**	**Name of Subject**
22561	Advanced Manufacturing Processes	-	**No Equivalent**
22062	Computer Integrated Manufacturing	32062	Computer Aided Design and Manufacturing
Elective - II Theory			
22581	Tool Design	32581	Tool Design
22582	Mechatronics	32582	Mechatronics
22583	Oil Hydraulics and Pneumatics	32583	Oil Hydraulics and Pneumatics
22083	Refrigeration and Air Conditioning	32083	Refrigeration and Air Conditioning
22064	Computer Integrated Manufacturing Practical	32064	Computer Aided Design and Manufacturing Practical
22065	Process Automation Practical	32055	Process Automation Practical
Elective - II Practical			
22585	Tool Design Practical	32585	Tool Design Practical
22586	Mechatronics Practical	32586	Mechatronics Practical
22587	Oil Hydraulics and Pneumatics Practical	32587	Oil Hydraulics and Pneumatics Practical
22087	Refrigeration and Air-conditioning Practical	32086	Refrigeration and Air-conditioning Practical
22567	Project Work	32567	Project Work

***COMMON WITH MECHANICAL ENGINEERING**

****COMMON FOR ALL BRANCHES**

*****COMMON WITH AUTOMOBILE ENGINEERING**

ANNEXURE - I

M SCHEME
Implemented from 2015 – 2016

1025: DIPLOMA IN PRODUCTION 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
32541	Engineering Metallurgy	5	-	-	5
32141	Thermal Engineering***	6	-	-	6
32043	Fluid Mechanics and Fluid Power *	5	-	-	5
32044	Electrical Drives & Control*	6	-	-	6
32045	Strength of Materials and Fluid Mechanics Practical*	-	-	4	4
32145	Thermal Engineering and IC Engines Practical***	-	-	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
32042	Special Machines*	5	-	-	5
32553	Engineering Metrology	6	-	-	6
Elective - I Theory		5	-	-	5
32071	Total Quality Management*				
32572	Modern Machining Processes				
32573	Industrial Robotics				
32555	Metrology and Machine Tool Testing Practical	-	-	4	4
32046	Special Machines Practical*	-	-	4	4
30002	Life and Employability Skills Practical **	-	-	4	4
	Seminar	1	-	-	1
TOTAL		**23**	**-**	**12**	**35**

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
32581	Tool Design				
32582	Mechatronics				
32583	Oil Hydraulics and Pneumatics				
32584	Process Planning and Cost Estimation				
32064	Computer Aided Design and Manufacturing Practical*	-	-	6	6
32055	Process Automation Practical*	-	-	4	4
Elective - II Practical		-	-	4	4
32585	Tool Design Practical				
32586	Mechatronics Practical				
32587	Oil Hydraulics and Pneumatics Practical				
32588	Process Planning and Cost Estimation Practical				
32567	Project Work	-	-	4	4
	Seminar	1	-	-	1
	TOTAL	**17**	**-**	**18**	**35**

***COMMON WITH MECHANICAL ENGINEERING**

****COMMON FOR ALL BRANCHES**

*****COMMON WITH AUTOMOBILE ENGINEERING**

ANNEXURE - II
M SCHEME
Implemented from 2015 – 2016

1025: DIPLOMA IN PRODUCTION 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		
32541	Engineering Metallurgy	25	75	100	40	3
32141	Thermal Engineering***	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
32145	Thermal Engineering and IC Engines Practical***	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
32042	Special Machines*	25	75	100	40	3
32553	Engineering Metrology	25	75	100	40	3
Elective - I Theory		25	75	100	40	3
32071	Total Quality Management*					
32572	Modern Machining Processes					
32573	Industrial Robotics					
32555	Metrology and Machine Tool Testing Practical	25	75	100	50	3
32046	Special Machines Practical*	25	75	100	50	3
30002	Life and Employability Skills Practical **	25	75	100	50	3

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
32581	Tool Design					
32582	Mechatronics					
32583	Oil Hydraulics and Pneumatics					
32584	Process Planning and Cost Estimation					
32064	Computer Aided Design and Manufacturing Practical*	25	75	100	50	3
32055	Process Automation Practical	25	75	100	50	3
Elective - II Practical		25	75	100	50	3
32585	Tool Design Practical					
32586	Mechatronics Practical					
32587	Oil Hydraulics and Pneumatics Practical					
32588	Process Planning and Cost Estimation Practical	25	75	100	50	3
32567	Project Work	25	75	100	50	3

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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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:** 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.	17

	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** **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.	**17**

III	**GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS** **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.	**17**
IV	**SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING** 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.	**16**

V	**THEORY OF TORSION AND SPRINGS** 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	**16**

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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32032

Semester : III

Subject Title : MANUFACTURING PROCESSES

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
Manufacturing Processes	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** **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.	17

	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** **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.	**17**
III	**Forming Technology** **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	**17**

	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 PRODUCTION 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 PRODUCTION ENGINEERING
Course Code : 1025
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**	5
	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.	
II	**LIMITS, FITS AND TOLERANCES**	5
	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	
III	**SURFACE TEXTURE**	5
	Surface texture – importance – controlled and uncontrolled surfaces – Roughness – Waviness – lay – Machining symbols	
IV	**KEYS, SCREW THREADS AND THREADED FASTENERS**	5
	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	

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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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

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			**:**	**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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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:

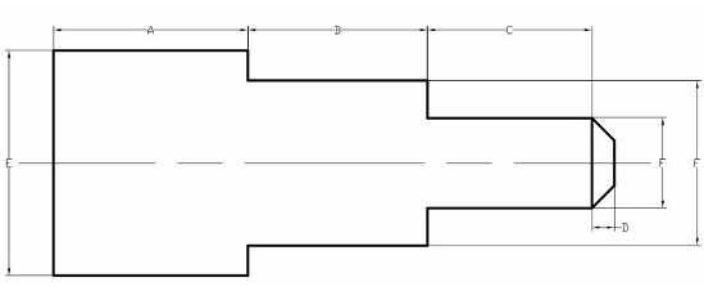
1. Introduction of safety in operating machines.
2. Study of lathe and its parts.
3. Types of tools used in lathe work.
4. Study of work holding devices and tool holding devices.

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

Exercises:

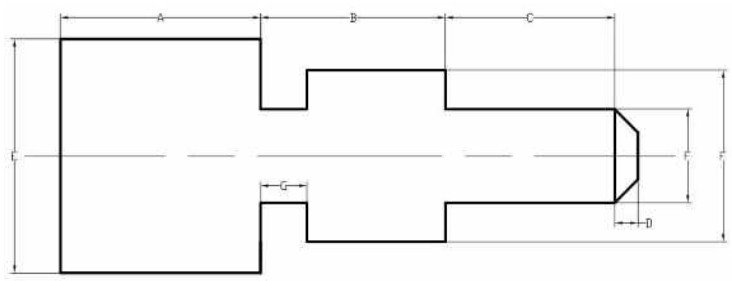
Make the following jobs in the lathe. Raw material ∟32 mm M.S. Rod

1. Facing, Step turning & Chamfering



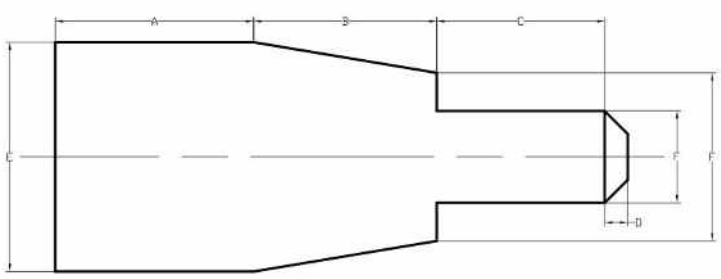
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Step turning & Groove cutting



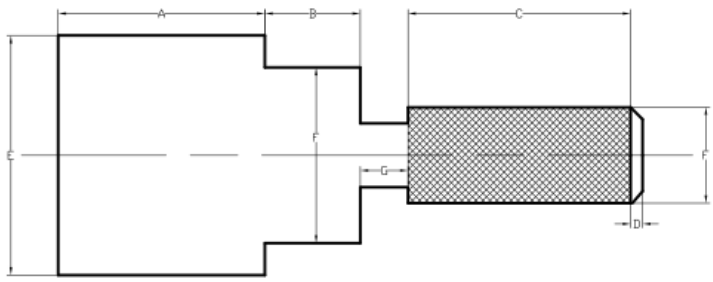
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Step turning & Taper turning



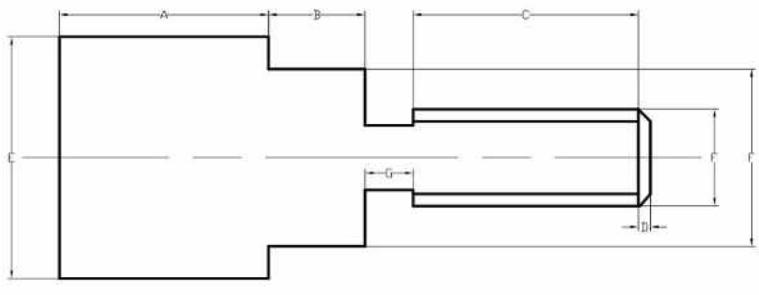
Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Step turning & Knurling



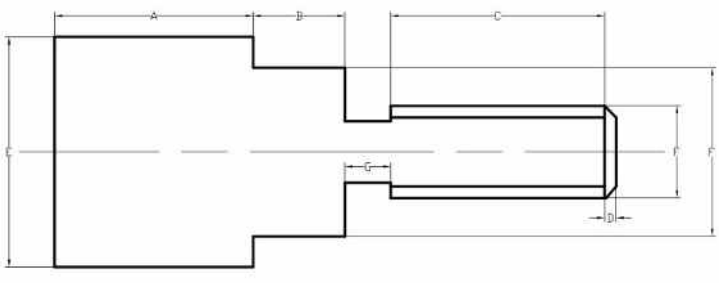
Dimensions			
Sl.No	Part Name	Actual	Obtained

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



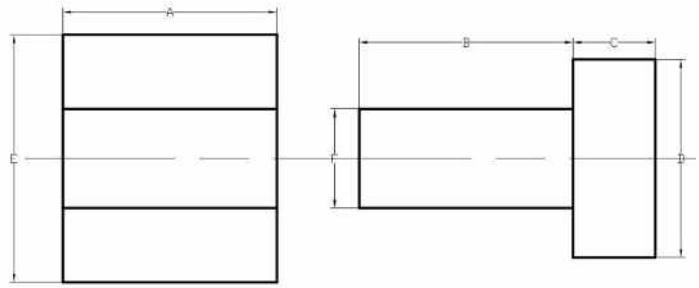
Dimensions			
Sl.No	Part Name	Actual	Obtained

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



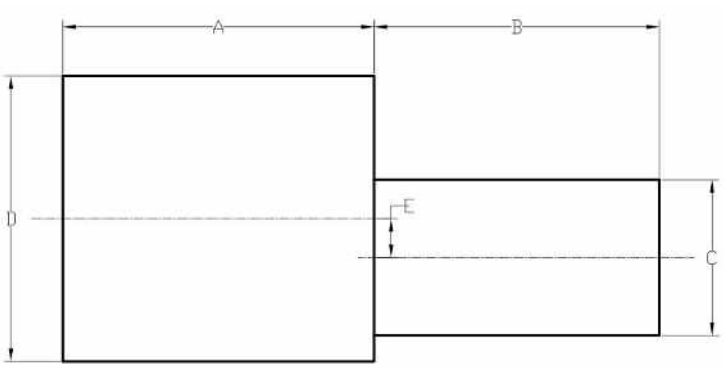
Dimensions			
Sl.No	Part Name	Actual	Obtained

7. Bush: Turning & Drilling



Dimensions			
Sl.No	Part Name	Actual	Obtained

8. Eccentric turning



Dimensions			
Sl.No	Part Name	Actual	Obtained

Drilling section:

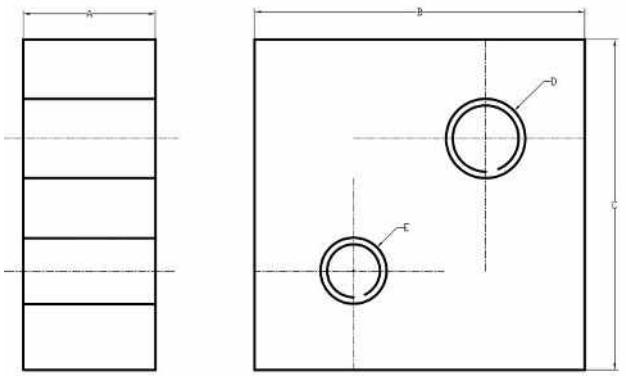
1. Introduction of safety in operating machines.
2. Study of drilling machines and its parts.
3. Study the types of tools used.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools.
6. Operation and practice.
7. Types of measuring instruments and their uses.

