DIPLOMA IN ENGINEERING AND TECHNOLOGY

3

DEPARTMENT OF MECHANICAL ENGINEERING

F- SCHEME

DRAFT SYLLABUS

IMPLEMENTED FROM 2020 – 2021

SESHASAYEE INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

TIRUCHIRAPPALLI – 620 010

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PREFACE

The wave of liberalization and globalization has created an environment for free flow of information and technology through fast and efficient means the world over. This has lead to shrinking of world, bringing people from different cultures and environment together, giving rise to a global village. A shift has been taking place in India from closed economy to knowledge based and opens economy. In order to cope-up with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate knowledge, professional skills and attitude. Technical education system is one of the significant components for human resource development. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by to revise the curriculum as per the needs of the industry are laudable.

In order to meet the requirements of future technical manpower, constant efforts have to be made to identify new employment opportunities, carryout activity analysis and design need based curricula of diploma programmes. This curriculum document has been designed by identifying job potential and competency profile of diploma holders leading to identification of curriculum areas for the course. It is needless to emphasize that the real success of the diploma programme depends upon its effective implementation. This will require harnessing and effective utilization of resources. In addition to acquisition of appropriate physical resources, the availability of competent and qualified faculty is essential. It is time for the managers of technical education system to reorganize the system to accept the challenges of both quantitative and qualitative expansion of technical education.

There are various online training facilities created by the Government of India through MHRD for the benefit of both the Teaching and Student community. Facilities like Spoken-Tutorial, SWAYAM, NPTEL, e-Yantra must be exploited to its fullest extent to reap the benefits of interactive electronic media for teaching-learning process. It is hoped that polytechnics will carry out job market research on a continuous basis to identify the new skill requirements and develop innovative methods of course offering and thereby infuse dynamism in the system.

PRINCIPAL & CHAIRMAN

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ii) Principal & Chairman, Seshasayee Institute of Technology, Trichy for initiating this project on designing of curriculum.

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iv) All the faculty members of the Mechanical Engineering department for their Sustained effort and support in the design of this curriculum and documentation.

Coordinator

DEPARTMENT OF MECHANICAL ENGINEERING

VISION, MISSION, PEO and PSO STATEMENT

VISION

To produce high self-esteem and technical expertise who can adapt themselves for the changing trends of industrial and social requirements by effective teaching and learning methods.

MISSION

- To maintain best quality of education by incorporating changing trends of industry in curriculum to satisfy all stake holders.
- To produce leaders who can serve society and nation by finding solutions to region wise and global wise community problems.
- To create competent professional who are trained in the design and development of mechanical engineering systems to accept any challenges that arises in rapidly changing technology.
- To instill confidence amongst the students as an individual or as a team player by involving them in organizing programmes and events.
- To empower the students with life skill programs and entrepreneurship Programs.

PEO

1. Use the knowledge of mechanical engineering to develop concepts that brings out solution for the real world challenges.
2. Analyze the design and use skills in order to formulate and solve mechanical engineering problems.
3. Practice mechanical engineering in a reasonable professional and ethical manner.

PSO

1. Distinct and maintain highest standards in the fields of design manufacturing, thermal and automobile.
2. Suit to current technologies and have a zeal to find out solutions to problems of industry and world in the respective fields.

Program Outcomes (PO)

1. **Basic and Discipline specific knowledge:**
   Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve theengineering problems.

2. **Problem analysis**:
   Identify and **analyze** well-defined engineering problems using codified standard methods.

3. **Design/ development of solutions:**
   Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

4. **Engineering Tools, Experimentation and Testing: Apply** modern engineering tools and appropriate technique to conduct standard tests and measurements.

5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.

6. **Project Management:** Use engineering management principles individually, as a Team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

2.R E G U L A T I O N S

DIPLOMA COURSES IN ENGINEERING
(TERM PATTERN)
(Implemented from 2020- 2021)
F– SCHEME
(Common to all Programmes)

2.1. Description of the Course:

a.Full Time (3 years)

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

b.Sandwich (3½ years)

The Course for the Sandwich Diploma in Paper Technology shall extend over a period of three and half academic years, consisting of 7 terms* 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 term the students undergo industrial training for six months. Industrial training examination will be conducted after completion of every 6 months of industrial training.

* Each term will have 16 weeks duration of study with 35 hrs. / Week for Regular Diploma Courses.

2.2. Condition for Admission:

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

(Or)

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

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examinations recognized as equivalent to the above by the Board

of Secondary Education, Tamil Nadu.

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

2.3. Admission to Second year (Lateral Entry):

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

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

Sl. No.	courses	H.Sc Academic	H.Sc Vocational		Industrial Training Institutes Courses
			Subjects studied		
		Studied any three of the following subjects	Studied any three of the following subjects	Vocational subjects	
1.	All the Regular and Sandwich Diploma Courses	• Maths • Physics • Chemistry • Computer Science • Electronics • Information Technology • Biology • Informatics Practices • Bio Technology • Technical Vocational subject • Agriculture • Engineering Graphics • Business Studies • Entrepreneurship	• Maths • Physics • Chemistry • Computer Science • Electronics • Information Technology • Biology • Informatics Practices • Bio Technology • Technical Vocational subject • Agriculture • Engineering Graphics • Business Studies • Entrepreneurship	Related Vocational Subjects Theory& Practical	2 years course to be passed with appropriate Trade

• For the Diploma Programmes related with Engineering/Technology, the related /

equivalent courses prescribed along with Practical's may also be taken for arriving the eligibility.

• Programmes will be allotted according to merit through counselling by the Principal as per communal reservation.

• Candidates who have studied Commerce Courses are not eligible for Engineering Diploma Programmes.

2.4. Age Limit:

No Age limit.

2.5. Medium of Instruction:

English

2.6. 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 3/3 ½ academic years (Full Time/Sandwich), affiliated to the State Board of Technical Education and Training, Tamil Nadu, when joined in First Year and 2/2 ½ years (Full Time/Sandwich), if joined under Lateral Entry scheme in the second year and passed the prescribed examination.

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

Diploma Programmes	**Minimum Period**	**Maximum Period**
Full Time	3 Years	6 Years
Full Time (Lateral Entry)	2 Years	5 Years
Sandwich	3½ Years	6½ Years
Sandwich (Lateral Entry)	2½ Years	5½ Years

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

2.7. Programmes of Study and Curriculum outline

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

The curriculum outline is given in Annexure – I.

2.8. Examinations:

Autonomous Examinations in all Programmes of all the terms under the scheme of examinations will be conducted at the end of each term.

The internal assessment marks for all the courses will be awarded on the basis Of continuous assessment earned during the term concerned. For each course, 25 marks are allotted for internal assessment. Autonomous Examinations are conducted for 100 marks and reduced to 75.

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

2.9. Continuous Internal Assessment:

A. For Theory Courses:

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

i) Course Attendance **5 Marks**

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

80 % - 83 %	**1 MARK**
84 % - 87 %	**2 MARKS**
88 % - 91 %	**3 MARKS**
92 % - 95 %	**4 MARKS**
96 % - 100 %	**5 MARKS**

ii) Test # 10 Marks

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

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

Test	Units	When To Conduct	Marks	Duration
Test I	Unit – I & Half of Unit II	End of 6th week	50	2 Hrs
Test II	Remaining Half of Unit II & III	End of 12th week	50	2 Hrs
Test III	Model Examination: Covering all the 5 Units. (Autonomous Examinations-Question paper-pattern).	End of 16th week	100	3 Hrs

From the Academic Year 2020 – 2021 onwards.

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

Part A Type questions (Any 4 out of 6 questions) : 4 Questions × 2 mark **08 marks**

Part B Type questions (Any 4 out of 6 questions) : 4 Questions × 3 marks **12 marks**

Part C Type questions (Either or) : 3 Questions × 10 marks **30 marks**

Total 50 marks

Assignment 10 Marks

- **Written Assignment - 4 Marks**
- **Multiple Choice Questions - 3 Marks**
- **Seminar Presentation - 3 Marks**
- **Total - 10 Marks**

iii) Assignment 4 Marks

For each course Two Assignments are to be given each for 10 marks and the average marks scored should be reduced for 4 marks.

iv) Multiple Choice Questions 3 Marks

For each course one MCQ test are to be given each for 30 marks and the average marks scored should be reduced for 3 marks.

v) Seminar Presentation 3 Marks

The students have to select the topics either from their course or general courses which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present seminar (For First and Second Year, the students will be permitted to present the seminar as a group not exceeding six members and each member of the group should participate in the presentation. For the Third Year, the students should present the seminar individually.) The seminar presentation is mandatory for all theory courses and carries 3 marks for each theory course. The respective course faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (1 ½ marks for the material submitted in writing and 1 ½ marks for the seminar presentation). For each subject minimum of two seminars are to be given and the average marks scored should be reduced to 3 marks.

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

B. For Practical Subjects:

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

a) Attendance : 5 Marks
(Award of marks same as theory subjects)

b) Procedure/ observation and tabulation/
Other Practical related Work **: 10 Marks**

c) Record writing : 10 Marks

TOTAL : 25 Marks

All the Experiments/Exercises indicated in the syllabus should be completed and the same to be given for final Autonomous examinations.

The observation note book / manual should be maintained for 10 marks. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical subject during practical classes should be evaluated properly during the practical class hours with date.

The Record work for every completed exercise should be submitted in the subsequent practical classes and marks should be awarded for 10 marks for each exercise as per the above allocation.

At the end of the term, the average marks of all the exercises should be calculated for 20 marks (including Observation and Record writing) and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)

Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Autonomous Practical Examinations.

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

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

2.10. Communication Skill Practical, Computer Application Practical and Physical Education:

The Communication Skill Practical and Computer Application Practical with more emphasis are being introduced in First Year. Much Stress is given to

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

2.11. Project Work and Internship:

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

a) Internal assessment mark for Project Work & Internship:

Project Review I … 10 marks

Project Review II … 10 marks

Attendance … 05 marks (Award of marks same as theory subject pattern)

TOTAL … 25 MARKS

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

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

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

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

c) Internship Report:

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

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

2.12. Scheme of Examinations:

The Scheme of examinations for courses is given in Curriculum outline.

2.13. 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 course if he/she secures not less than **40% in theory subjects and 50%in practical subjects** out of the total prescribed maximum marks including both the Internal Assessment and the Autonomous Examinations marks put together, course to the condition that he/she secures at least a **minimum of 40 marks out of 100 marks in the Autonomous Theory Examinations and a minimum of 50 marks out of 100 marks in the Autonomous Practical Examinations**.

2.14. Classification of successful candidates:

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

First Class with Superlative Distinction:

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

First Class with Distinction:

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

First Class:

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

Second Class:

All other successful candidates will be declared to have passed in **Second Class**. The above classifications are also applicable for the Sandwich students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021).

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

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

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3.SALIENT FEATURES OF THE DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING

Name of the Programme	DIPLOMA IN MECHANICAL ENGINEEING
Duration of the Programme	Three years (Six Terms)
Entry Qualification	Matriculation or equivalent as prescribed by State Board of Technical Education, Tamil Nadu
Intake	60+12
Pattern of the Programme	Term Pattern
Ratio between theory and practical	50:50 (Approximately)

4. EMPLOYMENT OPPORTUNITIES

Employment opportunities for Diploma holder in Mechanical Engineering are visualized in following industries at various levels / positions.

(1) Manufacturing Industries

- Production, Planning & Control
- Production Engineering and shop floor control
- Process Engineering and Methods control
- Product design & development
- Materials management
- Research and development

(2) Service industries

- Repair and maintenance of machines
- Repair and maintenance of automobiles
- Repair and maintenance of engines
- Repair and maintenance of other equipments

(3) Consultancy

- Design& Drawing consultants
- CNC machine program consultants
- Maintenance consultants

5. COMPETENCY PROFILE

Keeping in view the employment opportunities of Diploma holders in Mechanical Engineering, the programme is aimed at developing following knowledge and skills in the students:

1. Basic understanding of concepts and principles of Mechanical engineering so as to enable the students to apply the knowledge.
2. Development of communication and interpersonal skills for effective functioning in the world of work.
3. Ability to read and interpret drawings related to Mechanical Engg.
4. Knowledge of various materials used in Mechanical Engg., their properties and specifications.
5. Ability to prepare plan, section and elevation of equipment, devices and components of machines.
6. Ability to understand various manufacturing processes, allied areas and automation in manufacturing.
7. Understanding of fluid flow, Hydraulics & Pneumatic circuits.
8. Understanding the concepts of Thermodynamics, Thermodynamic processes, working of Engines, automobiles and energy sources.
9. Ability to Design the machine elements.
10. Ability to calculate the estimate time for producing the components and cost of the products.
11. Development of generic skills of thinking and problem – solving, communication attitudes and value system for effective functioning in industrial sectors.
12. Appreciation of the need of clean and green environment and its deterioration by various emissions from industry and preventive procedures and knowledge of safety regulations.
13. Understanding of the basic principles of managing men, material and machines / equipment for the production of components and others.
14. Proficiency in the use of computers.
15. Understanding about automation

16. Basic manual and machining skills for maintaining the quality of materials.
17. Knowledge of properties of materials used for manufacturing.
18. Development of good personality in order to have effective communication and professional ethics.
19. To Instill Confidence amongst students to venture into any start up and become successful entrepreneur

6. CURRICULUM AREAS AS DERIVED FROM COMPETENCY PROFILE

The following curriculum areas have been derived based on competency profile.