Exercises:

Make the following jobs in the drilling machine.

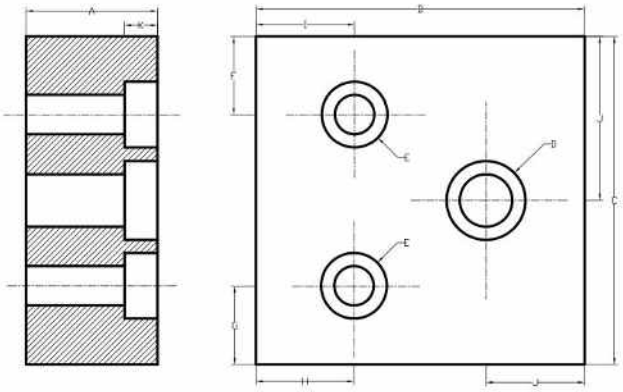
Raw material 50mm X 50mm X 20 mm thick M.S. Flat

1. Drilling & Tapping



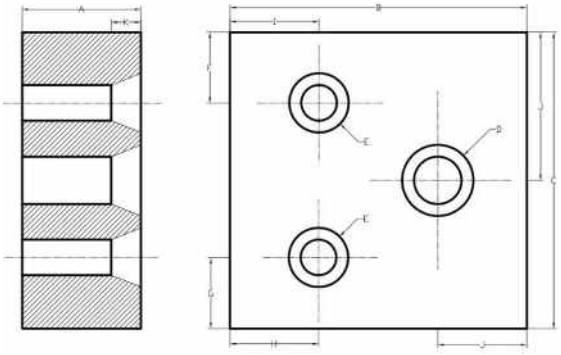
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Drilling & Counter boring



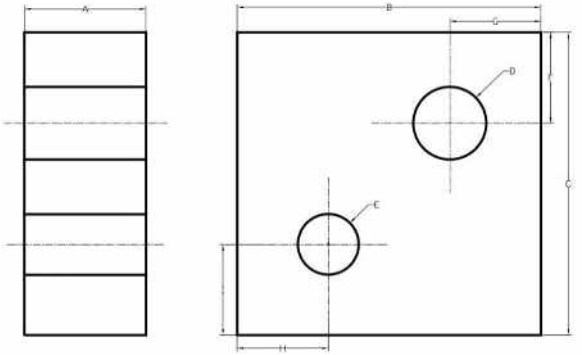
Dimensions			
Sl.No	Part Name	Actual	Obtained

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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32541 –ENGINEERING METALLURGY

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32541

Semester : IV

Subject Title : ENGINEERING METALLURGY

TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 15 weeks

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

TOPICS AND ALLOCATION OF HOURS:

Sl.No	Topic	Time(Hrs)
1.	Structure of Solids	14
2.	Phase Diagrams,Ferrous Metals & Its alloys	14
3.	Non-Ferrous Metals & Its alloys	14
4.	Failure analysis & Testing of Materials	13
5.	Corrosion & Surface Engineering	13
	TEST &REVISION	07
Total		75

Rationale:

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

Objectives:

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

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

ENGINEERING METALLURGY

DETAILED SYLLABUS

Contents: Theory

UNIT	NAME OF TOPICS	Hours
I	**STRUCTURE OF SOLIDS**	
	Crystal Structure: Introduction to Atomic Structure - Crystal Structure: Unit Cell and Space Lattice – Crystal System: The seven basic crystal systems – Crystal structure for Metallic Elements: BCC, FCC and HCP – Coordination Number for Simple Cubic, BCC and FCC – Atomic Radius: Definition, Atomic radius for Simple Cubic, BCC and FCC – Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP – Simple problems on finding number of atoms for a unit cell.	**14 Hrs**
	Bonds in Solids: Classification: Primary or Chemical Bond, Secondary or Molecular Bond – Types of Primary Bonds: Ionic, Covalent and Metallic Bonds – Types of Secondary Bonds: Dispersion Bond,Dipole Bond and Hydrogen Bond.	
II	**PHASE DIAGRAMS, FERROUS METALS & ITS ALLOYS**	
	Phase Diagrams, Isomorphous, Eutectic and Eutectoid systems – Iron Carbon binary diagram	**14 Hrs**
	Iron and Carbon Steels: Introduction – Flow sheet for production of Iron and Steel – Iron Ores – Pig Iron: Classification, Composition and Effects of impurities on Iron – Cast Iron: Classification, Composition, Properties and Uses – Wrought Iron: Properties, Uses/Applications of Wrought Iron.	
	Steel - Classification of Carbon Steels: Low Carbon Steel, Medium Carbon Steel and High Carbon Steel – Composition, Properties and Uses - Comparison of Cast iron, Wrought Iron and Mild Steel and High Carbon Steel or Hard Steel – Standard Commercial grades of Steel as per AISI.	
	Ferrous Alloys: Alloy Steels – Purpose of alloying – Effects of alloying elements - Important Alloy Steels: Silicon Steel, High Speed Steel (HSS), Heat Resisting Steel, Spring Steel, Stainless Steel (SS): Types of SS, Applications of SS - Magnet Steel – Composition, Properties and Uses.	

III NON-FERROUS METALS & ITS ALLOYS

14 Hrs

Non-Ferrous Metals & Alloys: Properties and uses of Aluminium, Copper, Tin, Lead, Zinc, Magnesium and Nickel. Copper Alloys: Brasses, Bronzes – Composition, properties and uses.Aluminium Alloys: Duralumin, Hindalium, Magnelium – Composition, properties and uses. Nickel Alloys: Inconel, Monel, Nichrome – Composition, properties and uses. Anti-friction / Bearing Alloys: Various types of Bearing Bronzes. Standard commercial grades as per ASME.

Cutting Tool Materials: Characteristic of ideal Cutting Tool Materials – Types: Carbon Steels, Medium alloy steel – HSS – Stellites – Cemented Carbide – CBN – Diamond and Abrasives. Various standards available for selction of ferrous and non- ferrous materials.

IV FAILURE ANALYSIS & TESTING OF MATERIALS

13 Hrs

Failure Analysis: Introduction to failure analysis – Fracture: ductile fracture, brittle fracture – Cleavage – Notch sensitivity – Fatigue – Endurance limit – Characteristics of fatigue fracture – Variables affecting fatigue life – Creep – Creep curve – Creep fracture. (Descriptive treatment only).

Testing of Materials: Destructive Testing: Tensile Testing – Compression Testing – Hardness Testing: Brinell, Rockwell, Scleroscope and Mohs Test – Bend test – Torsion test – Fatigue test – Creep test. Non-destructive testing: - Visual Inspection -Magnetic Particle inspection – Liquid penetrant test – Ultrasonic inspection, Radiography (Descriptive treatment only).

V CORROSION & SURFACE ENGINEERING

13 Hrs

Corrosion: Nature of corrosion: Why corrosion occurs?, Electro-chemical reactions, Electrolytes – Factors affecting corrosion: Environment, Material properties and Physical conditions – Types of corrosion (eight types) – Determination of corrosion characteristics – Corrosion control: Material selection, Environment control and Design.

Surface Engineering: Reasons for surface engineering – Surface engineering processes: Coatings and Surface treatments – Cleaning and Mechanical finishing of surfaces – Organic coatings – Electro-plating and Special metallic plating – Electro-polishing and Photo-etching – Conversion coatings: Oxide, Phosphate and Chromate coatings – Thin film coatings: PVD and CVD – Surface analysis – Hard-facing, Thermal spraying and High-Energy processes – Process / Material selection. Pollution norms for treating effluents as per standards.

Text Book

1. Introduction to Physical Metallurgy, Sydney Avner, Tata McGraw-Hill Education Private Ltd,

2. Material Science & Engineering, R.K.Rajput,S.K.Kataria & Sons, Delhi

Reference Books

1. Manufacturing Engineering Processes for Engg. Materials Serope Kalpakjian & Steven R.Schmid. Pearson Education Pvt. Ltd., New Delhi.

2. A Text Book of Material Science & Metallurgy, O.P.Khanna, DhanpatRai Publications Pvt. Ltd., New Delhi

2. Engineering Materials: Properties and Selection, G.Budinski & K.Budinski, PHI, New Delhi

4 . Material Science, R.S.Khurmi, S.Chand & Co. Ltd., New Delhi

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32141 – THERMAL ENGINEERING

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32141

Semester : IV

Subject Title : THERMAL ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

Topics and Allocation of Hours:

Unit	Topics	Hours
I	Thermodynamics – properties of perfect gases – thermodynamics processes	17
II	Air cycles – Fuels and Combustion	17
III	Properties of steam – steam boiler – steam engine – steam	17
IV	IC engines – Permormance of IC engines – Air compressors	16
V	Refrigeration – Air-conditioning	16
	TEST AND REVISION	7
	Total	**90**

THERMAL ENGINEERING
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**Thermodynamics :** Definition – fundamental units – derived units – SI units – Laws of motion –Newtons first law of motion - Newtons second law of motion - Newtons third law of motion – mass and weight – pressure – gauge and absolute pressure – temperature – absolute temperature – heat – specific heat – thermodynamic systems – properties of system – laws of thermodynamics – Zeroth law of thermodynamics – First law of thermodynamics – Second law of thermodynamics. **Properties of perfect gases :** Introduction – Laws of perfect gases – Boyle's law – Charle's law – general gas equation – Joule's law – characteristic equation of gas – Avogadro's law – Universal gas constant – Specific heats of a Gas – Specific heat at constant volume- Specific heat at constant pressure – relation between specific heats – ratio of specific heats.. **Thermodynamics processes of perfect gases :** Constant volume process – constant pressure process – hyperbolic process – isothermal process – adiabatic process – polytropic process - throttling process- Derivation of heat transfer, change of internal energy, change of entropy and Work done – Simple problems.	17
II	**Air cycles :** Introduction – assumptions – classifications – efficiency of the cycle – reversible cycle – irreversible cycle – types of thermodynamic cycles – Carnot cycle – Joules cycle – Otto cycle – Diesel cycle – Dual combustion cycle – derivation – simple problems. **Fuels:** Classification – solid fuels – liquid fuels – gaseous fuels - merits and demerits – requirement of good fuel – calorific value of fuels – Higher calorific value – lower calorific value – Construction and working of bomb calorimeter and gas calorimeter. **Combustion :** Elements and compounds – atoms and molecules – atomic weight – molecular weight – combustion of solid fuels – combustion of gaseous fuels – theoretical weight of air required for complete combustion - theoretical volume of air required for complete combustion – gravimetric analysis – Volumetric analysis– Weight of carbon in flue gases – weight of flue gases per kg of fuel burnt –Excess air supplied – weight of excess air supplied – flue gas analysis by Orsat Apparatus - simple problems. Introduction – assumptions – classifications – efficiency of the cycle – reversible cycle – irreversible cycle – types of thermodynamic cycles – Carnot cycle –Joules cycle – Otto cycle – Diesel cycle – Dual combustion cycle – derivation –simple problems.	17
III	**Properties of Steam:** Formation of steam –Temperature vs Heat – Important terms for steam – latent heat of steam - dryness fraction –	17

wetness fraction – types of steam – dry and saturated steam, wet steam and superheated steam – advantages of super heated steam - steam tables and their uses – Total heat – volume –internal energy – entropy – simple problems using steam tables. Measurement of dryness fraction of steam – barrel calorimeter – combined separating and throttling calorimeter – working principle - problems.

Steam Boiler: Important terms – essentials of good steam boiler – selection of a steam boiler – classification – Working principle of Locomotive boiler – Lamont boiler – BHEL boiler – merits and demerits.

Steam engine: Classification – important parts of steam engine – working of a single cylinder double acting reciprocating steam engine – theoretical indicator diagram – actual indicator diagram.

Steam Condenser: Advantages of a condenser in steam power plant – Requirement – Classification – Working principle of Jet condenser – types – working principle of surface condenser - types.

IV **IC Engines :**Introduction- classifications – four stroke cycle petrol and diesel engines- merits and demerits – two stroke cycle – petrol and diesel engines – comparison **16**

Performance of IC Engines :

Performance of I.C engines - indicated power - brake power - friction power efficiencies of I.C engines- indicated thermal, brake thermal, mechanical and relative efficiencies - Morse test- procedure - problems - heat balance sheet – problems.