S.NO	Competency	Curriculum Areas / Subjects
1.	Basic understanding of concepts and principles related to applied sciences like physics, chemistry and mathematics.	Applied physics Applied chemistry Applied mathematics
2.	To instill confidence amongst students to venture into any business become successful entrepreneur	Entrepreneurship and startup
3.	Understanding of basic concepts and principles of mechanical, electrical and civil engineering.	Applied Mechanics General workshop practice
4.	Ability to read and interpret drawings related to Mechanical Engg. Etc,	Engineering Graphics,Machine drawing and CAD practical
5.	Knowledge of various materials used in Mechanical Engg., their properties and specifications.	Strength of materials
6.	Ability to prepare plan, section and elevation of equipments, devices and components of machines.	Machine drawing and CAD practical
7.	Proficiency in the use of computers	Computer applications practical
8.	Ability to understand various manufacturing processes, allied areas and automation in manufacturing	Manufacturing Technology - I Manufacturing Technology -II Computer Integrated and

		manufacturing
9.	Understanding of fluid flow, Hydraulics & Pneumatic circuits.	Fluid mechanics and fluid power
10.	Understanding the concepts of Thermodynamics, Thermodynamic processes, working of Engines, automobiles and Energy sources	Thermal Engineering –I Thermal Engineering -II Automobile engineering Green energy and energy conservation
11.	Ability to Design the machine elements.	Design of machine elements
12.	Ability to calculate the estimate time for producing the components and cost of the products.	Industrial Engineering and management
13.	Development of generic skills of thinking and problem – solving, communication attitudes and value system for effective functioning in industrial sectors.	Industrial Engineering and management
14.	Understanding of the basic principles of managing men, material and machines / equipment for the production of components and others.	Industrial Engineering and management
15.	Understanding about automation	Mechatronics , electrical drives and control.
16	Knowledge of different welding concepts	Welding technology
17	Understanding different methods used in refrigeration and air conditioning	Refrigeration and air conditioning
18	Understanding concepts of robotics and their	Industrial robotics and 3D printing

	application in manufacturing	
19	Knowledge of electric vehicle and its effective utilization in Indian road condition	E Vehicle Technology and Policy
20	Understanding concepts and different methods of measurements	Measurements and metrology

8. CURRICULUM OUTLINE

a. Basic courses

1. Strength of Materials
2. Fluid mechanics and Fluid power
3. Manufacturing technology -I
4. Strength of materials & Fluid mechanics practical
5. Manufacturing technology – I practical
6. Thermal Engineering –I
7. Manufacturing technology –II
8. Machine drawing and CAD practical
9. Manufacturing technology –II Practical
10. Thermal Engineering -II
11. Thermal Engineering practical

b. Core courses

12. Measurements and metrology
13. Measurements and metrology practical
14. Design of machine elements
15. Computer integrated manufacturing
16. Automobile engineering
17. Green energy and energy conservation
18. Solid modelling practical
19. Computer integrated manufacturing ractical
20. Automobile engineering ractical
21. Green energy and energy conservation practical
22. Industrial engineering and management
23. Mechatronics
24. Welding technology
25. Refrigeration and air conditioning
26. Industrial robotics and 3D printing
27. Process automation practical

28. Welding technology practical
29. Refrigeration and air conditioning practical
30. Industrial robotics and 3D printing practical

c. Diversified courses

31. Electrical drives and control
32. Electrical drives and control practical
33. Electric vehicle technology policy
34. Entrepreneurship & startup
35. Project work and internship.

d. Value added

36. Concurrent Career Development
37. Universal Human Values.

10. CURRICULUM OUTLINE & SCHEME OF EXAMINATION

TERM - III

Sl. No	Course Code	Course Title	Hours per week				Scheme Of Examination		Total Mark	Minimum Mark For Pass	Duration of exam (Hours)
			Theory	Practical	Total	Credit	Internal	External*			
1.	3F 3201	Strength of Materials	5	-	5	5	25	100	100	40	3
2.	3F 3202	Fluid Mechanics and Fluid Power	5	-	5	5	25	100	100	40	3
3.	3F 3203	Manufacturing Technology - I	5	-	5	5	25	100	100	40	3
4.	3F 3401	Electrical Drives and Control	5	-	5	5	25	100	100	40	3
5.	3F 3204	Strength of Materials & Fluid Mechanics Practical	-	4	4	2	25	100	100	50	3
6.	3F 3402	Electrical Drives and Control Practical	-	4	4	2	25	100	100	50	3
7.	3F 3205	Manufacturing Technology - I Practical	-	4	4	2	25	100	100	50	3
			20	12	32	26	175		700		
		Physical education			2						
		Library			1						
		Total			35	26					

*Autonomous examinations will be conducted for 100 marks and will be reduced to 75 marks

IV TERM

Sl. No	Course Code	Course Title	Hours per week				Scheme Of Examination		Total Mark	Minimum Mark For Pass	Duration of exam (Hours)
			Theory	Practical	Total	Credit	Internal	External*			
1.	3F 4206	Thermal Engineering - I	5	-	5	5	25	100	100	40	3
2.	3F 4207	Manufacturing Technology – II	5	-	5	5	25	100	100	40	3
3.	3F 4301	Measurements and Metrology	5	-	5	5	25	100	100	40	3
4.	3F 4403	E Vehicle Technology Policy	4	-	4	4	25	100	100	40	3
5.	3F 4208	Machine Drawing and CAD Practical	-	5	5	3	25	100	100	50	3
6.	3F 4302	Measurements and Metrology Practical	-	4	4	2	25	100	100	50	3
7.	3F 4209	Manufacturing Technology practical - II	-	4	4	2	25	100	100	50	3
			19	13	32	26	175		700		
		Physical education			2						
		Library			1						
		Total			35	26					
8	3F 0006	Universal Human Values **				5	25	100	100	40	3

*Autonomous examinations will be conducted for 100 marks and will be reduced to 75 marks

** The total hours allotted for taking UHV is 75 Hrs and will be handled with flexible timings

V TERM

Sl. No	Course Code		Course Title	Hours per week				Scheme Of Examination		Total Mark	Minimum Mark For Pass	Duration of exam (Hours)
				Theory	Practical	Total	Credit	Internal	External*			
1.	3F 5303		Design ofMachine Elements	6	-	6	6	25	100	100	40	3
2.	3F5210		Thermal Engineering–II	5	-	5	5	25	100	100	40	3
3.	3F 5304	1	Computer Integrated Manufacturing	5	-	5	5	25	100	100	40	3
		2	Automobile Technology									
		3	Green Energy and Energy conservation									
4.	3F 5305		Solid Modeling Practical		4	4	2	25	100	100	50	3
5.	3F 5211		Thermal Engineering Practical		4	4	2	25	100	100	50	3
6.	3F 5306	1	Computer Integrated Manufacturing Practical		4	4	2	25	100	100	50	3
		2	Automobile Engineering practical									
		3	Green Energy and Energy Conservation practical									
7.	3F 5404		Entrepreneurship & Startup	2	2	4	3	25	100	100	50	3
				18	14	32	25	175		700		
			Physical education			2						
			Library			1						
			Total			35	25					
8	3F 0005		Concurrent career development **				5	25	100	100	40	3

*Autonomous examinations will be conducted for 100 marks and will be reduced to 75 marks

** The total hours allotted for taking CCD is 75 Hrs and will be handled with flexible timings.

VI TERM

Sl. No	Course Code		Course Title	Hours per week				Scheme Of Examination		Total Mark	Minimum Mark For Pass	Duration of exam (Hours)
				Theory	Practical	Total	Credit	Internal	External*			
1.	3F 6307		Industrial Engineering and Management	6		6	6	25	100	100	40	3
2.	3F 6308		Mechatronics	5		5	5	25	100	100	40	3
3.	3F 6309	1	Welding Technology	5		5	5	25	100	100	40	3
		2	Refrigeration and Air conditioning									
		3	Industrial Robotics and 3D Printing									
4.	3F 6310		Process Automation Practical		5	5	2	25	100	100	50	3
5.	3F 6311	1	Welding Technology Practical		5	5	2	25	100	100	50	3
		2	Refrigeration & Air Conditioning Practical									
		3	Industrial Robotics and 3D Printing Practical									
6.	3F 6405		Project work and Internship		6	6	3	25	100	100	50	3
				16	16	32	23	175		700		
			Physical education			2						
			Library			1						
			Total			35	23					

*Autonomous examinations will be conducted for 100 marks and will be reduced to 75 marks

11.EQUIVALENT PAPERS OF E - SCHEME to F- SCHEME

III TERM

	E-SCHEME		**F-SCHEME**
3E 3205	Strength of Materials	3F 3201	Strength of Materials
3E 3206	Fluid Mechanics and Fluid Power	3F 3202	Fluid Mechanics and Fluid Power
3E 3207	Manufacturing Processes	-	NO EQUIVALENT
3E 3301	Machine Drawing	-	NO EQUIVALENT
3E 3208	Strength of Materials & Fluid Mechanics Practical	3F 3204	Strength of Materials & Fluid Mechanics Practical
3E 3209	Metrology and Metallography practical	-	NO EQUIVALENT
3E 3210	Foundry ,Smithy and Welding Practice	-	NO EQUIVALENT

IV TERM

	E-SCHEME (SIT)		**PROPOSED F-SCHEME(SIT)**
3E 4211	Heat Power Engineering	-	NO EQUIVALENT
3E 4212	Special Machines	-	NO EQUIVALENT
3E 4401	Electrical Drives and Control	3F 3401	Electrical Drives and Control
3E 4213	Computer Applications and CAD Practical	-	NO EQUIVALENT
3E 4214	Heat Power Engineering Practical	3F 5211	Thermal Engineering Practical
3E 4302	Electrical Drives and Control Practical	3F 3402	Electrical Drives and Control Practical
3E 4215	Machining Practice-I	-	NO EQUIVALENT

V TERM

		E-SCHEME		F-SCHEME
3E 5303		Design of Machine Elements	3F 5303	Design of Machine Elements
3E 5304		Automobile Engineering	3F 5304-2	Automobile Technology
3E 5305		Mechatronics	3F 6308	Mechatronics
3E 5306	1	**ELECTIVE Theory** Renewable energy sources and energy conservation.	-	NO EQUIVALENT
	2	Total Quality Management		
3E 5307		Automobile Engineering Practical	3F 5306-2	Automobile Engineering practical
3E 5403		Machining Practice-II& Machine tool testing and Maintenance practice	-	NO EQUIVALENT
3E 5308		Life and employability skills practical	-	NO EQUIVALENT

VI TERM

	E-SCHEME		F-SCHEME
3E 6309	Industrial Engg. And Management	3F 6307	Industrial Engineering and Management
3E 6310	Computer Aided Design and Manufacturing	3F 5304-1	Computer integrated manufacturing
3E 6311	**ELECTIVE THEORY-II** 1.Welding Technology	3F 6309-1	**ELECTIVE THEORY** Welding Technology
	2.Refrigeration and Air conditioning	3F 6309-2	Refrigeration and Air conditioning
3E 6313	Process Automation Practical	3F 6310	Process Automation Practical
3E 6314	Computer Aided Design and Manufacturing practical	3F 5306-1	Computer integrated manufacturing practical
3E 6312	**ELECTIVE PRACTICAL** 1.Industrial Welding Practice	3F 6311-1	**ELECTIVE PRACTICAL** Welding Technology Practical
	2. Refrigeration & Air Conditioning Practical	3F 6311-2	Refrigeration & Air Conditioning Practical
3E 6404	Project work	-	NO EQUIVALENT

12.DETAILS OF ADDITION / DELETION OF SUBJECTS

III TERM

E-SCHEME	F-SCHEME	Remarks
Strength of Materials	Strength of Materials	DOTE-N-SCHEME FOLLOWED ADDED Micro and Nano particles.
Fluid Mechanics and Fluid Power	Fluid Mechanics and Fluid Power	**ADDED** Pressure head, Rota meter, Pressure sensor technologies-classification only. Total Pressure, Centre of pressure on immersed bodies (flat vertical)-Problems. Motion synchronization circuit
Manufacturing Processes	Manufacturing Technology - I	**ADDED** Arc Welding: Friction Welding-Induction Welding
Machine Drawing		
	Electrical Drives and Control	**ADDED** Types of stepper motor Microcontroller and circuit breakers **DELETION** sensors
Strength of Materials & Fluid Mechanics Practical	Strength of Materials & Fluid Mechanics Practical	**ADDED** Demo Experiments on hydraulic and pneumatic circuits Deflection Test
Metrology and Metallography practical		

	Electrical Drives and Control Practical	NO CHANGE
Foundry ,Smithy and Welding Practice		
	Manufacturing Technology - I Practical	DOTE-N-SCHEME FOLLOWED

IV TERM

E-SCHEME	F-SCHEME	Remarks
Heat Power Engineering		
	Thermal Engineering - I	DOTE-N-SCHEME FOLLOWED **DELETION(** as the topics are more) combustion equations – stoichiometric air required forcomplete combustion of fuels – excess air – products of combustion - problems – analysis of exhaust gases- Exhaust gas analyser.Dulong's formula
Special Machines		
	Manufacturing Technology – II	DOTE-N-SCHEME FOLLOWED
	Measurements and Metrology	DOTE-N-SCHEME FOLLOWED
	Electric Vehicle Technology Policy	DOTE-N-SCHEME FOLLOWED
Electrical Drives and Control		
Computer Applications and CAD Practical		
Heat Power Engineering Practical	Thermal engineering practical	**ADDED** Valve time diagram for

		four stroke petrol and diesel Engine Thermal Conductivity measurement using guarded plate apparatus
	Machine Drawing and CAD Practical	**ADDED** Knuckle joint.
Electrical Drives and Control Practical		
	Measurements and Metrology Practical	DOTE-N-SCHEME FOLLOWED
Machining Practice-I		
	Manufacturing Technology practical - II	DOTE-N-SCHEME FOLLOWED Exercises will be demonstrated using CNC turning and milling machine.