Air compressors : Air Compressor – uses of compressed air- classifications of Air compressor-reciprocating compressor-single stage reciprocating compressor- multi stage compression – merits and demerits –Two stage compressor with imperfect cooling – with perfect inter cooling – rotary compressors – Roots blower – vane blowers – centrifugal and axial flow air
compressors

V **REFRIGERATION :** Refrigeration - refrigerators and heat pumps-types and applications of refrigeration - vapour compression refrigeration system - vapour **16**
absorption system – comparison – refrigerating effect - capacity of refrigerating
unit - C.O.P - actual C.O.P – power required – mass of ice produced – problems - refrigerants-desirable properties - classification of refrigerants.

AIR CONDITIONING:

Air conditioning - psychrometric properties - dry air - moist air - water vapour - saturated air – dry bulb temperature - wet bulb depression - dew point depression - dew point temperature – humidity - specific and relative humidity – psychrometric chart – psychometric processes - sensible heating and cooling – humidification – dehumidification – classification and applications of air conditioning system – room air conditioning - central air conditioning – comparison – differences between comfort and industrial air conditioning - factors to be considered in air conditioning - loads encountered in air conditioning systems.

Text Books

1 Applied Thermodynamics,P.K. Nag, 2nd Edition, TATA McGraw - Hill Publishing Co., New Delhi.
2 Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition, S.Chand & Co, New Delhi

Reference Book

1 Thermal Engineering ,P.L Ballaney , 24th Edition ,Khanna Publishers, New Delhi.
2 Applied Thermodynamics, Domkundwar and C.PKothandaraman, 2nd Edition,Khanna publishers, New Delhi.
3 Refrigeration and Air conditioning, P. L. Ballaney, , 4th edition, Khanna Publishers, Newdelhi.
4 Power Plant Engineering Thermodynamics, Domkundwar and C.P Kothandaraman., 2nd Edition , Khanna Publishers.
5 Power plant Engineering, G.R. Nagpal,Khanna Publishers, New Delhi.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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 PRODUCTION 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 PRODUCTION ENGINEERING
Course Code : 1025
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	17
II	AC CIRCUITS AND AC MACHINES	17
III	STEPPER AND SERVO MOTORS & DRIVES	17
IV	POWER SUPPLIES AND LOGIC GATES	16
V	CONTROL ELEMENTS AND PLC	16
	TEST AND REVISION	7
	Total	**90**

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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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

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

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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32145 – THERMAL ENGINEERING AND IC ENGINES PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1020

Subject Code : 32146

Semester : IV

Subject Title : THERMAL ENGINEERING AND IC ENGINES PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

PART A

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

PART B

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

8. Dismantling and assembling of distributor pump and injectors

BOARD EXAMINATION

SCHEME OF EXAMINATION

Note: Question paper should have two questions, consisting one from each part.

PART A	**35**
PART B	**35**
Viva Voice	**5**
TOTAL	**75**

Resources required: Minimum one number is required for 60 intake. Based on the increase in intake the facility should be improved.

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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 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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32553 – ENGINEERING METROLOGY

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING
Course Code : 1025
Subject Code : 32553
Semester : V
Subject Title : ENGINEERING METROLOGY

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

TOPICS AND ALLOCATION OF HOURS:

Sl.No.	Topic	Time(Hrs)
1.	Introduction to Metrology	17
2.	Linear and Angular Measurement	17
3.	Form Measurement	17
4.	Measurement of Surface Finish	16
5.	Advanced Metrology & Calibration	16
	TEST & REVISION	07
Total		90

Rationale:

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

Objectives:

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

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

ENGINEERING METROLOGY

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**INTRODUCTION TO METROLOGY**	17

Definition, Necessity and Objectives of Metrology, Types of Metrology, Need of Metrology; Units and standards; Generalised measurement system - Elements of measuring system; Methods of measurement; measuring instruments: sensitivity, stability, range, Precision and Accuracy - static and dynamic response; Errors - systematic and random errors - Sources of Errors-correction; Selection and Care of instruments; calibration..

II	**LINEAR AND ANGULAR MEASUREMENT**	17

Definition of metrology-Linear measuring instruments: Vernier caliper, vernier height gauge, vernier depth gauge, micrometer, Slip gauges and classification, - Tool Makers Microscope-interferometery, optical flats,-Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: -Sine bar, Sine center, Bevel Protractor, Auto collimator, Angle Decker.

III	**FORM MEASUREMENT**	17

Measurement of screw threads: Thread gauges, floating carriage micrometer measurement of gear tooth thickness: constant chord and base tangent method, using profile projector. Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

IV	**MEASUREMENT OF SURFACE FINISH**	16

Introduction; Surface Texture; Methods of Measuring Surface finish- Comparison Methods & Direct Instrument Measurement; Sample Length; Numerical Evaluation of Surface Texture; Indication of Surface roughness Symbols used; Adverse effects of poor surface finish.

V	**ADVANCED METROLOGY CALIBRATION**	**16**

Metrology Integration; Universal Measuring machines; Use of Numerical control for measurements- Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- machine (CMM): need, construction, types, applications.- computer aided inspection.

Calibration – Definition – calibration of Vernier caliper, Vernier height gauge, Vernier depth gauge, micrometer, Slip gauges as per standards.

TEXT BOOKS

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 2005
2. Anand K Bewoor & Vinay A Kulkarni, “Metrology & Measurements”, Tata McGraw-Hill Education Private Ltd, 2009

REFERENCE BOOKS

1. Gupta I.C, “Engineering Metrology”, Dhanpat rai Publications, 2005
2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

ELECTIVE THEORY - I

32071 – TOTAL QUALITY MANAGEMENT

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

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**	**14**
	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.	
II	**CONTINUOUS PROCESS IMPROVEMENT – Q7 TOOLS**	**14**
	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 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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

ELECTIVE THEORY - I

32572 – MODERN MACHINING PROCESSES

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32572

Semester : V

Subject Title : MODERN MACHINING PROCESSES

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	
Modern Machining Processes	5	75	25	75	100	3 Hrs

TOPICS AND ALLOCATION OF HOURS:

Sl.No.	Topic	Time(Hrs)
1.	Automatic Lathes and Gear Manufacturing	14
2	Mechanical Energy Based Processes	14
3.	Electrical Energy Based Processes	14
4.	Chemicals and Electro Chemical Energy Based Processes	13
5.	Thermal Energy Based Processes	13
	TEST & REVISION	07
Total		75

Rationale:

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

essential in industries.

Objectives:

- Explain the working of automatic lathe.
- Compare different types of gear manufacturing methods.
- Explain the construction and working of ultrasonic machines.
- Explain the working of Electrical energy based machining processes.
- Compare different Electrochemical machining processes.
- Explain the working of LBM and Plasma arc machinery.
- Explain the applications and limitations of modern machining process.

MODERN MACHINING PROCESSES

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**AUTOMATIC LATHES AND GEAR MANUFACTURING**	14

Automatic Lathes: Automatic lathe – classification of single spindle

automatic lathe – principle of automatic lathes – automatic screw cutting machines – multi spindle automatic lathes Transfer Machines – In-line & Rotary types, advantages & disadvantages.

Gear Manufacturing Processes – Gear Broaching **:** Gear shaper-gear hobbing-principle of operation only-gear finishing processes-burnishings having- grinding and lapping-gear materials-cast iron, steel, alloy steels, brass, bronze, aluminum, nylon.

II	**MECHANICAL ENERGY BASED PROCESSES**	14

Ultrasonic Machining : Principle- Transducer types – Concentrators -Abrasive Slurry - Advantages and Limitations – Applications.

Abrasive Jet Machining: Process- Principle - Advantages and Limitations –Applications.

Water Jet Machining: Principle –Advantages and Limitations – Practical Applications.

III	**ELECTRICAL ENERGY BASED PROCESSES**	14

Electrical Discharge Machining (EDM), Mechanism of metal removal – Dielectric Fluid – Electrode Materials - Spark Erosion Generators – Electrode Feed System – Tool Electrode Design – Characteristics of Spark Eroded Surfaces - Advantages and Limitations – Practical Applications EDM Wire Cut and Grinding: Principle – Wire Feed System - Advantages and Limitations – Practical Applications

IV CHEMICALS AND ELECTRO CHEMICAL ENERGY BASED PROCESSES **13**

Chemical Machining : fundamentals, Principle –classification and selection of Etchant -chemical milling, Engraving, Blanking, Drilling andTrepanning-Advantages and limitations –Applications. Electro Chemical Machining: Electro-chemistry of the process-Electrolytes-Electrolyte and their Properties – Advantages and Limitations – Applications.

Electro Chemical Grinding: Honing, cutting off, Deburring and turning.

V THERMAL ENERGY BASED PROCESSES **13**

Electron Beam Machining: Principle –Generation and control of electron beam-Advantages and Limitations – Applications.

Laser Beam Machining: Principle –Solid and Gas Laser Application – Thermal Features of LBM - Advantages and Limitations – Applications. **Ion Beam Machining:** Equipment – Advantages and Limitations – Applications. Plasma Arc Machining: Principle –Gas mixture– Types of Torches –Advantages and Limitations – Applications.

Text Book :

1) “Modern Machining Process”, P.C Pandey And H.S. Shan, Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 2007

2) “ Advanced Machining Process”, V.K. Jain, Allied Publishers PVT Limited 2007

Reference Book:

1) “New Technology”, Amitadha Bhattacharyya, The Institution of Engineers ,(india).

2)."Production Technology”, HMT Banglore, Tata Mc Graw–Hill Publishing Company Limited,New Delhi, 2006.

3) ,”Text Book of Production Engineering”, P.C. SharmaS. Chand & Company Ltd., Ramnagar, New Delhi.

4) “Elements of workshop Technology”, S.K. Hajra Choudhury, S.K.Bose, A.K. Hajra Choudhury, Nirjhar roy.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

ELECTIVE THEORY - I

32573 – INDUSTRIAL ROBOTICS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32573

Semester : V

Subject Title : INDUSTRIAL ROBOTICS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

TOPICS AND ALLOCATION OF HOURS:

Sl.No	Topic	Time(Hrs)
1.	Fundamentals of Robotics	14
2.	Robotic Drive System and Controller	14
3.	Sensing and Machine Vision	14
4.	Robot Programming	13
5.	Robot Applications in Manufacturing	13
	TEST & REVISION	07
Total		75

Rationale:

Industrial robotics is a special – purpose Automated machine tools and is easily restrained (or) reprogrammed to perform an array of different tasks. Automated special – purpose machine tool can work on only a very limited class of tasks and designed to do one task very efficiently.

Objectives:

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

- Describe about robot anatomy and types, advantages and disadvantages
- Explain robotic electrical, hydraulic and pneumatic drive systems
- Describe about robot controllers
- Describe about various sensors used in robots
- Explain robot machine vision concepts
- Explain robot programming methods
- Describe robots applications in manufacturing

INDUSTRIAL ROBOTICS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**FUNDAMENTALS OF ROBOTICS**	**14**
	Introduction – definition – Robot anatomy (parts) and its working – robot Components – manipulator, end effectors – construction of links, type of joint – classification of robots – Cartesian, cylindrical, spherical, Scara, Vertical articulated – Structural Characteristics of robots – mechanical rigidity – effects of structure on control work envelope and work Volume – robot work Volumes, comparison - advantages and disadvantages of robots. End effectors, grippers-	

specifications

II	**ROBOTIC DRIVE SYSTEM AND CONTROLLER**	**14**

Actuators – Hydraulic, pneumatic and electrical drives - Linear actuator, rotary drives, AC servo motor , DC servo motors and stepper motors - conversion between linear and rotary motion – feedback devices - Potentiometers – optical encoders – DC tachometers. Robot controller – level of controller – open loop and closed loop controller – microprocessor based control system – Robot path control, point to point, continuous path control, sensor based path control, controller programming.

III	**SENSING AND MACHINE VISION**	**14**

Introduction, requirement of sensor, sensory devices – position sensors (Encoders, resolvers, Piezo Electric), Range sensors (Triangulation Principle, structured, lighting approach) Proximity sensing, Force and torque sensing. Introduction to machine vision – Robot vision system (scanning and digitizing image data) – Image processing and analysis- Cameras (Acquisition of images) - Working principle & construction- Applications of Robot vision system, Inspection, Identification, Navigation & serving.