V TERM

E-SCHEME	F-SCHEME	Remarks
Design of Machine Elements	Design of Machine Elements	SIT-E-SCHEME FOLLOWED **ADDED** Computer Aided Design
	Thermal Engineering–II	DOTE-N-SCHEME FOLLOWED **ADDED** Topics on Steam condenser
Automobile Engineering		
Mechatronics		
ELECTIVE Theory 1. Renewable energy sources and energy conservation. 2. Total Quality Management	ELECTIVE THEORY 1.Computer Integrated Manufacturing	DOTE-N-SCHEME FOLLOWED
	2.Automobile Technology	**ADDED** EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV and VI norms.

		Deletion: Classifications of I.C Engines – components of I.C Engines and functions cooling systems –air cooling – water cooling. Lubrication system – properties of lubricants –types of lubrication systems –Petrol and high pressure Classifications of fuels - merits and demerits – requirements of a good lubricants. Layout of fuel supply system in petrol engines -A.C. mechanical fuel pump — layout of fuel supply system in diesel engine- single acting fuel feed pump – CAV fuel injection pump – fuel injectors – types of nozzles -fuel filters. MPFI and CRDI System. Ignition systems – battery coil ignition systems – magneto ignition system
	3.Green Energy and Energy conservation	DOTE-N-SCHEME FOLLOWED
Automobile Engineering Practical		SIT-E-SCHEME FOLLOWED **ADDED** Trace the automobile electrical system with respect to (i) horn relay circuit, (ii) Wiper circuit & explain with neat circuit diagram
	Solid Modeling Practical	DOTE-N-SCHEME FOLLOWED

Machining Practice-II& Machine tool testing and Maintenance practice		
	Thermal Engineering Practical	SIT-E-SCHEME FOLLOWED **ADDED** Valve time diagram for four stroke petrol and diesel Engine Thermal Conductivity measurement using guarded plate apparatus
Life and employability skills practical		
	ELECTIVE PRACTICAL 1.Computer Integrated Manufacturing Practical	DOTE-N-SCHEME FOLLOWED **ADDED** Universal coupling
	2.Automobile Engineering practical	SIT-E-SCHEME FOLLOWED **ADDED** Trace the automobile electrical system with respect to (i) horn relay circuit, (ii) Wiper circuit & explain with neat circuit diagram
	3.Green Energy and Energy Conservation practical	DOTE-N-SCHEME FOLLOWED
	Entrepreneurship & Startup	DOTE-N-SCHEME FOLLOWED

VI TERM

E-SCHEME	F-SCHEME	Remarks
Industrial Engg. And Management	Industrial Engineering and Management	SIT-E-SCHEME FOLLOWED
Computer Aided Design and Manufacturing		
	Mechatronics	SIT-E-SCHEME FOLLOWED **ADDED:**Sensors for condition monitoring systems of production systems – Examples of

		monitoring methods: **DELETION:** D.C.Motor – brushless permanent magnet D.C.Motors, A.C.Motors – stepper motor – specifications.
ELECTIVE THEORY-II 1.Welding Technology	**ELECTIVE THEORY** 1.Welding Technology	SIT-E-SCHEME FOLLOWED
2.Refrigeration and Air conditioning	2.Refrigeration and Air conditioning	SIT-E-SCHEME FOLLOWED **ADDED** IAQ - principles
	3.Industrial Robotics and 3DPrinting	DOTE-N-SCHEME FOLLOWED
Process Automation Practical	Process Automation Practical	SIT-E-SCHEME FOLLOWED
Computer Aided Design and Manufacturing practical		
PRACTICALS **ELECTIVE PRACTICAL-II** 1.Industrial Welding Practice	**ELECTIVE PRACTICAL** 1.Welding Technology Practical	 SIT-E-SCHEME FOLLOWED
2. Refrigeration & Air Conditioning Practical	2.Refrigeration & Air Conditioning Practical	SIT-E-SCHEME FOLLOWED
	3.Industrial Robotics and 3DPrinting Practical	DOTE-N-SCHEME FOLLOWED
Project work		
	Project work and Internship	DOTE-N-SCHEME FOLLOWED

10. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sl. No.	Course code	Subject	Term	Credits			
				Basic	core	Allied/ Diversified	Value Added
		BASIC					
1.	3F 3201	Strength of Materials	III	5			
2.	3F 3202	Fluid Mechanics and Fluid Power	III	5			
3.	3F 3203	Manufacturing technology -I	III	5			
4.	3F 3204	Strength of Materials & Fluid Mechanics Practical	III	2			
5.	3F 3205	Manufacturing Technology practical - I	III	2			
6.	3F 4206	Thermal Engineering -I	IV	5			
7.	3F 4207	Manufacturing technology -II	IV	5			
8.	3F 4208	Machine drawing and CAD Practical	IV	3			
9.	3F 4209	Manufacturing Technology practical - II	IV	2			
10.	3F 5210	Thermal Engineering - II	V	5			
11.	3F 5211	Thermal Engineering Practical	V	2			
	CORE						
12	3F 4301	Measurements and Metrology	IV		5		

13	3F 4302	Measurement and metrology practical	IV		2		
14	3F 5303	Design of Machine Elements	V		6		
15.	3F 5304	**ELECTIVE Theory** 1. Computer Aided Design and Manufacturing 2. Automobile Engineering 3.Green Energy And Energy Conservation	V		5		
16.	3F 5305	Solid Modeling Practical	V		2		
17.	3F 5306	**ELECTIVE Practical** 1.Computer Aided Design and Manufacturing Practical 2.Automobile Engineering Practical 3. Green Energy And Energy Conservation practical	V		2		
18	3F 6307	Industrial Engg. And Management	VI		6		
19	3F 6308	Mechatronics	VI		5		
20	3F 6309	ELECTIVE THEORY-II 1.Welding Technology 2.Refrigeration and Air conditioning 3.Industrial robotics and 3D printing	VI		5		
21	3F 6310	Process Automation Practical	VI		2		
22	3F 6311	ELECTIVE PRACTICAL-II 1.Welding Technology Practical 2. Refrigeration & Air Conditioning Practical 3. Industrial robotics and 3D printing practical	VI		2		

DIVERSIFIED							
23	3F 3401	Electrical Drives and Control	IV			5	
24	3F 3402	Electrical Drives and Control Practical	IV			2	
25	3F 4403	Electric vehicle technology and policy	IV			4	
26	3F 5404	Entrepreneurship& Startup	V			3	
27	3F 6405	Project work and Internship	VI			3	
VALUE ADDED							
28	3F 0006	Universal Human Values	IV				5
29	3F 0005	Concurrent Career Development	V				5
	TOTAL (credits)			41	42	17	10
	Total Credits = First year 60 credits + programme 110 credits					170	

DETAILED SYLLABUS

III TERM

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F3201

Term : III

Course Name : STRENGTH OF MATERIALS

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
Strength Of materials	05	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Engineering Materials	15
II	Deformation of Metals	15
III	Geometrical Properties of Sections and Thin Shells	15
IV	Theory of Torsion and Springs	14
V	SF and BM Diagrams of Beams and Theory of Bending	14
Test & Model Exam		7
Total		**80**

RATIONALE:

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

OBJECTIVES:

- Define engineering materials, nano, composite material and mechanical testing of materials.
- 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 forDifferent load.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F3201**-CO1**	Ability to explain engineering materials,nano,composite materials , mechanical testing of materials and friction	U
3F3201**-CO2**	Ability to understand the behavior of simple load carrying members subjected to an axial, shear and thermal Loading.	U
3F3201**-CO3**	Ability to compute the centriod, moment of inertia and radius gyration of the various sections. Ability to compute the hoop stress and longitudinal stress in thin shells and spherical shells.	A
3F3201**-CO4**	Ability to calculate shear stresses, angle of twist due to torsion and stiffness of spring ,coil diameter, wire diameter	A
3F3201**-CO5**	Ability to construct the shear force and bending moment diagram on beams under varying load conditions and calculation of bending stress in beams.	A

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**Engineering materials** Classification - definition of Mechanical properties - definition of physical properties - ferrous metals - cast iron - uses - advantages - types of cast iron - properties and applications - effect of impurities on cast iron - steel -classification - alloying elements - purpose of alloying - effect of alloying elements on steel - uses of steels - properties of mild steel - factors affecting physical properties of steel - defects in steel - applications - properties of hard steel - market forms of steels - nonferrous metals - properties and uses. **Nano and Composite materials** Introduction –micro and Nano sized particles– properties - uses - applications - production of Nano layers-chemical vapour deposition method (CVD) - production of nano particles high energy ball milling. Composite materials - definition – classification-properties - application - uses. Mechanical testing of materials Compression test - bend test - hardness test - Brinell hardness test, Vickers hardness test, Rockwell hardness test - impact test - fatigue test - creep test. Tensile test of mild steel in UTM - stress strain diagram - limit of proportionality - elastic limit - yield stress - breaking stress - ultimate stress - percentage of an elongation and percentage reduction in area - problems. **Friction** Introduction - definition - force of friction - limiting friction - static friction - dynamic friction - angle of friction - coefficient of friction - laws of static and dynamic friction.	15
II	**DEFORMATION OF METALS**	15

	Simple stresses and strains Definition - load, stress and strain - classification of force systems - tensile, compressive and shear force systems - Hooke's law - definition Young's modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity. Linear strain - deformation due to tension and compressive force - simple problems in tension, compression and shear force. **Elastic constants** Definition - lateral strain - poisons 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. Composite bar - definition - problems in composite bars subjected to tension and compression. Temperature stresses and strains - simple problems. **Strain Energy** Definition – proof resilience – modulus of resilience – the expression for strain energy stored in a bar due to axial load – instantaneous stresses due to gradual, sudden, impact and shock loads – problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings.	
III	**GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS** **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 –	15

	Definition - Polar moment of Inertia - radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections. **Thin Shells** Definition – Thin and thick cylindrical shell – Failure of thin cylindrical shell subjected to internal pressure – Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems – change in dimensions of a thin cylindrical shell subjected to internal pressure – problems – Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure – simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems.	
IV	**THEORY OF TORSION AND SPRINGS** **Theory of Torsion** Assumptions – torsion equation - 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. **Springs** Types of springs – Laminated and coiled springs and applications – Types of coiled springs – Difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load – problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs.	14
V	**SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING** **SF and BM diagrams** Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment	14

	– 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 bending** 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.	

Reference Books

1. Strength of Materials, R. S. Khurmi, S.Chand & Co.,2021 Ram Nagar, New Delhi.
2. Strength of Materials, S. Ramamrutham, 2017, DhanpatRai Pub. Co., New Delhi.
3. Strength of Materials, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2018.
4. Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 9780070668959,
5. Strength of Materials, B K Sarkar, 2015,Tata Mcgraw hill, New Delhi.
6. Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, ,2018.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 3202

Term : III

Course Name : FLUID MECHANICS AND FLUID POWER

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
	Hours /Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
Fluid Mechanics And Fluid Power	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Basic Principles of Fluid Mechanics & flow of fluids	18
II	Pipe flow, impact of jets and hydraulic turbines	16
III	Reciprocating pumps & centrifugal pumps	13
IV	Pneumatic Systems	13
V	Hydraulic systems	13
Test & Model Exam		7
Total		**80**

RATIONALE:

Mechanical engineering diploma holders are required to deal with problem of fluid flow and use of hydraulic and pneumatic circuits. Hence knowledge and skills about fluid flow and hydraulic and pneumatic circuits are required to be imparted for enabling them to perform above function. This course aims at development of

knowledge and skills about various properties of fluids, fluid power machines and hydraulic and pneumatic systems.