IV	**ROBOT PROGRAMMING**	**13**

Robot programming – lead through methods and textual robot languages – motion specification - motion interpolation - basic robot languages – generating of robot programming languages – On-Line & Off-Line programming - robot language structure – basic commands – artificial intelligence and robotics.

V	**ROBOT APPLICATIONS IN MANUFACTURING**	**13**

RGV, AGV- Implementation of Robots in industries– material handling – assembly finishing –adopting robots to work station - requisite and non – requisite robot characteristics – stages in selecting robot for individual application – precaution for robot – future of robotics.

TEXT BOOKS

1. Robotics, Prof.S.Dharmalingam,R.Senthil kumar & Prof.D.R.Kumar.

REFERENCE BOOKS

1. Industrial Robotics – Technology – Programming and Applications, Mikell P.Groover, Mite chell weiss, Roger Negal and Nicholes G.Odress, McGraw Hill.
2. Robotics – An Introduction, Doughales – R. Halconnjr.
3. Modern Electric Equipments for Automobile, Judge. AW Chapman & Hall.
4. Robotic Engineering, Richard David Klafter, Thomas A chmielewski, Michael Negin, Prantice Hall, 1989.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32555 – METROLOGY AND MACHINE TOOL TESTING PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32555

Semester : V

Subject Title : METROLOGY AND MACHINE TOOL TESTING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

Rationale:

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

Objectives:

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

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

- Do alignment tests of conventional machine tools as specified in the manufacturer's catalog.

EXERCISES

I. Metrology (Part A)

1. Measurement of components using Vernier depth gauge & Vernier height gauge.
2. Calibration of Vernier caliper and micrometer using slip gauges.
3. Checking of flatness and concentricity of ground job using dial indicator.
4. Measurement of bore using cylindrical bore gauge.
5. Checking flatness of the given job by using monochromatic checklite.
6. Measurement of angles by using optical type bevel protractor.
7. Measurement of angles using Auto Collimator.
8. Identify the various types of threads and measure their pitches using pitch gauges.
9. Measurement of effective diameter of screw threads by three wire method.
10. Measurement of surface roughness of the machined component using surface roughness tester.

II. Machine Tool Maintenance (Part B)

1. Study of maintenance stages of machine tool (Lathe).
2. Dismantling and assembling of tailstock of lathe.
3. Dismantling and assembling of three jaw chuck of lathe
4. Dismantling and assembling of four jaw chuck of a lathe
5. Dismantling and assembling of machine vice.
6. Alignment test on lathe.
7. Alignment test on shaper.
8. Alignment test on milling machine
9. Alignment test on radial drilling machine.
10. Alignment test on planer.

List of Equipments

Sl.No	List of Equipments	Qty
1	Vernier Caliper LC 0.02 mm	06
2	Micrometer LC 0.01 mm	03
3	Vernier Height Gauge LC 0.02 mm	01
4	Vernier Depth Gauge LC 0.02 mm	02
5	Sine bar	02
6	Slip gauge	02
7	Inside Micrometer LC 0.01 mm	03
8	Bevel Protractor	02
9	Gear Tooth vernier Caliper	02
10	Thread micrometer	02
11	Pitch gauge mm & Inch set	02 each
12	Dial Indicator with magnetic stand	06
13	Straight edge	02
14	Squares	02
15	Spirit level	06
16	Test Mandrals (01 for each machine)	-
17	Autocollimator	01
18	Surface table with stand	02
19	Digital Micrometer	02
20	Monochromatic checklite	01

Board of Examination

Note: All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise from metrology another from machine tool testing.

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

Time : 3 Hrs Max Marks : 75

Sl.No	Detail	Marks
1	Part A	35
2	Part B	35
3	Viva Voce	05
	Total	75

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

32046 – SPECIAL MACHINES PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32046

Semester : IV

Subject Title : SPECIAL MACHINES PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

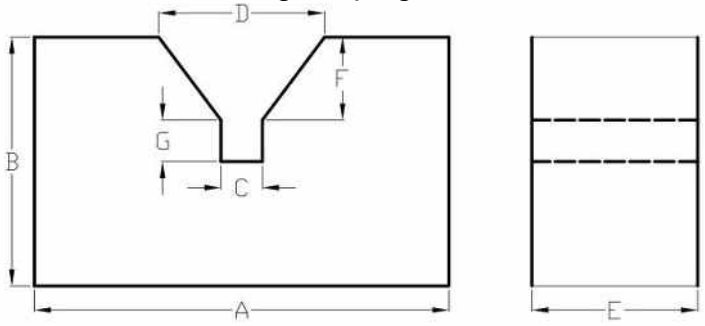
Subject	**Instructions**		**Examination**			
	Hours /Week	**Hours/ Semester**	**Marks**			**Duration**
Special Machines Practical	4	60	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

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.

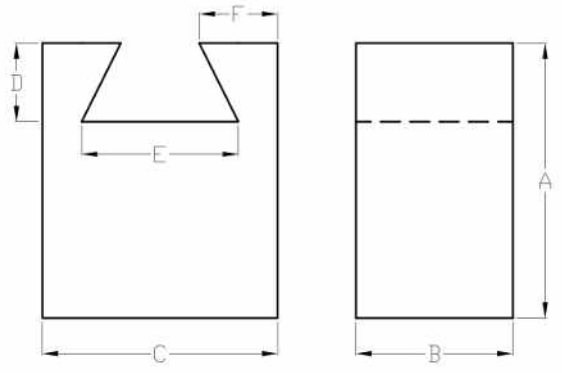
EXERCISES: **Raw Material: M.S. / C.I**

1. Make 'V' Block using shaping machine



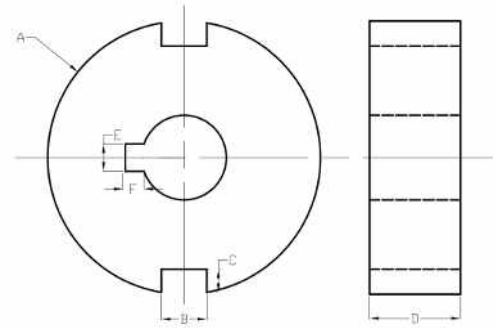
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Make dovetail using shaping machine



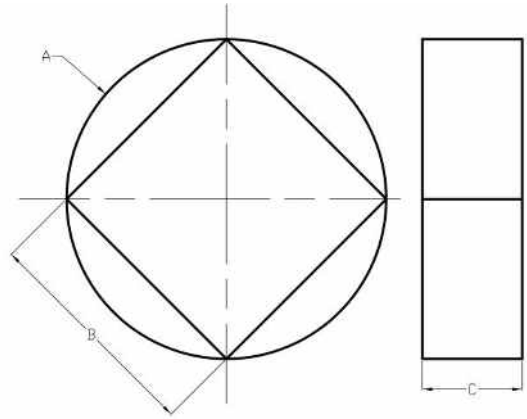
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Make groove cut using slotting machine



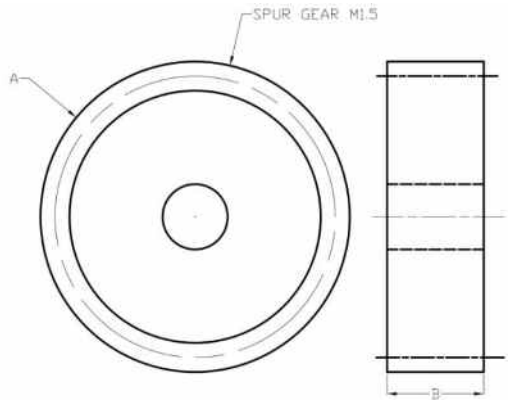
Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Make round to square in milling machine.



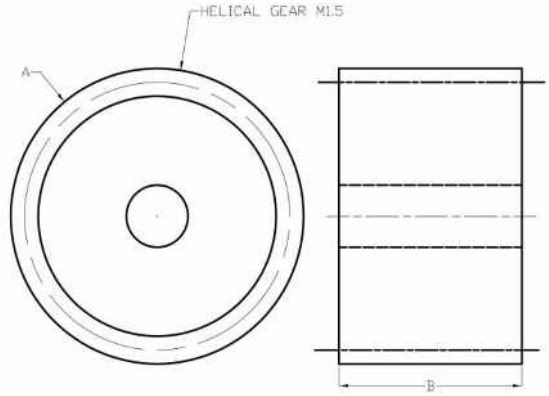
Dimensions			
Sl.No	Part Name	Actual	Obtained

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



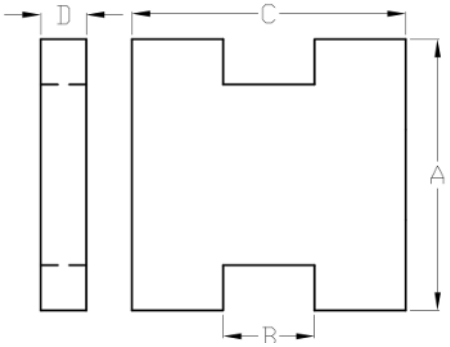
Dimensions			
Sl.No	Part Name	Actual	Obtained

6. Make Helical Gear using milling machine



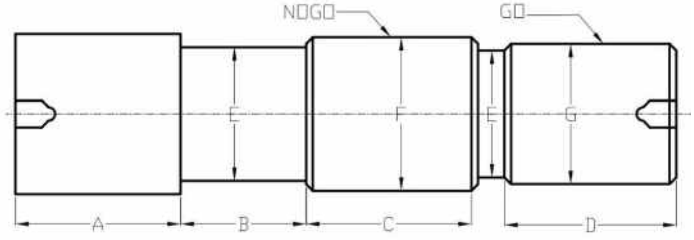
Dimensions			
Sl.No	Part Name	Actual	Obtained

7. Make slot cut using milling machine.



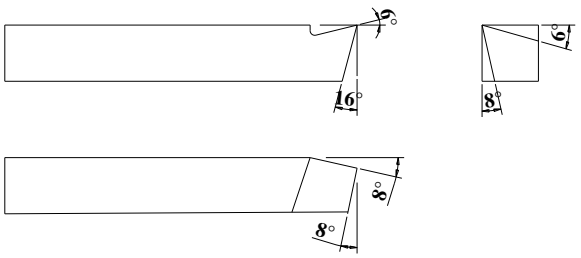
Dimensions			
Sl.No	Part Name	Actual	Obtained

8. Make Progressive type Plug gauge using Cylindrical Grinding machine



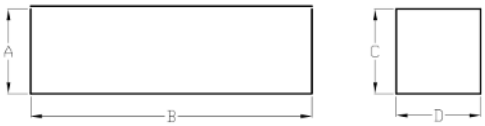
Dimensions			
Sl.No	Part Name	Actual	Obtained

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 PRODUCTION 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 : **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**	**20**

	Entrepreneurship, Project Preparation, Productivity, Occupational Safety, Health, Hazard, Quality Tools& Labour Welfare	
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 PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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 PRODUCTION 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 PRODUCTION ENGINEERING
Course Code : 1025
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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32581 – TOOL DESIGN

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32581

Semester : VI

Subject Title : TOOL DESIGN

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

TOPICS AND ALLOCATION OF HOURS:

Sl.No.	Topic	Time(Hrs)
1.	Design of single point cutting tools and milling cutters	1
2.	Design of taper shank twist drill, tap, reamer and broach	1
3.	Design of blanking dies, piercing dies and bending dies	1
4.	Design of drawing dies and forming dies	13
5.	Design of jigs and fixtures	13
	TEST & REVISION	07
Total		75

Rationale:

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

Objectives:

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

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

TOOL DESIGN

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**DESIGN OF SINGLE POINT CUTTING TOOLS AND MILLING CUTTERS** **Design of single point cutting tools:** Nomenclature of Single Point Cutting Tool - Tool signature - Functions of various tool angles - Optimum values of tool angles - Cutting tool materials - Orthogonal & Oblique cutting – Problems - Chip formation – Merchant's theory of mechanics of metal cutting - Permissible speed, feed& depth of cut - Design of single of cutting tools - Design of parting-off tool - Chip breaker - Types and uses – Simple Design problems. **Design of milling cutters:** Introduction - Angle of contacts - Forces analysis- Forces and power consumption - Allowable feed and depth of cut - Tooth form and cutter design - Cutting edge angles of milling cutter tooth – Simple Design problems on Plain Milling cutter. ISO designation of Cutting Tools.	14
II	**DESIGN OF TAPER SHANK TWIST DRILL, TAP, REAMER AND BROACH** **Design of taper shank twist drill& taps:** Nomenclature of Twist drill -Design aspects - Cutting forces - Material selection – Simple Design problems. Nomenclature of taps - Types- Tool materials - Design and selection – Simple Design problems. **Design of reamer and broach tool:** Nomenclature of reamer – Types - Reamer design - Tool materials - Design problems Introduction - Design considerations - Constructional detail of broach - Angles of tooth – Simple Design problems.	14
III	**DESIGN OF BLANKING DIES, PIERCING DIES AND BENDING DIES Design of blanking and piercing dies:** Fundamentals of die - Cutting operations - Power press types - Cutting action in punch and die operation – Die clearance - Cutting forces - Types of die construction - Die block design - Punch Design - Description of other parts in a die and punch – Assembly - Stock feed mechanism – Simple Design problems.	14

Design of bending dies: Bending terminology - Bending methods - Design principles - Blank length - Bend radius - Bend allowances - Spring back - Bending pressure – Simple Design problems.

IV DESIGN OF DRAWING DIES AND FORMING DIES

Design of drawing dies: Drawing operations - Deep drawing and materials for deep drawing - Drawing die - Design consideration - Calculation of blank diameter, number of draws – Pressure – Clearance – Allowance - Radius of draw dies - Punch radius - Drawing speed and single and double action draw dies – Simple Design problems. .

Forming dies: Embossing dies, curling dies, Bulging dies - Hole flanging or extruding dies - Twisting operations - Coining dies - Swaging dies (Descriptions only).

V DESIGN OF JIGS AND FIXTURES

Design of jigs: Principles of locating and clamping - Definition of drill jig - General considerations in the design of drill jigs - Drill bushings - Jig feet - Types of drill jigs - Methods of constructions - Design of solid jigs, leaf jig, plate jig and indexing jig.

Design of fixtures: Definition of fixture - Design of Milling fixtures, lathes fixtures, welding fixtures and grinding fixtures

TEXT BOOKS

1. A Text Book of Production Engineering, P.C.Sharma, S.Chand& Co. Ltd., New Delhi.
2. Tool Engg. and Design, G.R.Nagpal, Khanna Publishers, New Delhi.

REFERENCE BOOKS

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

Board Examination - Question paper pattern

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)***

1. Note: **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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32582 – MECHATRONICS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32582

Semester : VI

Subject Title : MECHATRONICS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

TOPICS AND ALLOCATION OF HOURS:

Sl.No.	Topic	Time(Hrs)
1.	Introduction, Sensors & Transducers	14
2.	Actuation Systems	14
3.	Basic System Models, input/output systems	14
4.	Programmable Logic Controller (PLC)	13
5.	Design examples & Advanced Applications in Mechatronics	13
	TEST & REVISION	07
Total		75

Rationale:

Mechatronics is the combination of Mechanical, Electrical, Electronics and computer engineering deals with study of sensors and transducers Actuation systems, Basic system models, input/output systems, programmable logic controller advanced application. These enable the students to fulfil the Industrial needs.

Objectives:

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

- select sensors and transducers for different applications
- design actuation system of mechanical, electrical and pneumatic systems
- develop mathematical building blocks for mechanical, electrical, thermal and fluid systems.
- design interfacing of input/output ports.
- Develop PLC programs – Ladder diagram and selection of PLC

MECHATRONICS

DETAILED SYLLABUS

Theory contents:

Unit	Name of the Topic	Hours
I	**SENSORS & TRANSDUCERS**	14
	Introduction – Systems – Measurement Systems – Control Systems – Microprocessor Based Controllers Examples – Mechatronics approach.	
	Measurement System terminology – Displacement, Position & Proximity Sensors – Velocity and Motion Sensors – Force Sensors – Fluid Pressure Sensors – Flow Sensors – Liquid Level Sensors – Temperature Sensors – Light Sensors – Selection of Sensors	
II	**ACTUATION SYSTEMS (MECHANICAL, ELECTRICAL, PNEUMATIC & HYDRAULIC)**	14
	Mechanical Actuation Systems– Types of motion – Freedom and constraints – Loading – Gear Trains – Pawl & Ratchet – Belt & Chain drive – Bearing – Selection – Ball & Roller bearings – Mechanical aspects of motor selection.	
	Electrical Actuation Systems – Switches & Relays – Solenoids – D.C Motors– A.C.Motors – Stepper Motors – Specification and control of stepper motors– Servomotors: D.C Servomotor and A.C Servomotor.	
	Pneumatic & Hydraulic Systems – Power supplies – DCV – PCV – Cylinders– Rotary actuators.	

III	**BASIC SYSTEM MODELS, INPUT/OUTPUT SYSTEMS**	**14**

Mathematical Model – Introduction to mathematical model - Mechanical System building blocks – Electrical System building blocks – Fluid System building blocks – Thermal System building blocks.

System Model – Engg.Systems – Rotational-Translational Systems – Electro- Mechanical System – Hydro-Mechanical System.

Interfacing - Input/Output ports - Interface requirements: Buffers, Handshaking, Polling and interrupts, Serial interfacing - Introduction to PIA - Serial communications interface - Example of interfacing of a seven-segment display with a decoder..

IV	**PROGRAMMABLE LOGIC CONTROLLER (PLC)**	**13**

Definition – Basic block diagram and structure of PLC – Input/Output processing – PLC Programming: Ladder diagram, its logic functions, latching and sequencing – PLC mnemonics – Timers, internal relays and counters – Shift registers – Master and jump controls – Data handling – Analog input/output – Selection of PLC..

V	**DESIGN EXAMPLES & ADVANCED APPLICATIONS IN MECHATRONICS**	**13**

Design process stages - Traditional Vs Mechatronics designs - Possible design solutions: Timed switch, Wind-screen wiper motion, Bath room scale - Case studies of mechatronics systems: A pick-and-place robot, Car park barrier, Car engine management system, Automatic Camera and Automatic Washing Machine only.

Sensors for condition monitoring systems of production systems - Examples of monitoring methods: Vibration monitoring, Temperature monitoring, Wear behavior monitoring - Mechatronics control in automated manufacturing: Monitoring of manufacturing processes, On-line quality monitoring, Model- based systems, Hardware-in-the-loop simulation, Supervisory control in manufacturing inspection, Integration of hetrogeneous systems.

TEXT BOOKS

1. Mechatronics, W.Bolton, Pearson Education, New Delhi.

2. A Text Book of Mechatronics, R.K.Rajput, S.Chand& Co. Ltd., New Delhi

REFERENCE BOOKS

1. Mechatronics, HMT, Tata McGraw Hill, New Delhi.

2. Mechatronics System Design, DevdasShetty & Richard A.Kolk, PWS Publishing Co., Boston.

3. Electromechanic, James H.Harter, Prentice-Hall of India, New Delhi.

4. Mechatronics, M.D.Singh & J.G.Joshi, Prentice-Hall of India, New Delhi.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32583 – OIL HYDRAULICS AND PNEUMATICS

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2016-2017 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32583

Semester : VI

Subject Title : OIL HYDRAULICS AND PNEUMATICS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Oil Hydraulics and Pneumatics	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

TOPICS AND ALLOCATION OF HOURS:

Sl.No.	Topic	Time(Hrs)
1.	Introduction, hydraulic pumps, cylinder and motors	14
2.	Hydraulic valves, seals & filters and basic circuits	14
3.	Design of hydraulic elements	14
4.	Basic pneumatic system and circuits	13
5.	Design of pneumatic logic circuits, low cost automation, installation & maintenance of fluid power systems	13
	TEST & REVISION	07
Total		75

Rationale:

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

Objectives:

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

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

OIL HYDRAULICS AND PNEUMATICS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**INTRODUCTION, HYDRAULIC PUMPS, CYLINDER AND MOTORS**	14
	Introduction to Fluid Power System and its basic components – Basic law – Applications of fluid power – Advantages and drawbacks of fluid power. Classification – Positive displacement Pumps: Gear pump, Lobe pump, Vane pump, Piston pump – Pump performance – Pump noise – Pump selection. Cylinder mountings and mechanical linkages – Cylinder force, velocity and Power – Cylinder loads due to moving of weights – Cylinder loading through mechanical linkages – Hydraulic cylinder cushions and shock absorbers.	
	Analysis of torque capacity – Gear motor – Vane motor – Piston motor – Hydraulic motor theoretical torque, power and flow rate – Hydraulic motor performance.	
II	**HYDRAULIC VALVES, SEALS & FILTERS AND BASIC CIRCUITS**	14
	Pressure Control Valves (PCV): Simple pressure relief valve, Compound pressure relief valve, Pressure reducing valve, Unloading	

valve, Sequence valve, Counter balance valve. Flow Control Valves (FCV): Orifice as flow control valve, Needle valve, Pressure compensated and Non-pressure compensated valve.

Direction Control Valves (DCV): Check valve, Pilot operated check valve, three-way valve, four-way valve, Manual/Mechanical/Solenoid operated valves. Servo valves: Definition – Mechanical-hydraulic servo valve – Electro- hydraulic servo valves. Seals and its classification – Filters and its types – Filter location. Accumulators: Reservoirs and accumulators – Types of accumulators – Charging and discharging of accumulators – Accumulator circuits.

Deceleration circuit – Intensifier circuit – Regenerative circuit – Synchronizing circuit – Automatic cylinder reciprocating circuit – Sequencing circuit. Safety Circuits: Two-hand safety control circuit – Fail-safe control circuit by using emergency cut-off valve.

III DESIGN OF HYDRAULIC ELEMENTS **14**

Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Example simple problems – Cylinder preferred sizes – Piston rod buckling and simple problems.

Selection of Hydraulic Motor: Hydro-static drives – Hydro-static drive characteristics – Braking of hydro-static drives – Matching motor to load – Simple problems.

Selection of Control Valves: Relief valves – Flow control valves – Direction control valves.

Selection of Other Devices: Selection of filters – Selection of conduits: tubing and hoses – Selection of pump – Pressure losses – Reservoir and its design – Sizing of accumulator – Simple problems

IV BASIC PNEUMATIC SYSTEM AND CIRCUITS **13**

Comparison of pneumatic system with hydraulic system – Basic pneumatic system: Air filter, Pressure regulator, Lubricator and Muffler – Pneumatic valves: Direction control valve, Flow control valve, Shuttle valve (for .OR. operation), Two-pressure valve (for .AND. operation), Quick exhaust valve and Time delay valve. Cylinders – Air-motors and its types – Basic pneumatic circuits:

Simple circuit, Material-handling circuit.

Hydro-pneumatics: Air-oil reservoir – Air-oil cylinder – Air-oil intensifier – Comparison of hydraulic, pneumatic and hydro-pneumatic systems. Advantages – Pneumatic sensors – Position sensors and its types – Pressure sensor – Switching elements.

Operation of single-acting cylinder – Operation of double-acting cylinder – Air- pilot control of double- acting cylinder – Cylinder cycle timing system – Two- step speed control system – Two-handed safety control system – Control of air motor – Deceleration air cushion of cylinder. Cylinder sequencing circuit – Control of pneumatic cylinder using flip-flop.

V DESIGN OF PNEUMATIC LOGIC CIRCUITS, LOW COST AUTOMATION, INSTALLATION & MAINTENANCE OF FLUID POWER SYSTEMS **13**

Methods of designing Pneumatic Logic Circuits: Classic method, Cascade method, Step-counter methods, Karnaugh-Veitch mapping method and Combinational circuit design.

Concepts – Case studies: Conveyor feed system, Car park barrier and Pick & Place robot.

Installation of hydraulic pumps, cylinder, valves – Installation of tubing and Power pack, Filling systems – Maintenance of hydraulic system – Trouble- shooting of hydraulic system – Fault finding procedure – Troubles, Possible causes and Remedies of pumps, relief valves, DCV and other valves, hydraulic motor, accumulators – General circuit problems.

Installation of pneumatic systems – Maintenance of pneumatic system – Trouble-shooting of pneumatic system – Troubles, Possible causes and Remedies of compressor, FRL, air cylinder and motor, valves, air motor, pipe lines and hoses

TEXT BOOKS

1. Hydraulic and Pneumatic Controls, R.Srinivasan, Vijay Nicole Imprints Pvt. Ltd., Chennai.

2. Fluid Power and Its Applications, Anthony Esposito, Pearson Education, New Delhi.

REFERENCE BOOKS

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

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE THEORY - II

32584 – PROCESS PLANNING AND COST ESTIMATION

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2016-2017 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32584

Semester : VI

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 No	Topics	Hours
I	Process planning	14
II	Group technology and automated process planning	14
III	Introduction to cost estimation	14
IV	Labour, material and overhead costs	13
V	Production cost estimation	13
	TEST AND REVISION	07
	Total	75

Rationale:

Process planning bridges the design and manufacturing activities. This subject aims to provide basics to prepare process plan for various components of an assembly in an effective way. It also exposes the students to the area costing, an important field in any engineering discipline.