OBJECTIVES:

- Making the students to resolve hydraulic related problems at the current scenario.
- 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.
- Draw Pneumatic circuits for industrial application.
- State the properties of hydraulic Systems.
- Develop hydraulic circuit for machine tools applications.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 3202 **-CO1**	Ability to understand the properties of fluids, pressure measuring devices, types of fluids and flows, bernoulli's theorem and their applications	**U**
3F3202 **-CO2**	Ability to calculate the major and minor losses of head in flow through pipes and working principles of turbines	**A**
3F3202**-CO3**	Ability to identify parts and performance of centrifugal and reciprocating pumps	**A**
3F3202 **-CO4**	Ability to describe the pneumatic system and their application circuits	**R**
3F3202**-CO5**	Ability to describe the hydraulic system and their application circuits	**R**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**Basic Principles of Fluid Mechanics** Fluids – Definition – Properties – Density – Specific weight – specific volume – Relative density – Viscosity – Vapour pressure – compressibility – Surface tension – Capillarity – Ideal and Real fluids – Newtonian and Non-Newtonian fluids – pressure – Atmospheric pressure – Absolute pressure – Gauge pressure and vacuum pressure– Pressure head - Pressure measurement – Bourdons tube pressure gauge **Flow of fluids** Types of flow – Laminar flow – Turbulent flow – Steady flow – Unsteady flow – Uniform flow – non-Uniform flow – mean velocity – Continuity equation – Bernoulli's equation – Proof – Applications – Venturi meter - Orifice meter – Pitot tube – Rotameter - Problems. Pressure sensor technologies-classification only. Total Pressure, Centre of pressure on immersed bodies (flat vertical)- Problems	18
II	**Pipe Flow** Froude's experiment – Wetted perimeter – Wetted area – Hydraulic radius – Head loss due to friction – Darcy-Weishbach equation – Minor losses (No derivation) – problems. **Impact of Jets** Impact of jet on fixed and series of moving flat vanes – Work done and efficiency – Simple problems on the above. **Hydraulic turbines** Layout of a Hydro-electric power plant – Classification of turbines – Working of Pelton wheel, Francis turbine and Kaplan turbine – Differences between impulse and reaction turbines –-Surge tanks –Draft tubes-Types.	16

III	**Centrifugal Pump** Components and working of a single stage centrifugal pump – Types of casing – types of impellers – Multi stage pumps – Priming – Self priming pump – Constant speed Characteristic curves – Jet pump – Trouble shooting, causes and remedies – Comparison of centrifugal pump and reciprocating pumps – No problems. **Reciprocating pump** Reciprocating pump – Classification – Single acting – Double acting Reciprocating pumps – Plunger and piston pump – differences – Discharge of reciprocating pump – Theoretical power required – Coefficient of discharge – Slip – Percentage slip – Negative slip –Cavitation – Air vessels – Trouble shooting, causes and remedies-Problems on discharge, slip, percentage slip and theoretical power required.	13
IV	**Components of Pneumatic system** Pneumatic Systems – elements – filter – regulator - lubricator unit - pressure control valves - pressure relief valves - pressure regulating 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 for pneumatic components – pneumatic circuits – direct control of single acting cylinder – operation of double acting cylinder – merits and demerits of pneumatic system - applications. **Pneumatic circuits** operation of double acting cylinder with metering-in control circuit - operation of double acting cylinder with metering-out control circuit – use of shuttle valve in pneumatic circuits – use of quick exhaust valve in pneumatic circuits - automatic operation of double acting cylinder single and – multiple cycle circuits	13
V	**Components of Hydraulic systems**	

	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 – Motion synchronization circuit. comparison of hydraulic and pneumatic systems.	13

Reference Books

1. “Dr.R.K.Bansal” “Fluid Mechanics and Machines”, Laxmi publications, 2018,New Delhi.
2. “P.N.Modi and S.N.Seth” “ Hydraulic & Fluid Mechanics” Standard Book House,New Delhi.
3. Hydraulic Systems Hand Book “Utility Publications Limited, Secunderabad”
4. “John Pippenger &Tyler Hicks” “Industrial Hydraulics” Mc Graw Hill International Book Company
5. Audel’s Practical Guide to Fluid power “ D.B.Tara pare vale Sons & Co., Pvt Ltd., Bombay”.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course : 3F 3203

Term : III

Course Name : MANUFACTURING TECHNOLOGY-I

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Manufacturing technology-I	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Casting Processes	15
II	Joining Processes	15
III	Bulk Deformation Processes and Heat Treatment	15
IV	Manufacturing of Plastic Components and Powder Metallurgy	15
V	Centre Lathe And Special Purpose Lathe	13
Test & Model Exam		7
Total		**80**

RATIONALE:

Manufacturing, the major and the most important aspect in industries needs utmost care and attention. Knowledge about various processes and allied

areas will be of great use to the personnel involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJECTIVES:

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

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F3203 **-CO1**	Ability to explain the various methods of manufacturing the components by Foundry practice	R
3F3203 **-CO2**	Ability to explain various welding process and its working principle and different types of welding joints and testing of welded joints.	U
3F3203 **-CO3**	Ability to distinguish Hot working, Cold working processes and understand the press tools and accessories, Types of presses and its different types of press working.	U
3F3203 **-CO4**	Ability to understand the different Types and their uses of Engineering plastics and manufacturing of different types of plastics and composites.	R
3F3203 **-CO5**	Ability to describe automatic lathe semiautomatic lathe work holding devices and tool holding devices and machining operations.	R

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**CASTING PROCESSES** **Patterns** Definition – pattern materials – factors for selecting pattern materials – Types of Pattern - solid piece, split patterns, loose piece, match plate, sweep, skeleton, segmental, shell – pattern allowances – core prints. **Moulding** Definition – moulding boxes, moulding sand – ingredients – silica – clay -moisture and miscellaneous materials – properties of moulding sand – sand additives – moulding sand preparation - moulding tools – mixing – tempering and conditioning – types of moulding – green sand – dry sand -machine moulding –Top and bottom squeezer machines – Jolting machines – sand slinger-core – CO_2 core making – types of core – coreboxes. **Casting** Definition – sand casting using green sand and dry sand – gravity die casting – pressure die casting – hot and cold chamber processes – centrifugal casting – continuous casting – chilled casting – malleable casting – melting of cast iron – cupola furnace – melting of nonferrous metals – crucible furnace melting of steel - arc furnaces – induction furnaces – instrument for measuring temperature – optical pyrometer – thermo electric pyrometer – cleaning of casting – tumbling, trimming, sand and shot blasting – defects in casting – causesand remedies –safety practices in foundry.	**15**
II	**JOINING PROCESSES** **Arc Welding**	**15**

	Definition – arc welding equipment – arc welding methods – carbonarc, metal arc, Metal Inert gas (MIG), Tungsten inert gas (TIG), Atomic hydrogen, Friction Welding- Induction welding - working principle - applications - advantages and disadvantages. Plasma arc, Submerged arc and Electro slag welding. **Gas welding** Definition Gas Welding Equipment– Oxy and acetylene welding - Three types of flame– resistance welding – classification of resistance welding– butt – spot – seam – projection welding – welding related processes – oxy and acetylene cutting – arc cutting – hard facing bronze welding – soldering and brazing special welding processes – cast iron welding – thermit welding – solid slate welding, ultrasonic, diffusion and explosive welding – explosive cladding – modern welding, electron beam and laser beam welding – types of welded joints – merits and demerits of welded joints – inspection and testing of welded joints – destructive and nondestructive types of tests – magnetic particle test – radiographic and ultrasonic test defects in welding – causes and remedies – safety practices in welding .	
III	**BULK DEFORMATION PROCESSES AND HEATTREATMENT** **Forming** 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 tool and accessories – press working operations – bending operations – angle bending – chemical bending – curling – drawing – shearing operations – blanking, piercing, trimming – notching – lancing.	**15**

	Heat treatment Heat treatment processes – purpose – procedures – applications of various heat treatment processes – Iron – carbon equilibrium diagram full annealing – process annealing stress relief annealing - spherodising annealing – isothermal annealing – normalizing – hardening – temperingquenching medium – different types and their relative merits – case hardening – pack carburizing – cyaniding – nitriding – inductionhardening and flame hardening.	
IV	**MANUFACTURING OF PLASTIC COMPONENTS AND POWDERMETALLURGY** **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 and types-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. **Powder Metallurgy** Methods of manufacturing metal powders – atomization, reduction and electrolysis deposition – compacting – sintering– sizing – infiltration – mechanical properties of parts made by powder metallurgy – design rules for the power metallurgy	**15**

	process.	
V	**CENTRE LATHE AND SPECIAL PURPOSE LATHES** **Centre Lathe** Theory of lathes – specifications – simple sketches – principle parts –head stock – back geared type – all geared type – tumbler gear mechanism – quick change gear box – apron mechanism – carriage cross slide – automatic, longitudinal and cross feed mechanism – tail stock and its functions – work holding device – face plate – three jaw chuck – four jaw chuck – catch plate and carrier – types of center's – machining operations done on lathe - straight turning – step turning-taper turning-knurling-Thread cutting - Facing – Boring - chamfering –cutting speed – feed-depth of cut. **Semi-Automatic Lathes** Types of semi-automatic lathes – capstan and turret lathes – difference between turret and capstan – tools and work holding devices – self- opening die head – collapsible taps. **Automatic Lathes** Automatic lathe – classification of single spindle automatic lathe– principle of automatic lathes – automatic screw cutting machines – multi spindle automatic lathes.	**13**

Reference Books:

1. Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya 2013 - Media Promoters & Publishers Pvt. Ltd., Seewai Building `B', 20-G,Noshir Bharucha Marg, Mumbai 400 007.

2. Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers,2010, 4835/24,

Ansari Road,Daryaganj, New Delhi – 110002.

3. Manufacturing process – Begeman - 5th Edition -McGraw Hill, New Delhi 1981.
4. Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd.,4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
5. Workshop Technology – Raghuwanshi - Khanna Publishers. Jain & Gupta,2015
6. Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, NewDelhi 110 006 – 2006
7. Production Technology - P. C. SHARMA - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 – 2014
8. Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course code : 3F 3401

Term : III

Course Name : ELECTRICAL DRIVES & CONTROL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per term: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
Electrical Drives & Control	5	80	25	100*	100	3 Hrs.

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

TOPICS AND ALLOCATION OF HOURS

Unit no	Topic	Hours
I	DC circuits and DC machines	15
II	AC circuits and AC machines	15
III	Stepper and servo motors & drives	14
IV	Power supplies and logic gates	14
V	Control elements	15
	Cycle tests and model examination	07
	Total	80

RATIONALE

Automation is being the order of the day to improve the production with high quality consciousness. It involves electrically operated switches, sensors controlled through electrically driven motors 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 the 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 systems.
- Compare the use of servo motors and stepper motors in electrical driving system.

Course outcome

On successful completion of the course, the students will be able to attain below course outcome (co):

Course outcome		BTL
3F 3401-1	Ability to Explain the fundamental concepts of DC Circuits& DC Machine	R
3F 3401-2	Ability to summarize the fundamental concepts of AC Circuits& AC Machine	R
3F 3401-3	Ability to describe the construction and working of Stepper motor, Servo motor& industrial drives	R
3F 3401-4	Ability to paraphrase the fundamental concept of Electronic devices	R
3F 3401-5	Ability to interpret the construction and working of circuit breakers & Microcontroller	R

Legends: U= understand; A= apply and above levels (BTL-bloom's revised taxonomy level)

Detailed syllabus

UNITS	NAME OF THE TOPIC	HOURS
I	**DC CIRCUITS AND DC MACHINES** Definitions - Electric current, voltage and resistance - Ohm's Law and Kirchhoff's Laws - 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 laws of electromagnetic Induction, electrical and mechanical units. **DC generators** – Construction, principle of operation, types and applications. **DC motors** – Construction, principle of operation, types and applications. Necessity of starter- Three point, four point starters. **Necessity of starter:** three point, four point starters.	15
II	**AC CIRCUITS AND AC MACHINES** Fundamentals of AC voltage and current - Peak, average, RMS value of sine wave, Frequency, time period, amplitude, power & power factor (Definition only) - 3Φ circuits: Star and Delta Connections - relationship between phase and line voltage in Star and phase and line current in Delta connections. **Transformers**: Principle of operation and construction – Types - EMF equation(no definition) – losses in transformer – efficiency – applications- Auto Transformer(Principle Only). **Alternator** : Construction – principle of operation – types and applications. **AC machines**: AC motors – principle of operation of single phase capacitor start induction motor only – applications – Three phase induction motors – Squirrel cage and Slip ring induction motors (Construction and working principle only) – applications – speed control of 3Φ induction motor –Necessity of starters – DOL and star delta starter.	15
III	**STEPPER AND SERVO MOTORS & DRIVES:** • PMDC, Stepper motor – construction, working principle, Types-Permanent magnet stepper, Hybrid	14

	synchronous stepper, Variable reluctance stepper - 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: Energy conservation measures in Homes & Industries.	
IV	**POWER SUPPLIES AND LOGIC GATES** **Diode** –forward biasing and reverse biasing – use of diode in rectifiers – half wave, full wave & Bridge rectifiers – 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	14
V	**CONTROL ELEMENTS** **Fuses** – selection of fuse – necessity of fuse – fuse switch units. **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	15

	Miniature circuit breaker(MCB), Oil Circuit breakers(OCB), Earth leakage circuit breakers(ELCB). **Microcontroller**: Definition - Architecture of 8051 : Block diagram of Microcontroller –Functions of each block. Pin details of 8051-Application.	

Reference books

Sl.no.	Name of the book	Author	Publisher
1	A Text book of Electrical Technology volume-I MCE-23-2015	B.L.Theraja	S.Chand & CoNew Delhi
2	Electrical machines A course ofElectrical Engg 4th Edition2014.	K.Bhattachaya , Principal,TTT I, Chandigar	Tata -Mc Graw Hill ,New Delhi
3	Electronic devices applications and integrated circuits5th Edition,2010	Mathur Kulshreshtha Chadha	Umesh publications, New Delhi -6
4	Measurement and Instrumentation	ARUN.K	PHI 2010

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 3204

Term : III

Course Name : STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Strength of Materials and Fluid Mechanics Practical	5	80	25	100*	100	3 Hrs.

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

RATIONALE:

Diploma holders in this course are required to experience the mechanical properties of materials, fluid flow, fluid machines and hydraulic and pneumatic systems. The knowledge thus acquired helps them in understanding the behavior of materials when stressed, and the functioning of fluid power machines, hydraulic and pneumatic systems

OBJECTIVES:

- Determine stress strain relations for steel and cast iron.
- Determine hardness of materials.

- Perform torsion, bending, impact and shear tests
- Determine coefficient of discharge of venture meter and orifice meter.
- Determine the co efficient of friction in pipes.
- Verify Bernoulli's theorem.
- Conduct performance test on centrifugal and reciprocating pump.
- Conduct performance test on impulse and reaction turbine.
- Design and make fluid power circuits.