Objectives:

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

- Prepare process plan which would be helpful to carryout the process in least time.
- Automate the processes involved in the manufacturing.
- Group the components to achieve manufacturing excellence.
- Work out the cost of producing a product.

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PROCESS PLANNING AND COST ESTIMATION

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**PROCESS PLANNING**	**14**

Definition – Objective – Scope – approaches to process planning- Process Plan – information required – Finished part requirements- operating sequences- machine selection – material selection parameters- Set of documents for process planning- Developing manufacturing logic and knowledge- production time calculation – Preparation of process sheet

II	**GROUP TECHNOLOGY AND AUTOMATED PROCESS PLANNING**	**14**

Introduction- Part family – Methods of forming part families,

classification and coding system; rank order clustering technique, composite part – cellular manufacturing – automated process planning – variant and generative approaches.

III INTRODUCTION TO COST ESTIMATION **14**

Objective of cost estimation- costing - differences– classification of costs- Elements of cost. Types of estimates – methods of estimates – data requirements and sources- collection of cost- allowances in estimation.

IV LABOUR, MATERIAL AND OVERHEAD COSTS **13**

Estimation of labour cost- introduction to time study and labour norms; learning curves, material cost – estimation – make or buy decision

Elements in overhead cost – factory, administrative, sales and distribution expenses- methods of absorbing overheads – direct labour, direct material, direct labour hour, machine hour rate methods;

V PRODUCTION COST ESTIMATION **13**

Cost Estimation for Machined components, welded components and castings

Text books :

1. Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995.
2. Peter Scallan, “Process Planning”, Butterworth Heinemann, Amsterdam, 2004.

Reference Books:

1. Phillip.F Ostwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 1998
2. Russell.R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition, 2003.
3. Chitale.A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI, 2nd Edition, 2002.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION 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 PRODUCTION ENGINEERING

Course Code : 1025

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:

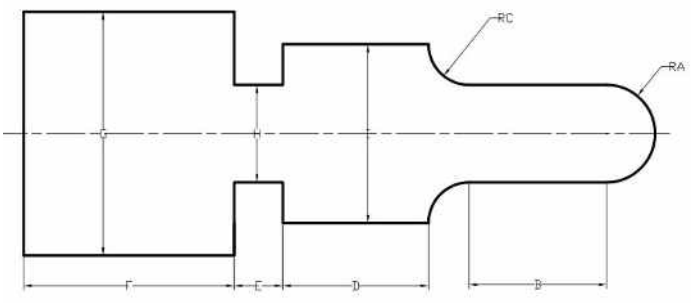
1. Study of CNC lathe, milling.
2. Study of international standard codes: G-Codes and M-Codes
3. Format – Dimensioning methods.
4. Program writing – Turning simulator – Milling simulator, IS practice – commands menus.
5. Editing the program in the CNC machines.
6. Execute the program in the CNC machines.

Exercises

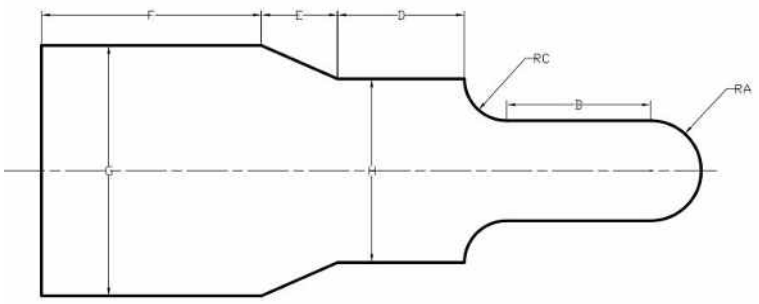
Note: Print the part program from the simulation software and make the component in the CNC machine.

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

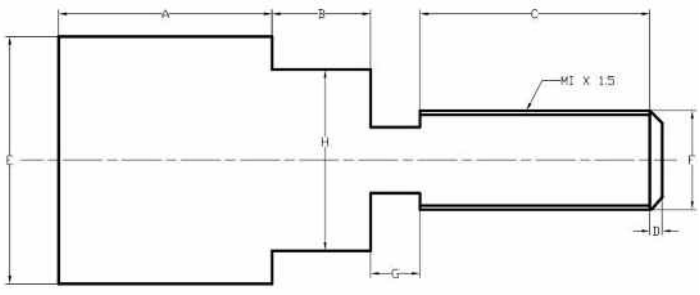
1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.



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

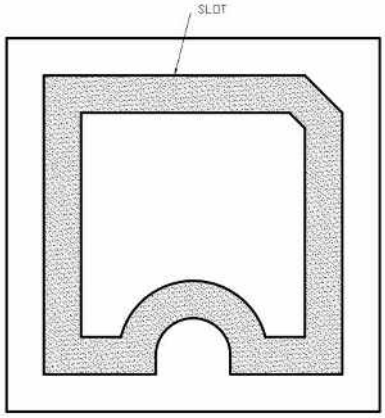


3. Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.

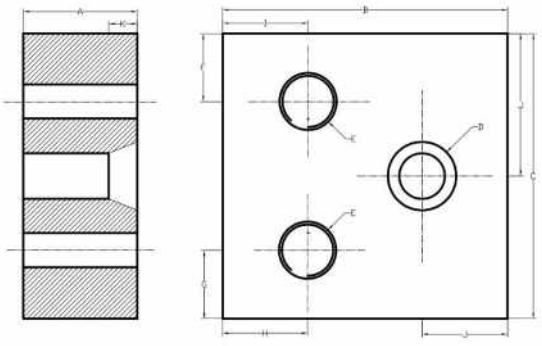


CNC Milling Machine **Material:** M.S / Aluminum / acrylic fibre / plastic

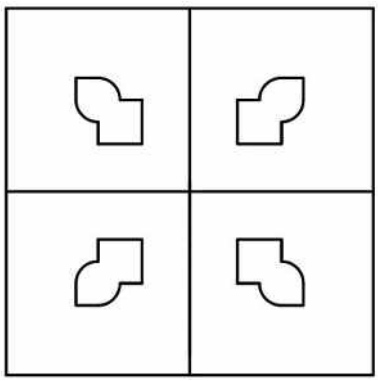
4. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.



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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32055 – PROCESS AUTOMATION PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32055

Semester : VI

Subject Title : PROCESS AUTOMATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	**Instructions**		**Examination**			
Process Automation Practical	**Hours/ Week**	**Hours/ Semester**	**Marks**			**Duration**
	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 PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32585 – TOOL DESIGN PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32585

Semester : VI

Subject Title : TOOL DESIGN PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

Rationale:

The aim of this course is to provide enough practice in design of gauges (GO/NO GO), Press tools, Jigs & Fixture, so that students would be capable of design and develop production tools required for manufacturing.

Objectives:

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

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

Exercises

I. Drill Jigs:

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

II. Fixtures:

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

III. Press Tools:

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

IV. Gauges:

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

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

Scheme of Examination

Sl.No	Detail	Marks
1	Part Drawing Preparartion	30
2	Design Calculations	10
3	Assembly Drawing	30
4	Viva Voce	05
	Total	75

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE PRACTICAL

32586– MECHATRONICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32586

Semester : VI

Subject Title : MECHATRONICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

Rationale:

Mechatronics is the combination of Mechanical, Electrical, Electronics and computer engineering deals with study of sensors and transducers Actuation systems, Basic system models, input/output systems, programmable logic controller advanced application. These enable the students to fulfil the Industrial needs.

Objectives:

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

- select sensors and transducers for different applications
- design actuation system of mechanical, electrical and pneumatic systems
- Develop mathematical building blocks for mechanical, electrical, thermal and fluid systems.
- design interfacing of input/output ports
- Develop PLC programs – Ladder diagram and selection of PLC

Exercises

PNEUMATICS LAB: (Part A)

1. Study of pneumatic system - elements - pressure control valves - directional control valves (DCV)

2. Direct operation of a single acting cylinder

3. Direct operation of a double acting cylinder.

4. Operations of single acting cylinder controlled from two different positions using shuttle valve.

5. Operation of a double acting cylinder with quick exhaust valve.

6. Speed control of double acting cylinder using metering in and metering out circuit.

HYDRAULICS LAB: (Part B)

1. Study of hydraulic system and its elements.

2. Direct operation of double acting cylinder.

3. Direct operation of hydraulic motor.

4. Speed control of double acting cylinder - using metering-in and metering-out control.

5. Speed control of hydraulic motor - using metering-in and metering-out control.

6. Operation of a double acting cylinder using solenoid operated directional control valve.

PLC LAB: (Part C)

1. Study of PLC system and its elements.

2. Direct operation of a motor using latch circuit .

3. Operation of a motor using AND logic control.

4. Operation of a motor using OR logic control.

5. On-delay timer control of a motor.

6. Off-delay timer control of a motor.

7. Develop a sequential logic to fill three tanks with water in a sequential manner. i.e. first tank, second tank and finally the third tank. Once all the tanks are full then the tanks are drained in the order: third tank, second tank the first tank. The process continues till a toggle switch is in ON position. Include the sensors wherever necessary or use timers to determine the filling and draining time.

8. When ON push button is pressed a wood saw and a cooling fan should be switched ON immediately. After 5 seconds a lubrication pump should be switched ON. When the OFF push button is pressed, the wood saw and the lubrication pump should be switched OFF immediately and the fan should continue to run for an additional 10 seconds for the purpose of cooling.

List of Equipments

1. Hydraulic trainer kit – 3 Nos.
2. Pneumatic trainer kit – 3 Nos.
3. PLC trainer kit – 3 Nos
4. DC Motor (24 V 0r 12 V) – 3 Nos

Board Examination

Time : 3 Hrs Max Marks: 75

Sl.No	Detail	Marks
1	Part A or Part B	35
2	Part C (compulsory)	35
3	Viva Voce	05
	Total	75

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE PRACTICAL

32587 – OIL HYDRAULICS AND PNEUMATICS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32587

Semester : VI

Subject Title : OIL HYDRAULICS AND PNEUMATICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

Rationale:

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

Objectives:

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

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

Exercises

PART-A

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

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

PART-B (Descriptive only)

1. Sketch the circuit for the hydraulic operation of a planning machine and explain how table motion, cross rail motion and tool head motion are achieved.
2. Sketch the circuit for hydraulic control of a vertical milling machine and explain how various feed motions are achieved.
3. Sketch the circuit for hydraulic operation of a grinding machine and explain how table reciprocation and feed motion are achieved.
4. Sketch the circuit for hydraulic control of press and explain the same.
5. Draw the pneumatic circuit for automatic material handling.

6. Sketch and explain a two-hand safety control circuit.

List of Equipments

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

Board Examination

Time : 3 Hrs Max Marks: 75

Sl.No	Detail	Marks
1	Part A	40
2	Part B	30
3	Viva Voce	05
	Total	75

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

ELECTIVE PRACTICAL

32588 – PROCESS PLANNING AND COST ESTIMATION PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32588

Semester : VI

Subject Title : PROCESS PLANNING AND COST PRACTICAL

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 Practical	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Rationale:

Process planning bridges the design and manufacturing activities. This subject aims to provide basics to prepare process plan for various components of an assembly in an effective way. It also exposes the students to the area costing, an important field in any engineering discipline.

Objectives:

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

- Prepare process plan which would be helpful to carryout the process in least time.
- Automate the processes involved in the manufacturing.
- Group the components to achieve manufacturing excellence.
- Work out the cost of producing a product.

EXERCISES

1. Consider the simple component illustrated in Fig.1. An analysis of the geometry, based on the matrix in Fig.2, indicates that this type of component would be produced by milling the slots and drilling the holes. The production of both the slots and the holes can be carried out on a milling machine. Therefore, determine the sequence of operations to produce these features on a milling machine if the billet is 200mm x 120mm x 65mm.

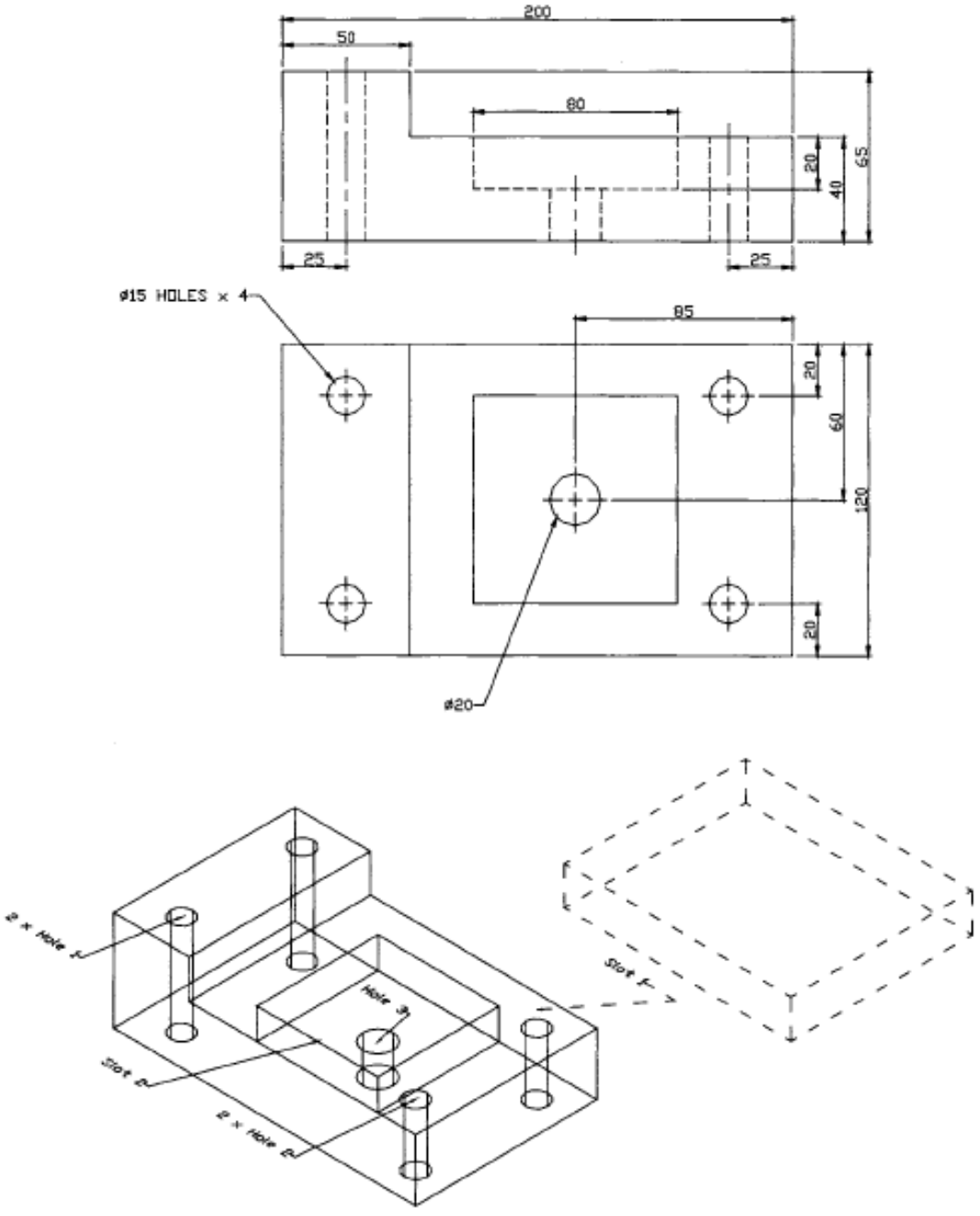


Figure 1

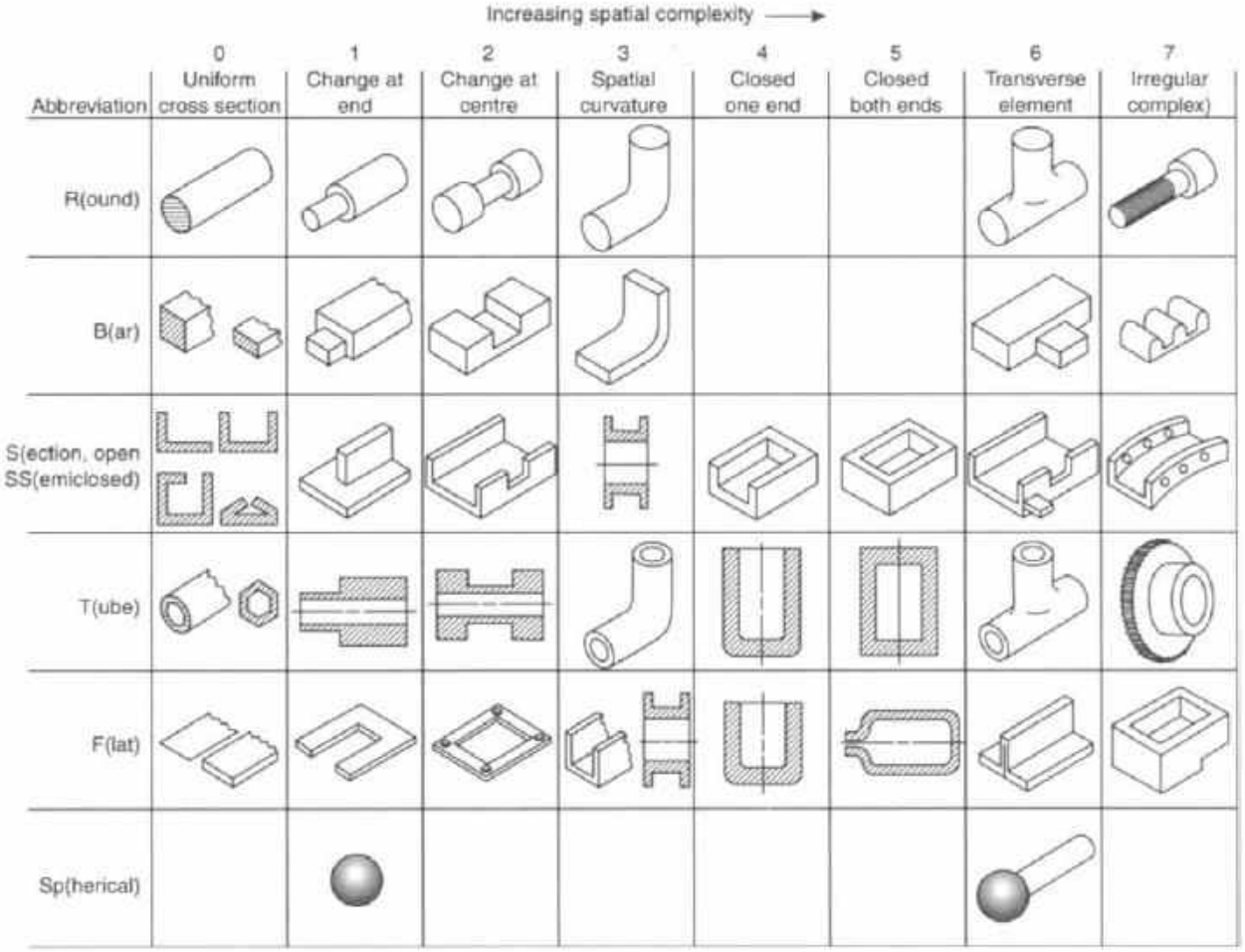


Figure 2

2. For the component shown below, determine what tooling would be required to turn it. The brass billet is represented by the rectangle that is 100mm x Dia.20mm. Therefore, the material to be removed is the shaded area in both Fig.3&4. The part is to be turned on a small bench lathe. To produce this part four distinct operations have been identified as detailed below. Identify the tooling required to produce this part.

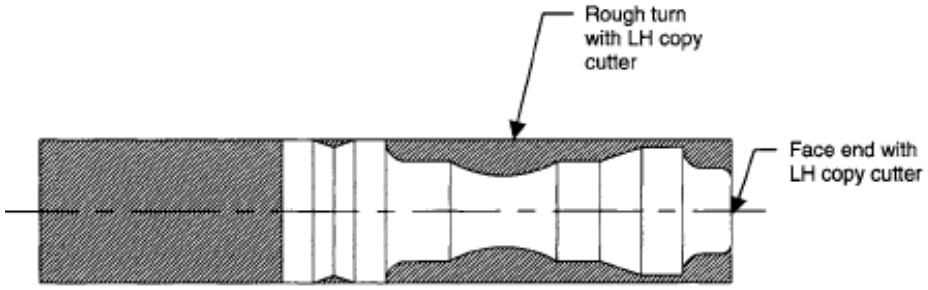


Figure 3 Facing and roughing out of example part

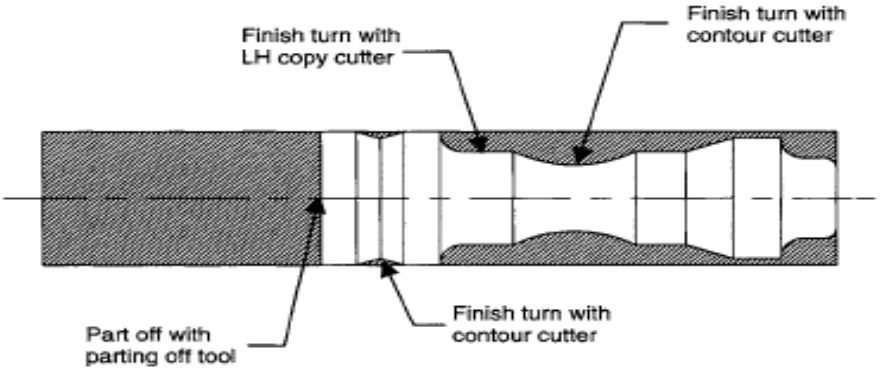


Figure 4 Finishing and parting-off of example part

3. Consider the component in Fig.5. The component is to be made from mild steel with carbide tooling at a constant surface speed of 100 m/min on a lathe with a maximum spindle speed of 1500 rpm. The machining allowance is 2mm. Determine the total machining time for the component if the lathe is capable.

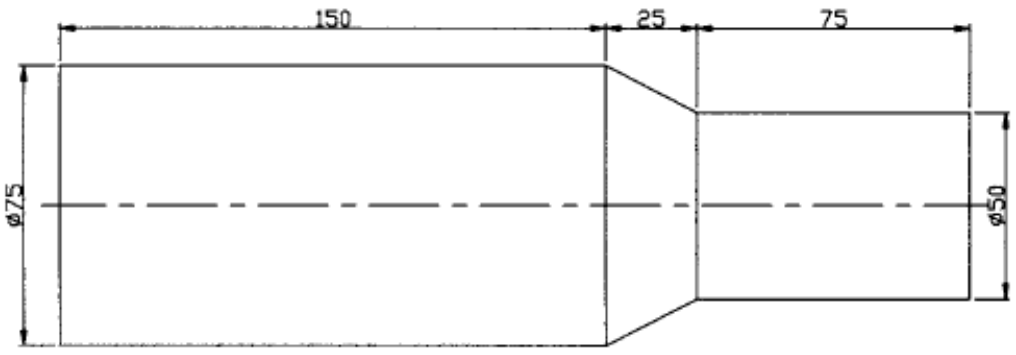


Figure 5

4. a) A semi automatic turret lathe costs. Rs. 80000 and it produces 16 pieces per hour and its operator receives Rs. 2 per hour. An engine lathe which costs Rs. 32000 produces to pieces per hour and its operator receives Rs. 2.50 per hour. Calculate the minimum number of pieces which makes turret lathe more economical.

b) The aircraft flap nose rib can be produced either by hydropress or by steel draw die. The following data is available for Total number of parts to be produced per single run (Nt) = 500. Unit tool process-a cost (Pa) = Rs.8.40 and Unit tool process-b cost (Pb) = Rs.14.80; Total tool cost for process-a (Ta) = Rs. 6480.00 and Total tool cost for process-b (Tb) =Rs.1616.00. Determine the quantity of production at 'break even point' and tool unit cost for method 'a' and method 'b'.

5. The following Fig.6 shows a "lathe stock". Estimate the weight and cost of material if C.I. weighs 7.787 gm/cc and material cost is 60 per kg.