Course Outcomes:

CO	Details	BTL
3F3204 -CO1	Ability to compute stress strain for steel by tension test and measurement of hardness of materials by hardness test	**A**
3F3204 -CO2	Ability to analyse the behaviour of the materials by performing torsion, bending, impact and shear tests	**A**
3F3204 -CO3	Ability to calculate coefficient of discharge of venturi meter and orifice meter and the friction factor in pipes.	**A**
3F3204 -CO4	Ability to analyse the Bernoulli's theorem.	**A**
3F3204 -CO5	Ability to analyse the performance of centrifugal and reciprocating pump impulse and reaction turbine.	**A**

DETAILED SYLLABUS

Contents: Practical

Exercise

1. STRENGTH OF MATERIALS LABORATORY

1. Test on ductile materials: Finding Young's modulus of elasticity, yield points, percentage elongation and percentage reduction in area, Tests on mild steel

2. Hardness test:

Determination of Rock well's Hardness number for various materials like mild steel, high carbon steel, brass and copper.

3. Torsion test: Torsion test on mild steel – relation between torque and angle of twist – Determination of shear modulus -- determination of elastic constants for mild steel.

4. Bending and deflection tests: Determination of Young's modulus for steel by deflection test.

5. Impact test:

Finding the resistance of materials to impact loads by (a) Izod test (b) Charpy test.

6. Tests on springs of circular section:

Determination of modulus of rigidity, strain energy, shear stress by load deflection method – compression and tension test (closed coil spring only).

7. Shear test:

Determination of shear strength of a given metal (M.S)

2. FLUID MECHANICS LABORATORY

1. Verification of Bernoulli's Theorem.
2. Determination of Co-efficient of discharge of the Venturimeter.
3. Determination of Co-efficient of discharge of the Orifice meter.
4. Determination of Co-efficient of friction in the pipes.
5. Performance test on given reciprocating pump.
6. Performance test on given centrifugal pump
7. Performance test on Pelton wheel.
8. Performance test on Francis Turbine.
9. Performance test on Kaplan Turbine.
10. Study of Pneumatic and Hydraulic circuits [Demo experiments]
    - Direct operation of single and double acting cylinder.
    - Operation of double acting cylinder with quick exhaust valve.
    - Speed control of double acting cylinder using metering-in and metering-out circuits.
    - Automatic operation of double acting cylinder in single cycle - using limit switch.
    - Automatic operation of double acting cylinder in multi cycle - using limit switch.

AUTONOMOUS EXAMINATION

Note:

- Students will be asked to take one set of questions by a lot or

question paper issued by autonomous cell

- Each set of questions will have either two experiments from strength of materials practical or one main question and one question from demo experiments of Fluid mechanics laboratory
- All the experiments should be given in the question paper
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

DETAILED ALLOCATION OF MARKS

Strength of Materials laboratory:

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

Fluid Mechanics laboratory:

Part-A	**:**	**60 marks**

Procedure / Observation	15	
Tabulation / Calculations	35	
Result / Graph	10	
Part - B		**30 marks**
Circuit diagram	10	
Pneumatic diagram	10	
Description	10	
Viva-voce	:	**10 marks**
Total	:	**100 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. Deflection testing arrangement 01
6. Spring testing arrangements. 01
7. Shear testing machine. 01
8. Vernier calliper. 02
9. The Bernoulli's Apparatus. 01
9. An arrangement to find friction factor of pipe. 01
10. A reciprocating pump with an arrangement for collecting data to find out theefficiency and plot the characteristics curves 01
11. A centrifugal pump with an arrangement for collecting data to find out the efficiency and plot the characteristics curves. 01
12. A impulse turbine (pelton turbine) with an arrangement for calculating data to find out the efficiency. 01
13. A reaction turbine (Francis turbine) with an arrangement for calculating data to find out the efficiency. 01

14 A reaction turbine (Kaplan turbine) with an arrangement for

	calculating data to find out the efficiency.	01
15	components for hydraulic and pneumatic circuits	01

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 3402

Term : III

Course Name : ELECTRICAL DRIVES AND CONTROL PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per term: 16 weeks

COURSE	Instructions		Examination			
	Hours /Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Electrical drives and control Practical	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

In this course the students will verify the principles behind the construction of various electrical & electronics equipments and circuits and also learn the performances of transformer, DC and AC motors, Stepper and Servo motor drivers, rectifiers and verify the truth table for various types of gates.

OBJECTIVES:

- Identify starters for different motors.
- 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.

Course Outcomes:

Course Outcome		BTL
3F3402.1	Able to Analyze Ohm's Law.	A
3F3402..2	Able to Compare the characteristics and applications different types of DC Motors	U
3F3402.3	Able to analyze the characteristics of PN junction diode,Half wave,Fullwave & Bridge rectifier	A
3F3402..4	Able to analyze the characteristics of regulator, logic gates & stepper and servo motors	A
3F3402.5	Able to Estimate the efficiency and regulation of the single phase transformer .	U

DETAILED SYLLABUS

1. Verification of Ohm's law.
2. Load test on DC shunt motor.
3. Load test on single phase transformer.
4. OC & SC tests on single phase transformer.
5. Measurement of Earth Resistance using Megger.
6. Study of DC motor Starters – 3 Point & 4 Point Starters.
7. Study of AC motor starters – DOL & star – Delta starters.
8. Study of relays, contactors, push buttons and limit switch.
9. Speed Control of DC shunt motor by Armature control & Field control.
10. Study of single phase induction motor.
11. V-I characteristics of semiconductor diode.
12. Construction and testing of Half wave rectifier.
13. Construction and testing of full wave rectifier.
14. Construction and testing of bridge rectifier.

15. Construction and testing of IC voltage regulator using IC 7805
16. Verification of truth tables for logic gates.
17. Verification of universal gates.
18. Study of stepper motor.
19. Study LED & 7 segment LED
20. Study of Servo motor.

SCHEME OF EVALUATION

SLNO	Description	Maximum Marks
1	Circuit diagram	30
2	Connection	30
3	Execution	25
4	Output / Result	10
5	Viva Voce	05
	Total	100

Note: Only one question will have to be answered by the students in the examination BY LOT out of the total 15 Questions.

ELECTRONICS EXPERINEMNTS

1. Construct and determine the VI characteristics of PN junction diode under forward bias condition.
2. Construct the Bridge rectifier circuits using diodes and measure the ripple factor
3. Construct the Full wave rectifier circuits using diodes and measure the ripple factor
4. Construct the Half wave rectifier circuits using diodes and measure the ripple factor
5. Verify the truth table of basic gates and using 74xx ic's.
6. Verify the truth table of basic universal gates and using 74xx ic's.
7. Construction and testing of IC voltage regulator using IC 7805
8. Conduct and test the stepper motor.

9. Conduct and test the servo motor.

ELECTRICAL EXPERIMENTS

10. To determine the unknown resistance value by using ohm's law

11. Conduct load test on 1phase transformer

12. Conduct load test on 3phase squirrel cage induction motor and also calculate efficiency.

13. Conduct load test on DC shunt motor.

14. Conduct Speed Control of DC shunt motor by Armature control & Field control

15. Conduct a suitable experinement of OC & SC tests on single phase transformer.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 3205

Term : III

Course Name : Manufacturing Technology - I Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Manufacturing Technology - I Practical	4	64	25	100*	100	3 Hrs.

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

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:

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

- Appropriate the safety practices used in welding

Course Outcomes:

CO	Details	BTL
3F3205 -CO1	Ability to List the different safety precaution in lathe and Identify the parts of a centre lathe.	**R**
3F3205 -CO2	Ability to Understand the basics of metal cutting and working of different types of machine tools.	**R**
3F3205 -CO3	Ability to Create sand mould by using the different types of pattern.	**C**
3F3205 -CO4	Ability to Identify the tools used and safety precautions in welding.	**A**
3F3205 -CO5	Ability to Apply the knowledge to make different types of joints by arc and gas welding.	**A**

DETAILED SYLLABUS

Lathe: Study of Lathe parts and its fuctions – Operations - Plain Turning , Step Turning, Taper turning, Knurling, Thread cutting, Bushing, Ecentric Turning.

Foundry: Study of foundry - green sand – properties – patterns – Types - Solid Pattern - Stepped pulley, Bearing top, Gear wheel. Split Pattern - T Pipe, Bent Pipes, Dumbles - Loose Piece pattern – Dovetail – Core – Cores sand - Cylindrical coremaking.

Welding Exercises

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

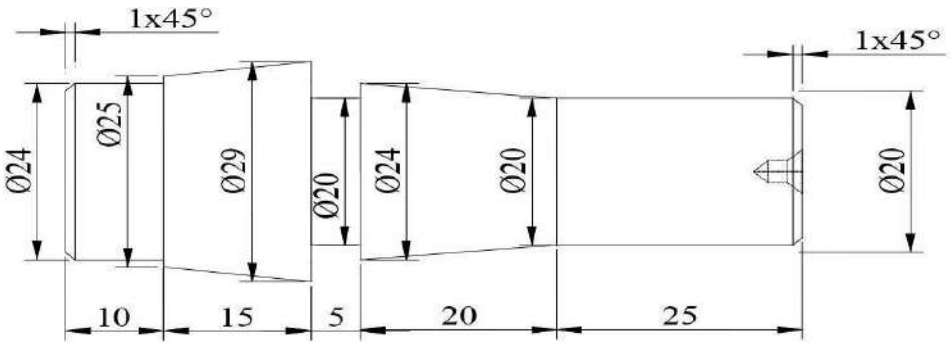
Exercises

PART A – Lathe Exercises

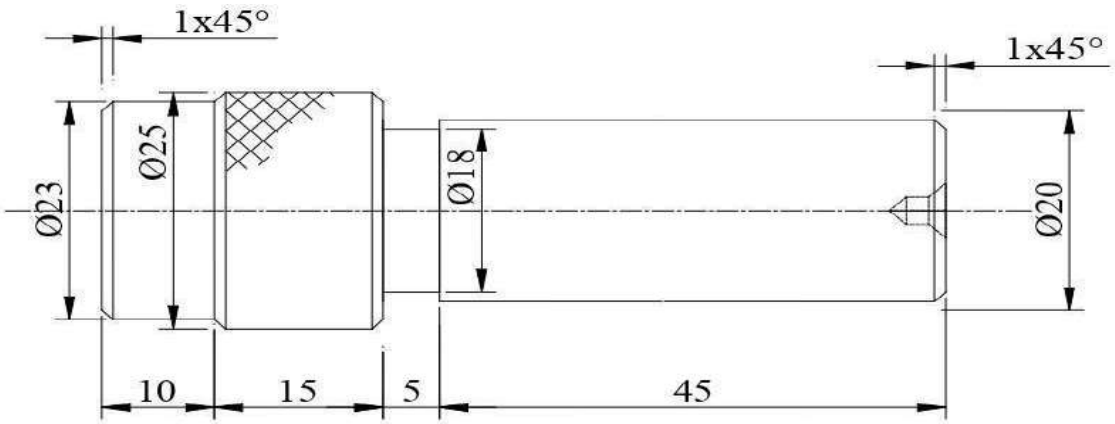
Note**:** All Dimensions are in mm. All linear dimensions in ± 0.5mm tolerance. All cylindrical dimensions in ± 0.2mm tolerance. Estimate the cost of the job for following exercises for M.S. round rod with suitable raw material for the final size. Final job of the raw material should be retained for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

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

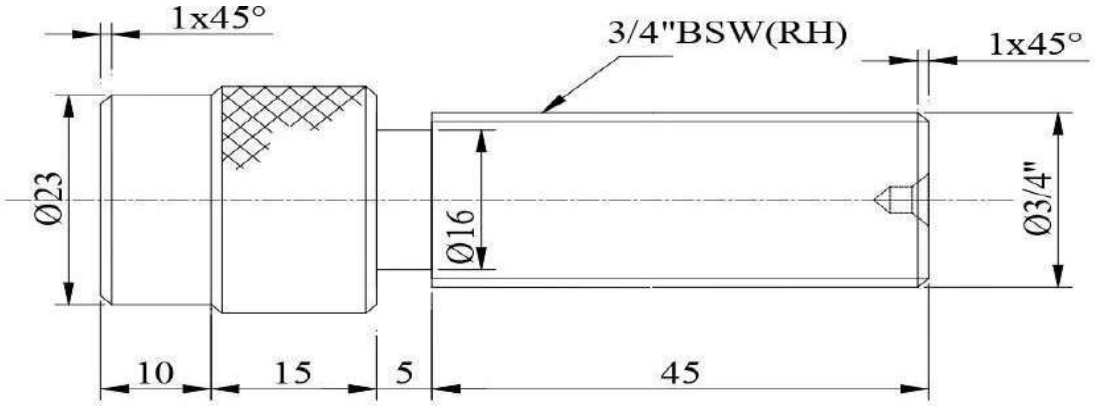
1.Prepare the specimen and make the Step turning & Taper turning as shown in figure using the Lathe.