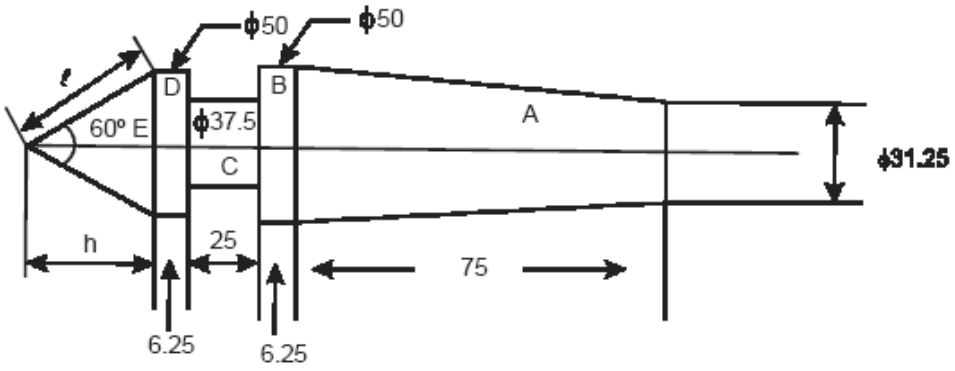


Figure 6

6. a) A hexagonal bolt with a finished diameter of 25mm, shank length 110mm and bolt head height of 25mm is to be forged. What would be the size of the stock and its length, if forging loss is 3%? Find the total length of stock for 300 bolts, if scrap loss is 4%.

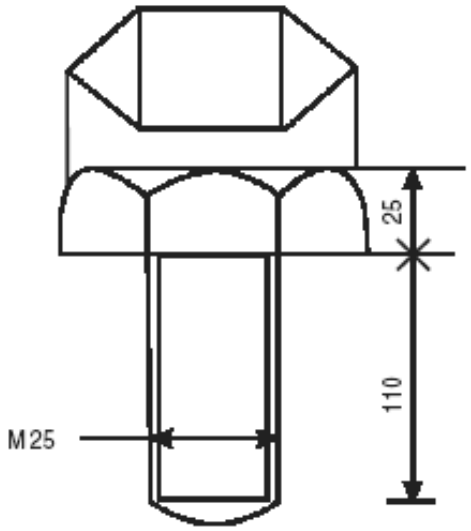


Figure 7

7. a) Estimate the material cost for welding two flat pieces of ms 15cm×6cm×1cm size at an angle of 90º by gas welding. Neglect preparation cost and assume cost of O_2 is Rs.60/m^3, cost of C_2H_2 is Rs.350/m^3 and cost filler metal is Rs.75/kg.

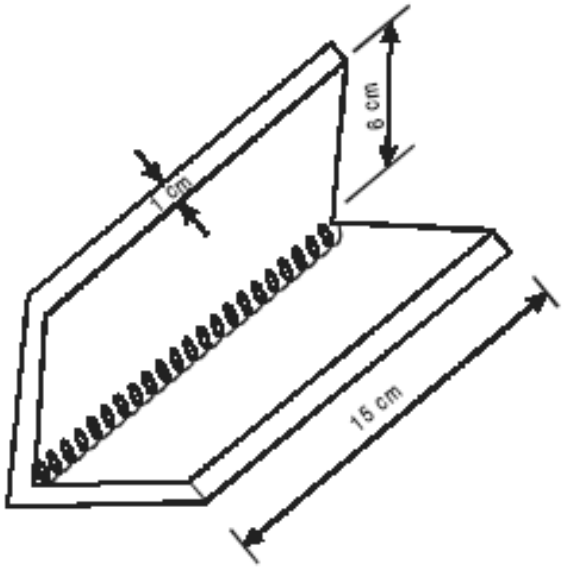


Figure 8

b) Calculate the cost of welding two plates 200mm×100mm×8mm thick to obtain a piece 200mm x 200mm x 8mm approximately using right ward welding technique.

i) Cost of filler material = Rs. 35/kg

(ii) Cost of oxygen = Rs. 400 per 100 cu.m

(iii) Cost of acetylene = Rs. 4000 per 100 cu.m

(iv) Consumption of oxygen = 0.8 cu.m

(v) Consumption of acetylene = 0.8/cu. m

(vi) Diameter of filler rod = 4mm

(vii) Density of filler material = 7.3 gm/cc

(viii) Filler rod used/m of weld = 350 cm

(ix) Speed of welding = 2.5 m/hr

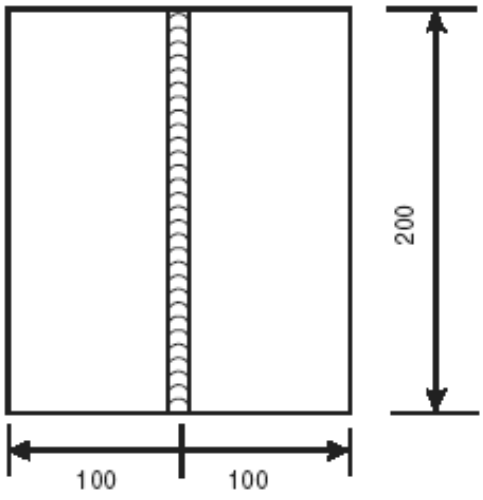


Figure 9

8. a) Figure 10 shows a cast bevel gear blank made up of mild steel. Find the weight and cost of material required for it. Assume the density of mild steel=7.85 gm/cc and its cost as Rs.60/kg.

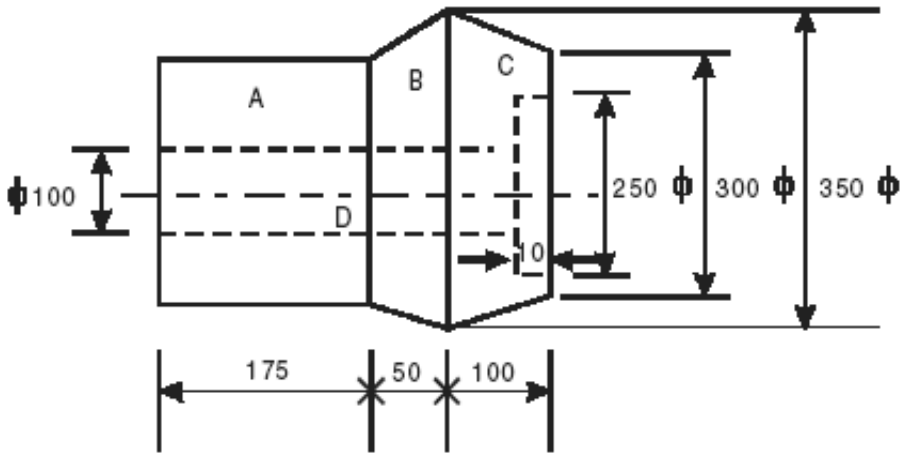


Figure 10

b) Estimate the weight and cost of the mild steel casting as shown in Figure 11. Assume density of steel as 7.85 gm/cc and steel cost as Rs.55/kg.

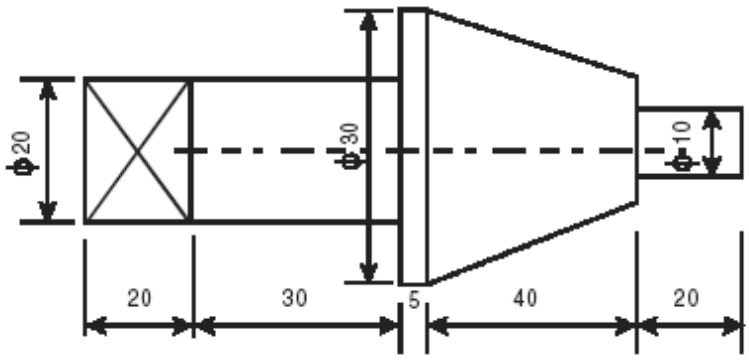


Figure 11

9. a) A mild steel bar 100mm long and 40mm in diameter is turned to 38mm diameter and was again turned to a diameter of 35mm over a length of 40mm as shown in Figure 12. The bar was chamfered at both the ends to give a chamfer of 45º×5mm after facing. Calculate the machining time. Assume cutting speed of 60m/min and feed 0.4mm/rev. The depth of cut is not to exceed 3mm in any operation.

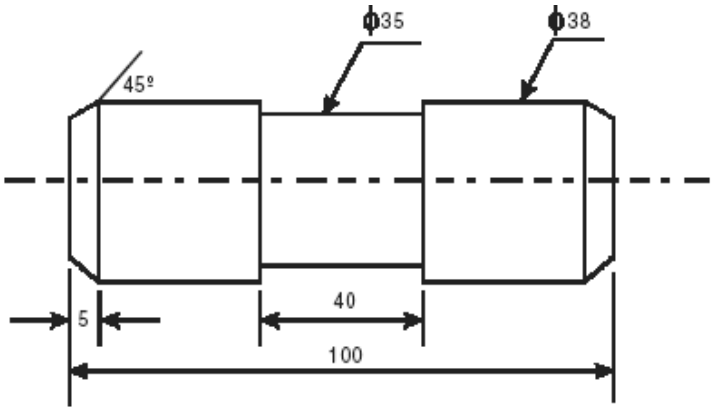


Figure 12

b) Find the machining time to finish the job as shown in Figure 13 from a 45mm diameter and 95mm long raw material.

Assume

'V' for turning = 30 m/min; 'V' for thread cutting = 10 mm/min

'f' for turning = 0.35 mm/rev; Depth of cut = 1.25mm

'V' for drilling = 30 m/min; 'f' for chamfering = 0.25 mm/rev

'f' for drilling = 0.1 mm/rev

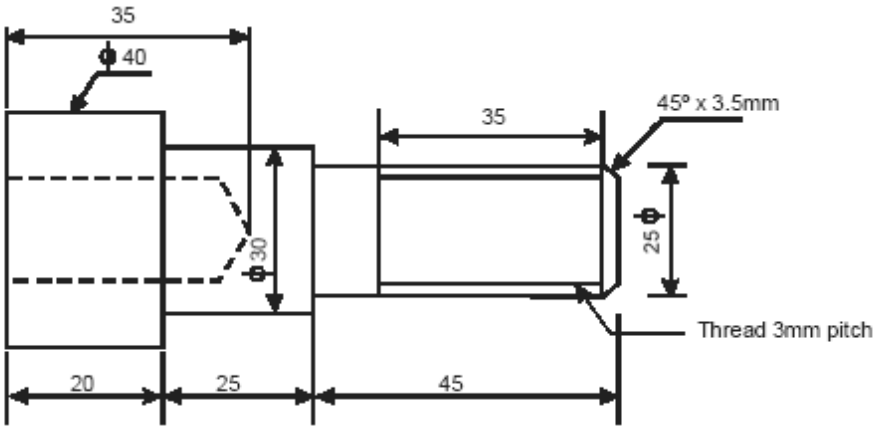


Figure 13

10. Estimate the cost of manufacturing high carbon steel spanner as shown in Figure 14 is to be made by die forging. The following data are available:

(*i*) Batch size = 500 pieces

(*ii*) Die cost per batch = Rs.1500

(*iii*) Stock cutting charges = Rs.25 per batch

(*iv*) Set-up and machine operation cost = Rs.375 per batch

(*v*) Labour charges = Rs.150 per batch

(*vi*) Density of steel = 8.5gm/cc

(*vii*) Cost of high carbon steel = Rs.400 per kg.

Assume suitable allowances for calculating the weight of the component.

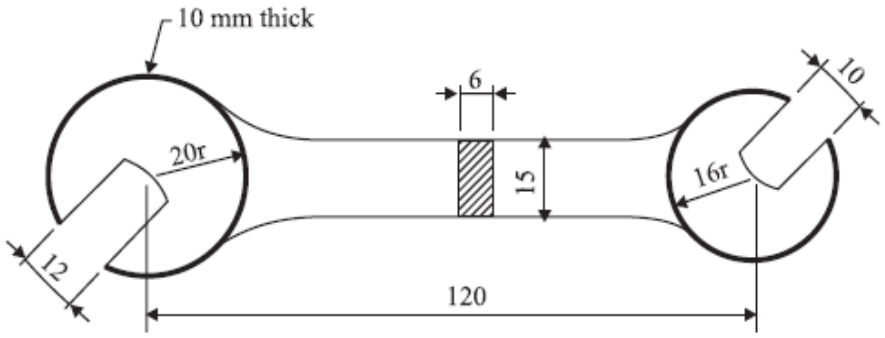


Figure 14

Board Examination

Time : 3 Hrs Max Marks: 75

Sl.No	Detail	Marks
1	Identification of operations/ process route	30
2	Machining Time Calculations/ Cost Calculations	40
3	Viva Voce	05
	Total	75

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN PRODUCTION ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

VI SEMESTER

32567 – PROJECT WORK

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN PRODUCTION ENGINEERING

Course Code : 1025

Subject Code : 32567

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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