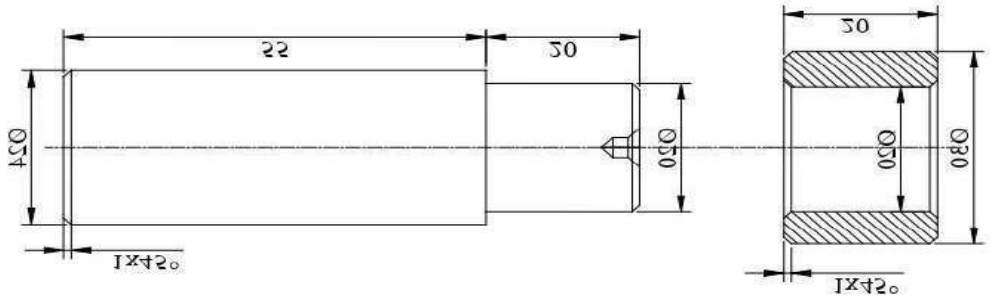
2. Prepare the specimen and make the Step turning & Knurling as shown in figure using the Lathe.



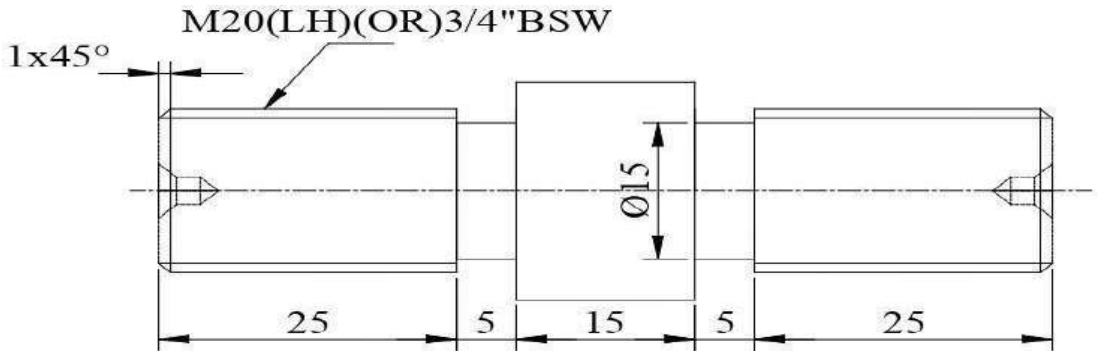
3.Prepare the specimen and make the Step turning &BSW Thread cuttingas shown in figure using the Lathe.



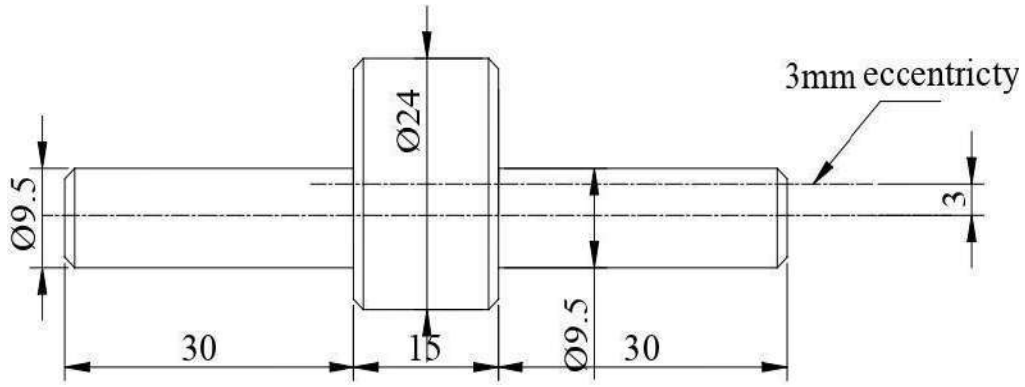
4.Prepare the specimen and make the Shaft and Bush as shown in figure using the Lathe



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



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



PART B – Exercises

1.Prepare the green sand moulding using a Solid Pattern in the foundry.(Stepped pulley, Bearing top, Gear wheel)

2.Prepare the green sand moulding using a Split Pattern in the foundry.(T Pipe, Bent Pipes, Dumbles)

3.Prepare the green sand moulding using a Loose Piece pattern in the foundry.(Dovetail)

4.Prepare the specimen and make the Lab joint by the Arc Welding(Both side welded). (Raw material 25mmX6mm MS flat)

5.Prepare the specimen and make the T joint by the Arc Welding(Both side welded).
(Raw material 25mmX6mm MS flat)

6.Prepare the specimen and make the corner joint by the GasWelding. (Raw material 25mmX3mm MS sheet)

7.Prepare the specimen and make the Butt joint by the Spot welding. (Raw material 25mmX3mm GI sheet)

Allocation of marks for Autonomous Examination

PART-A	55 MARKS
Procedure / Preparation	10 Marks
Machining /Dimensions	35 Marks
Finishing	10 Marks
PART-B	**40 MARKS**
Procedure /Preparation	10 Marks
Machining /Dimensions	25 Marks
Finishing	5 Marks
Viva voce	5 Marks
Total marks	**100 Marks**

LIST OF EQUIPMENT

1. Center Lathe 4 ½ ‘ Bed length – 15 No’s
2. 4 Jaw / 3 Jaw Chucks – required Numbers
3. Chuck key (10 mm x 10 mm size) – 15 No’s
4. Box spanner – 15 No’s
5. Cutting Tool H.S.S ¼ ‘’ X ¼ ‘’ X 4 ‘’ long – 15 No’s
6. Pitch gauge – 5 Nos
7. Vernier Caliper (0-25 and 25-50) – 5 nos each
8. Micrometer, Inside and Outside(0-25 and 25-50) - 5 each
9. Vernier Height Gauge(300mm) - 1 no
10. Snap gauge – 1 set
11. Gear tooth Vernier - 1 No
12. Parallel Block - 2 Nos
13. Steel Rule (0-150) – 15 Nos.
14. Outside and Inside Calipers - 15 Nos. each

15. Thread gauge – 5 Nos.
16. Bevel Protractor – 1 No
17. Jenny Caliper – 5 Nos.
18. Dial Gauge with Magnetic Stand – 5 Nos.
19. Marking Gauge – 10 Nos.
20. Safety Glass – 15 Nos.

    Arc welding booth -2 No's with oil /air cooled welding transformer with accessories
21. Gas welding unit (Oxygen and acetylene cylinder) – 1 Set
22. Flux - 500 grams
23. Electrode 10 SWG – 200 No's
24. Face shield– 3 No's
25. Gas welding goggles – 2 No's
26. Leather Glows 18'' – 4 Set
27. Flux chipping hammer – 4 No's
28. Spot welding machine - 1 No
29. Crucible furnace - 1 No
30. Tilting furnace - 1 No
31. Shovel - 20 Nos
32. Rammer set - 30 Nos
33. Slick - 30 Nos
34. Strike-off bar - 30 Nos
35. Riddle - 15 Nos
36. Trowl - 30 Nos
37. Lifter - 30 Nos
38. Sprue pin - 60 Nos
39. Brush - 20 Nos
40. Vent rod - 30 Nos
41. Draw spike - 30 Nos
42. Gate cutter - 30 Nos
43. Cope box - 30 Nos
44. Drag box - 30 Nos

45. Core box - 10 Nos
46. Runner & riser - 60 Nos
47. Moulding board - 30 Nos
48. Patterns - 5 Nos each

IV TERM

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 4206

Term : IV

Course Name : THERMAL ENGINEERING - I

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
THERMAL ENGINEERING - I	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Basics of thermodynamics and thermodynamic processes of perfect gases	15
II	Steady flow energy equation, thermodynamic air cycles and heat transfer	15
III	Refrigeration and air conditioning	13
IV	Internal combustion engines	15
V	Fuels & combustion of fuels and performance of I.C engines	15
Test & Model Exam		7
Total		**80**

RATIONALE:

A diploma holder in mechanical engineering is supposed to have

The knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation, thermodynamic air cycle and heat transfer ,internal combustion engine and combustion offuels ans performance of I.C engines.

OBJECTIVES:

- Explain basics of systems, laws of thermodynamics and thermodynamic processes.Explain different types of air cycles.
- Apply steady flow energy equation for nozzles and condensers etc., Explain vapour compression and vapour absorption refrigeration system.Compare the properties and applications of various refrigerants.
- Describe the equipment used for air conditioning.Explain the types and functions of I.C engines.
- Explain the performance tests on I.C engine.
- Compare the modes of heat transfer and evaluate heat transfer by various modes.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 4206-**CO1**	Ability to evaluate thermodynamic properties of substances.	**A**
3F 4206 **-CO2**	Ability to estimate the efficiency of air cycles and application of steady flow energy equation.	**U**
3F4206 **-CO3**	Ability to Illustrate the fundamental principles and applications of refrigeration and air conditioning system	**A**
3F4206 **-CO4**	Ability to Understand I.C. Engines and Cycles of operation.	**U**
3F4206**-CO5**	Ability to Evaluate performance Analysis of I.C Engine	**A**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**Basics Of Thermodynamics And Thermodynamic Processes Of Perfect Gases** Basics Of Thermodynamics Introduction – definitions and units of mass, weight, volume, density, work –power- energy – types- specific weight, specific gravity and specific volume – pressure – units of pressure – temperature - absolute temperature – S.T.P and N.T.P conditions – heat - specificheat capacity at constant volume and at constant pressure – law of conservation of energy – thermodynamic system– types – thermodynamic equilibrium - properties of systems – intensive and extensive properties – State of System- process – cycle – point and path functions - zeroth, first and second laws of thermodynamics. Thermodynamic Processes Of Perfect Gases Perfect gases–laws of perfect gases – Boyle's, Charles' , Joule's, Regnault's and Avogadro's laws–General Gas Equation- characteristic gas equation–relation between specific heats and gas constant– universal gas constant-problems– Thermodynamic Processes-Change in Internal Energy- enthalpy –change in enthalpy– entropy – change in entropy – general equations for change in entropy. Constant volume, constant pressure , isothermal , isentropic (reversible adiabatic), polytropic, hyperbolic – P-V and T-S diagrams, work done , change in internal energy , heat transfer , change in enthalpy , change in entropy for various processes – problems – Free expansion and throttling processes.	15
II	**Steady flow energy equation, thermodynamic air cycles and heat transfer**	15

	Steady flow energy equation Steady flow system – control volume – steady flow energy equation –assumptions –Engineering applications of steady flow energy equation–non flow energy equation **Thermodynamic Air Cycles** Air cycles – air standard efficiency – reversible and irreversible processes –assumptions in deriving air standard efficiency – Carnot cycle – Otto cycle –Joule cycle – Diesel cycle – comparison of Otto cycle and Diesel cycle -Comparison of ideal and actual p-V diagramsof Otto and Diesel cycles –problems . **Heat Transfer** Modes of heat transfer – heat transfer by conduction – Fourier's Law- Thermal conductivity – heat conduction through plane and composite walls – heat conduction through a cylinder – heat transfer by convection –heat exchanger – Parallel flow and Counter flow – LMTD– forced convection – natural convection – heat transfer by radiation – Radioactive properties definitions of black and white and opaque , transparent & grey bodies.	
III	**Refrigeration And Air Conditioning** Refrigeration – refrigerators and heat pumps – types and applicationsof refrigeration Systems –refrigerating effect –unit of Refrigeration –C.O.P. – actual C.O.P.- Air Refrigeration System – reversed Carnotcycle – C.O.P of refrigerator, heat pump &Heat Engines –Power Required –Mass of Ice Produced – Problems. Bell-coleman cycle– problems – Vapour compression refrigeration system - vapourabsorption system – Comparision - refrigerants – properties. Psychrometry-psychometric properties – dry air – moist air – water vapour – saturated air – dry bulb temperature – wet bulb temperature– wet bulb depression – dew point temperature – dew pointdepression – humidity – specific and relative humidity – psychrometricchart –psychrometric	**13**

	processes – sensible heating and cooling- By-Pass Factor-humidification – dehumidification –Mixing of Air Stream. Air conditioning – classification and applications of air conditioning system – room air conditioning – central air conditioning – comparison–comfort and industrial air conditioning – factors to be considered in air conditioning – loads encountered in air conditioning systems.	
IV	**Internal Combustion Engines** Internal combustion engines. Classifications of I.C Engines – components of I.C Engines and functions material and method of manufacturing - four stroke cycle petrol and diesel engines – two stroke cycle petrol and diesel engines - comparison of four stroke and two stroke engines – Comparison of petrol and diesel engines - valve timing diagram for four stroke petrol and diesel engines – port timing diagram for two stroke petrol and diesel engines. Layout of fuel supply system in petrol engines -A.C. mechanical fuel pump – simple carburetor – layout of fuel supply system in diesel engine- single acting fuel feed pump – CAV fuel injection pump – fuel injectors – types of nozzles -fuel filters. Ignition systems – battery coil ignition systems – magneto ignition system-MPFI and CRDI System.Governing of I.C. engines - quantity and quality governing – cooling systems –air cooling – water cooling. Lubrication system – properties of lubricants –types of lubrication systems –Petrol and high pressure Lubrication system- oil pump (Gear & Rotor Pumps) and oil filters.	**15**
V	**Fuels & Combustion Of Fuels And Performance Of I,C Engines** **FUELS & COMBUSTION OF FUELS** Classifications of fuels - merits and demerits – requirements of a good fuel - properties of fuel - calorific value of fuels – higher and lower calorific values – determination of	**15**

	calorific value – Bomb and Junker's calorimeter – problems. **Performance Of I.C Engines** Testing - thermodynamic and commercial tests – indicated power – brake power– friction power – efficiencies of I.C. engines – indicated thermal ,brake thermal, mechanical and relative efficiencies Specific fuel consumption – problems - Morse test – procedure–heat balance sheet – procedure.	

Reference Books:

1. Thermal Engg, R.K.Rajput, 10 th Edition,2018, Laxmi publications Pvt Ltd , New Delhi.
2. Applied Thermodynamics, P.K. Nag, 2nd Edition,2017, TATA Mcgraw – Hill PublishingCompany, New Delhi .
3. Thermal Engineering, R.S. Khurmi and J.K. Gupta, 2020 , S. Chand & Co, NewDelhi.
4. Thermal Engineering, P.L Ballaney , 24th Edition Khanna Publishers, New Delhi.
5. Thermal Engineering, B.K. Sarkar , 2017 , Dhanpat Rai & Sons New Delhi .
6. Applied Thermodynamics, 2016,Domkundwar and C.P Kothandaraman, Khannapublishers, New Delhi.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 4207

Term : IV

Course Name : MANUFACTURING TECHNOLOGY-II

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Manufacturing Technology-II	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Theory of Metal Cutting, Drilling Machine & Abrasive Process	12
II	Reciprocating Machines and Broaching	16
III	Milling Machines and Gear Generating	16
IV	Unconventional Machining Processes	15
V	CNC Machine and CNC Programming	14
Test & Model Exam		7
Total		**80**

RATIONALE:

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

are very much essential for atechnician to at promptly and with precision.

OBJECTIVES:

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

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
4F4207 **-CO1**	Ability to explain the nomenclature of twist drill,types of drill and drilling machines and principles of operation in drilling and knowledge of measuring instruments.	R
4F4207 **-CO2**	Ability to illustrate of reciprocating machines and nomenclacture of tools machining operations.	U
4F4207 **-CO3**	Ability to analysis of gear generating processes and milling attachment principle of milling operations.	U
4F4207 **-CO4**	Ability to explain of nonconventional machining and abrasive processes operations.	R
4F4207 **-CO5**	Ability to discuss of CNC machines advantages disadvantages application and components of CNC machines.	U

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**THEORY OF METAL CUTTING, DRILLING MACHINE &ABRASIVEPROCESS** **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. **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 and deep hole drilling. **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 grindingwheel – mounting of grinding wheels – dressing and truing of wheels – balancing of grinding wheels.	12
II	**RECIPROCATING MACHINES**	16

	Planer Introduction – description of double housing planner – specifications – principles of operation – drives – quick return mechanism – feed mechanism – work holding devices and special fixtures - types of toolsoperations. **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 Milling machines Types – column and knee type, plain, vertical and universal milling machines – principles of operation – specification of milling machines– work holding devices – tool holding devices – arbor – stub arbor –spring collet – adaptor. Milling cutters – cylindrical milling cutter –slitting cutter – side milling cutter – angle milling cutter – T slot milling cutter – woodruff milling cutter – fly cutter – nomenclature of cylindrical milling cutter. Milling operations – straddle milling - gang milling – vertical milling attachment. Indexing plate – differential indexing – simple indexing and compound indexing – simple problems. **Generating processes**	16

	Gear shaper – gear hobbing – principle of operations only. Gear finishing processes – burnishing – shaving – grinding and lapping –gear materials.	
IV	**UNCONVENTIONAL MACHINING PROCESSES** **Mechanical energy based process** Introduction – classification – process selection – advantages – limitations – demerits of conventional processes.–Mechanical energy based process: Introduction – abrasive jet machining – metal removal rate process parameters – water jet machining – hydrodynamic jet machining – ultrasonic machining process – advantages – disadvantages – applications – compare ultrasonic machining with traditional abrasive machining. **Electrical energy based processes** Introduction – electrical discharge machine (EDM) – flushing system in EDM – tool (electrode) materials - tool wear – metal removal rate and surface finish - factors affecting the metal removal rate – advantages – disadvantages – applications – wire cut EDM features of wire cut EDM – difference between EDM and wire cut EDM. **Chemical and electrochemical energy based processes** Extrusion-general features of single screw extrusion – twin screw extruders and types-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. **Thermal energy based processes** Introduction – electron beam machining – laser beam machining – lasing materials – machining applications of laser – plasma arc machining – gases used in plasma arc machining – types of	15

	plasmaarc torches –advantages – disadvantages – applications. Introduction to newer machining process and Additive manufacturing.	
V	**CNC MACHINE AND ITS COMPONENTS** **CNC machines** Numerical control – definition – working principle of a CNC system – features of CNC machines – advantages of CNC machines – difference between NC and CNC – construction and working principle of turning centre – construction and working principle of machining centre - machine axes conventions turning centre and machining centre – co- ordinate measuring machine – construction and working principle. **Components of CNC machine** Slide ways – requirement – types – friction slide ways and anti-friction slide ways – linear motion bearing – recirculation ball screw – ATC – tool magazine – feedback devices – linear and rotary transducers – encoders– in process probing – tool material – tool inserts. **CNC Programming:** Introduction – Cartesian coordinate system – Polar coordinate system – Absolute and incremental positioning – Purpose of G and M codes. Basic codes – basic CNC program. CNC turning program using linear interpolation and circular interpolation. Machine control panel – Homing position – Offset setting– Auto. CNC milling program using linear interpolation and circular interpolation. Compensation – Machine control panel – Home position–Work offset setting procedure – Tool offset .	14

Reference Book:

1. Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, Edn.15,published by Media Promoters and Publishers Pvt. Ltd.,

Seervai Buildings `B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2016.

2. Production Technology, Jain & Gupta, Khanna Publishers, 2-B, North Market, Naisarak,New Delhi – 110 006 – 2006.

3. Production Technology, HMT, 2017, published by Tata McGraw Hill Publishing Co.Ltd., 7, West Patel Nagar, New Delhi 110 008.

4. Manufacturing process, Myro N Begman, , Edn. 5, Tata McGraw Hill Publishing Co. Ltd.,7, West Patel Nagar, New Delhi 110 008.

5. Workshop Tech Vol I,II, III, WAJ. Chapman, published by Viva Books Pvt. Ltd., 4262/3,Ansari Road, Daryaganj, New Delhi 110 002.

6. Production processes, NITTTR, published by 5, Tata McGraw Hill Publishing Co. Ltd.,West Patel Nagar, New Delhi 110 008.

7. Principles of the manufacturing of Composite materials – Suong V Hoa, DES techpublication. Inc, 439, North Duke street, Lancaster, Pennsylvania – 17602 U.S.A.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 4301

Term : IV

Course name : Measurements and Metrology

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
Measurements and Metrology	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Basic Concepts of Measurements	15
II	Linear and Angular Measurements	15
III	Form Measurement	15
IV	Advances in Metrology	14
V	Measurement of Mechanical Parameters	14
	Test and Revision	7
Total		**80**

RATIONALE:

Measurements and metrology are the basic and prominent tools in all the industriesin the present scenario. The students should be trained not only in manufacturing also they should have knowledge about the various measuring instruments which is used in industries. This will provide the students an

opportunity to skill themselves for how to handle the various metrological equipment available to measure the dimensions of the components.

OBJECTIVES

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

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
CO1	Understand the basic concepts of measurements, Precision and Accuracy	U
CO2	Explain the working principle of devices used for linear & angular measurements**.**	U
CO3	Understand the devices for gear, screw threads and surface finish measurements.	U
CO4	Explain the devices used in Laser Metrology and concepts involved in Coordinate measuring machines	A
CO5	Explain the devices used for the measurement of mechanical parameters force, power and flow	E

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**BASIC CONCEPTS OF MEASUREMENTS** **Introduction** Basic units - system concepts used in measuring technology -	**15**

	measuring instruments - length, angles and surface - scope of Metrology - standardization - international standardization, the bureau of Indian standards - legal Metrology - definition - applications - important elements of measurements - methods of measurements - needs for inspection - need for measurement - important terminology. **Precision and accuracy** Precision - definition - accuracy - definition - difference between precision and accuracy - factors affecting the accuracy of the measuring system - general rules for accurate measurements -precautions for use of instruments so as to avoid in accuracy in measurements - reliability - definition - error - definition - sources of errors - classification of error - compare systematic error and random error - selection of measuring instruments - symbols for metallurgical terms (ASME and ISO).	
II	**LINEAR AND ANGULAR MEASUREMENTS** **Linear measurements** Classification of linear measurement instrument - construction and the principles only - Steel rule - callipers - outside calliper, inside calliper, Jenny caliper - combination set - feeler gauge- pitch screw gauge - Vernier caliper - digital caliper – Vernier height gauge- micrometer - inside micrometer - thread micrometer - optical micrometer - light wave micrometer - possible sources of errors in micrometers - slip gauges - requirements - Indian standard - care and use. **Angular measurements** Introduction - vernier bevel protractor - universal bevel protractor - optical bevel protractor. Sine bar - types - uses and limitations - working principle of clinometer, autocollimator, angle dekkor. Comparators - uses - application - classification of comparator -	**15**

	mechanical comparator, optical comparator, electrical comparator, pneumatic comparator - principles - advantages and disadvantages - compare comparator with measuring instruments – compare electrical and mechanical comparators.	
III	**FORM MEASUREMENT** **Measurement of screw threads** Screw thread terminology - error in thread - measurement of various elements of thread (description only) - thread gauges - classification- plug screw gauges, ring screw gauges, caliper gauges - adjustable thread gauge - gauging of taps - function of various types of gauges floating carriage micrometer. **Measurement of gears** Introduction - types of gear - gear terminology - gear errors - spur gear measurement - run out, tooth measurement, profile measurement, lead checking backlash checking, tooth thickness measurement - vernier gear tooth caliper - David brown tangent comparator - constant chord method - measurement of concentricity, alignment checking – Parkinson gear tester - Rolling gear testing machine - radius measurement - radius of circle - surface finish measurement - classification of geometrical irregularities - elements of surface texture - methods of measuring surface finish - measuring surface roughness - tracer type profilogram - double microscope.	**15**
IV	**ADVANCES IN METROLOGY** **Laser Metrology** Basic concepts of lasers - types of lasers - uses, advantages and applications - laser telemetric system - laser and LED based distance measuring instruments - scanning laser gauge - photodiode array imaging - diffraction pattern technique - laser triangulation sensors - two frequency laser interferometer - gauging wire diameter from the diffraction pattern formed in laser - interferometry - use of laser in interferometry - interferometer -	**14**

	standard interferometer, single beam interferometer, AC interferometer, Michelson interferometer, dual frequency laser interferometer - Twyman green interferometer - applications. **Computer in Metrology** Coordinating measuring machine - introduction - types of measuring machines - types of CMM - futures of CMM - causes of errors in CMM - 3 co-ordinate measuring machine - performance of CMM - applications - advantages disadvantages - computer controlled coordinating measuring machine - mechanical system of computer controlled CMMs - trigger type probe system, measuring type prop system, features of CNC and CMM - features of CMM software - factors affecting CMM - digital devices - Computer based inspection - Computer aided inspection using robots.	
V	**MEASUREMENT OF MECHANICAL PARAMETERS** **Force** Measurement of force - Direct methods - equal arm balance, unequal arm balance, multiple lever system, pendulum scale – indirect methods - electromagnetic balance - load cells - hydraulic load cell, pneumatic load cell, strain gauge load cell, share type load cell, electronic weighing system. Torque measurement - torque measurement using strain gauge - laser optical torque measurement- stroboscope for torque measurement. **Measurement of power** Mechanical dynamometer - DC dynamometer - inductor dynamometer - hydraulic dynamometer - diaphragm pressure sensor - deform cage with LVDT - diaphragm gauge with strain gauges - piezoelectric sensors. **Measurement of flow** Types of flow metres - rotameter, electromagnetic flow metre, hot wire anemometer, ultrasonic flow metre, laser Doppler	**14**

	anemometer (LDA) - reference beam mode, interference French mode.	

Reference Books:

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

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 4403

Term : IV

Course name : E Vehicle Technology & Policy

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
E Vehicle Technology &Policy	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
	4	64	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Environmental impact and history, Types of Electric Vehicles	12
II	Electric vehicle, Electrical Propulsion System	12
III	Energy Storages, Charging System, Effects and Impacts	11
IV	Electric Mobility Policy Frame Work	11
V	Tamilnadu E-Vehicle Policy 2019	11
	Test And Revision	7
	Total	**64**

RATIONALE:

The world is transitioning to cleaner mobility options with the aim at improving air quality and reducing dependency on fossil fuels. Electric Vehicles (EVs) have emerged a popular clean mobility choice to reduce emissions. EVs are powered

fully or partially by batteries, they can help to reduce dependence on fossil fuels also air quality. Tamil Nadu is one of the most advanced states in India. Tamil Nadu has a highly developed industrial eco-system and is very strong in sectors like automobiles and auto- components. Many globally renowned companies have setup their manufacturing facilities in Tamil Nadu. Due the rapid depletion of fossil fuel and increase in fuel cost, environmental pollution, the shift to clean transport is necessary. This subject introduced by keeping all the above factors.

OBJECTIVES:

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

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
CO1	Ability to Understand the Environmental impact of conventional vehicle and Types of Electric Vehicles.	**U**
CO2	Ability to explain the Electric Vehicles and Electric Propulsion Systems.	**U**
CO3	Ability to describe the construction and functional features Energy Storages device, its charging and effects & impacts.	**U**
CO4	Ability to Summarize the Electric Mobility Policy Frame Work.	**U**
CO5	Ability to Remember the Tamil Nadu E-Vehicle Policy 2019	**R**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**Environmental impact and history:** Environmental impact of conventional vehicle - Air pollution – Petroleum resources – History of Electric vehicles & Hybrid Electric Vehicles - Conventional drive train system – Rear Wheel, Front Wheel and All wheel - Parts of Drive train system **Types of Electric Vehicles:** Introduction to Battery Electric Vehicle (BEV) – Definition BEV – Necessity BEV – Different between BEV and Conventional Vehicle - Advantages of BEV - Block diagram of BEV – Hybrid electric Vehicle (HEV) - Plug-in Hybrid Electric Vehicle (PHEV) – Fuel Cell Electric Vehicle (FCEV) – Description.	12
II	**Electric Vehicles:** Configurations of Electric Vehicle – Performance of Electric Vehicles – Tractive Effort in Normal Driving – energy consumption. **Hybrid Electric Vehicles:** Concept of Hybrid electric drive trains– Architecture of Hybrid Electric Drive trains – Series, Parallel and Series & Parallel **Electric Propulsion Systems:** Types of EV motors - DC motor drives– Permanent Magnetic Brush Less DC Motor Drives (BLDC) – Principles, Construction and Working – Hub motor Drive system – Merits and Demerits of DC motor drive, BLDC motor drive.	12

III	**Energy Storages:** Electrochemical Batteries – Battery Technologies – Construction and working of Lead Acid Batteries, Nickel Based Batteries and Lithium Based Batteries - Role of Battery Management System (BMS)– Battery pack development Technology– Cell Series and Parallel connection to develop battery pack. **Charging:** Battery Charging techniques - Constant current and Constant voltage, Trickle charging – Battery Swapping Techniques – DC charging – Wireless charging – Maintenance of Battery pack – Latest development in battery chemistry. **Effects and Impacts:** Effects of EV – Impacts on Power grid – Impacts on Environment – Impacts on Economy.	**11**
IV	**Electric Mobility Policy Frame Work** Government of India Electric Mobility Policy Frame work – Global Scenario of EV adoption – Electric mobility in India – National Electric Mobility Mission Plan 2020 – Action led by Original Equipment Manufacturers – Need of EV Policy – Advantage of EV Eco system – Scope and Applicability of EV Policy – ARAI Standards for Electric Vehicle – AIS 038, AIS 039 &AIS 123 - Key Performance Indicator - Global impact –Trends and Future Developments	**11**
V	**Tamil Nadu E-Vehicle Policy 2019** Tamil Nadu E-vehicle Policy 2019: Vehicle Population in Tamil Nadu – Objectives of EV Policy – Policy Measures – Demand side incentives – Supply side incentives to promote EV manufacturing – Revision of Transport Regulation of EV – City building codes – Capacity Building and Skilling – Charging structure – implementing agencies – Reasearch &Development and Business Incubation – Recycling Ecosystem – Battery and EVs.	**11**

Reference Books

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi, CR Press, London, New York.

2. Comparison of Electric and Conventional Vehicles in Indian Market: Total Cost of Ownership, Consumer Preference and Best Segment for Electric Vehicle (IJSR), Akshat Bansal, Akriti Agarwal

3. A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development (MDPI), Fuad Un-Noor, Sanjeevikumar Padmanaban, Lucian Mihet-Popa,Mohammad Nurunnabi Mollahand Eklas Hossain

4. Electric Vehicles: A future Projection CII October 2020 report. Design and analysis of aluminum/air battery system for electricvehicles,Shaohua Yang, Harold Knickle, Elsevier.

5.Propelling Electric Vehicles in India, Technical study of Electric vehicles,Shaohua Yang, Harold Knickle, Elsevier.

6.Propelling Electric Vehicles in India, Technical study of Electric Vehicles andCharging Infrastructure

7.ZERO EMISSION VEHICLES (ZEVs): TOWARDS A POLICY FRAMEWORK – NTI Aayog.

8.FASTER ADOPTION OF ELECTRIC VEHICLES IN INDIA: PERSPECTIVEOF CONSUMERS AND INDUSTRY, The Energyand Resources Institute, New Delhi.

9.India EV Story: Emerging Opportunities by Innovation Norway.

10.Automotive Industry Standards – AIS 038, AIS 039 & AIS 123 – Manual.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 4208

Term : IV

Course Name : MACHINE DRAWING & CAD PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
MACHINE DRAWING & CAD PRACTICAL	5	80	25	100*	100	3 Hrs.

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

RATIONALE:

Diploma holders are required to read and interpret drawings. Hence it is essential that they should have competency in preparing drawings, sketches and assembly of various machine parts.The contemporary progressing world is fast with the latest production systems. The advanced manufacturing of products is developed instantly using CAD software. Even a small scale industry is now using a CAD software as it has become the heart of the design department. So CAD has now become inevitable in industries.

Accuracy and precision are the two important things that decide the quality of a product to survive its competitors in the market. Using CAD software design, the uniform accuracy, multiples of copies and storing in a small space for long time are assumed.

So drawing is an important subject to be studied by the students to carry and

complete the production and assembly process successfully.

OBJECTIVES:

- To learn the parts and assembly of the machine components.
- Appreciate the need of sectional view and types of sections.
- Draw assembly and part drawings of various mechanical components.
- To prepare geometrical model of various machine elements.
- Draw sectional views using different types of sections.
- Practice on CADD commands in making 2D Drawings.
- Draw assembled drawings using CADD.
- Draw sectional views using different types of sections.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

CO	Details	BTL
3F4208 -CO1	Ability to explain sectional views and types of sections	U
3F4208 -CO2	Ability to Illustrate assembly Drawing Knowledge of various types of machine elements using manual drafting.	U
3F4208-CO3	Ability to analyse on CADD commands in making simple 2D Drawings.	A
3F4208 -CO4	Ability to create sectional views using different types of sections.	C
3F4208 -CO5	Ability to create assembled drawings using CADD.	C

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

PART–A: MANUAL DRAWING PRACTICE

Sectioning - sectional views – representation of sectional plane – hatching – inclination – spacing – hatching large areas – hatching adjacent parts - full section

–half section – types of half sections – conventional representation of materials in section – Dimensioning - Detailed drawings of the machine parts are given to students to assemble and draw any two views of the machine elements in the Drawing Sheet. Front View /Full Section / Half Section Front View and Top View / Left Side View / Right Side View with dimensions.

PART–B: COMPUTER AIDED DRAFTING (CAD)

CAD applications – Hardware requirement – Software requirement – CAD screen interface– menus – Toolbars – types of co-ordinate system – Creating 2D objects –Using draw commands – Creating text – Drawing with precision – Osnap options – drafting settings – drawing aids – Fill, Snap, Grid, Ortho lines – Function keys –Editing and modify commands – Object selection methods – Erasing object – Oops –Cancelling and undoing a command– Copy – Move – Array – Offset – Scale – Rotate – Mirror – Break – Trim – Extend – Explode. Divide – Measure – stretch – Lengthen – Changing properties – Colour – line types – LTscale – Matching properties – Editing with grips – Pedit – Ddedit – Mledit - Basic dimensioning – Editing dimensions – Dimension styles – Dimension system variables.

Machine drawing with CAD.

Creation of blocks – Wblock – inserting a block – Block attributes – Hatching – Pattern types – Boundary hatch – working with layers – Controlling the drawing display – Blipmode – View group commands – Zoom, redraw, regen, regenauto, pan, viewers –Realtime zoom. Inquiry groups– calculating area – Distance – Time– Status ofdrawing– Using calculator. Plot Detailed drawings of the machine parts are given to students to assemble and draw any two views of the machine elements in the Drawing Sheet. Front View / Sectional Front View (Full Section / Half Section) and Top View / Left Side View / Right Side View with dimensions in the CAD software.

EXERCISE:

Draw the Front View / Sectional Front View (Full Section / Half Section) and Top

View / Left Side View / Right Side View in the given drawing sheet and create the same in the CAD package.

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

ALLOCATION OF MARKS

Manual Drawing	
Assembled Front view	25
Assembled Top View / Side View	15
	40 marks
CAD	
Drafting	20
Assembly	15
Dimensioning	15
	50 marks
Viva-voce	**10 marks**
Total	**100 marks**

LIST OF EQUIPMENTS

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

MODEL QUESTION PAPER

Programme: **Mechanical Engineering** Max.marks:**100**

Course: **Machine Drawing and CAD practical** Course code:3F 4208

Term: **III** Time: **3 Hrs.**

[**Note:**

1.PART -A question are to be answered in the drawing sheet only

PART – B question are to be answered using computer aided drafting (CAD)]

2. Note: Questions are to be asked in any one of the following

A.1. Draw the Front View and left side view of SLEEVE & COTTER JOINT in the given drawing Sheet and create the same in the CAD software.

B.1. Draw the Front View and left side view of KNUCKLE JOINT in the given drawing Sheet and create the same in the CAD software.

C.1. Draw the Front View and left side view of PLUMMER BLOCK in the given drawing Sheet and create the same in the CAD software.

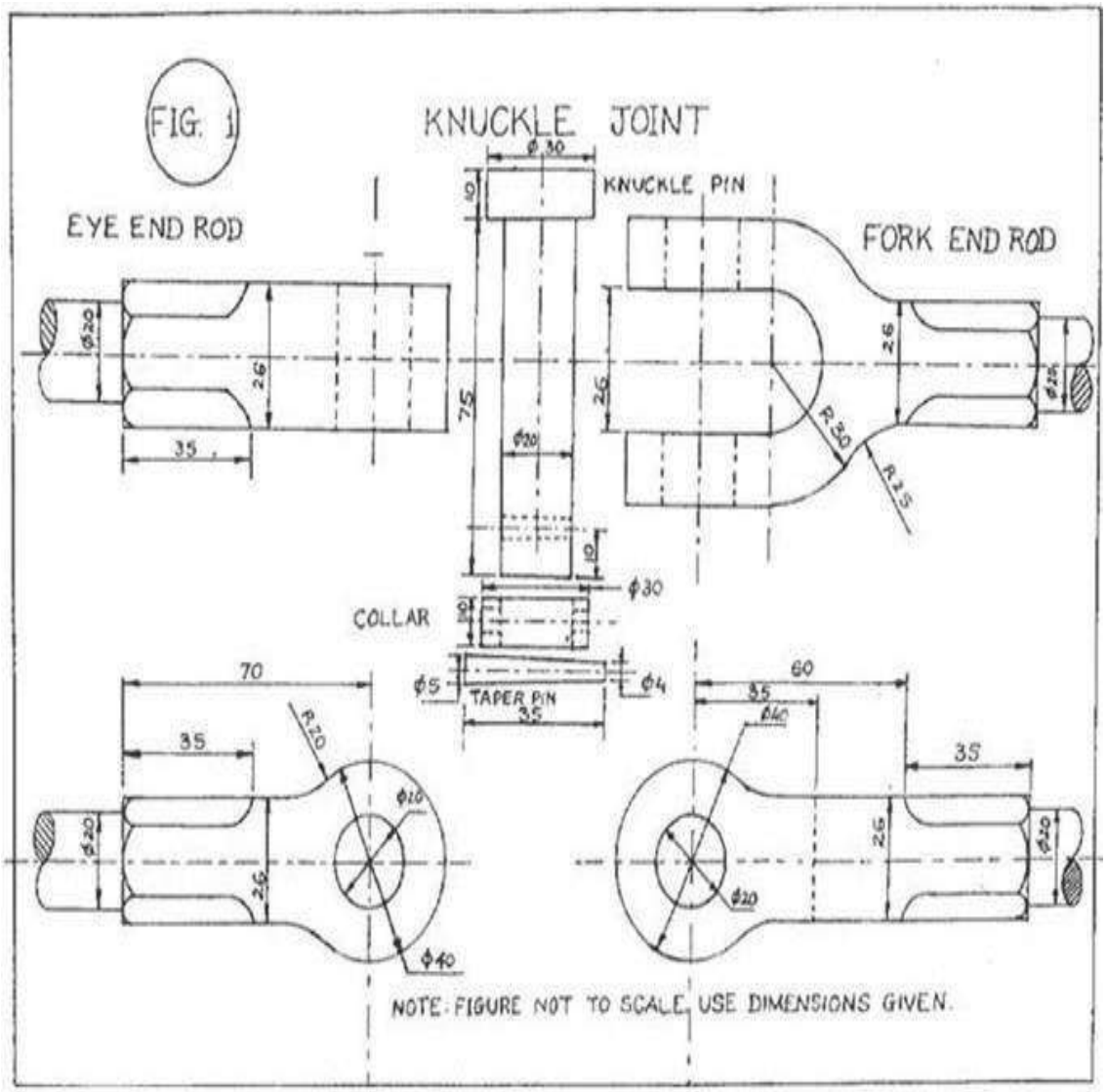
D.1. Draw the Front View and left side view of SIMPLE ECCENTRIC in the given drawing Sheet and create the same in the CAD software.

E.1. Draw the Front View and left side view of MACHINE VICE in the given drawing Sheet and create the same in the CAD software.

F.1. Draw the Front View and left side view of Protected type flanged coupling in the given drawing Sheet and create the same in the CAD software.

G.1. Draw the Front View and left side view of Screw jack in the given drawing Sheet and create the same in the CAD software.

Sample diagram



Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 4302

Term : IV

Course name : Measurements and Metrology Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Measurements and Metrology Practical	4	64	25	100*	100	3 Hrs.

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

RATIONALE :

Diploma holders need to measure different form products after machining and while the products from maintenance operation. For this reason they should be familiar with different types of equipments with its accuracy and its precision. With the current trends adopted in the industry, it is imperative that the students should possess basic knowledge on measurement and metrology. so that this will help in their carrier.

OBJECTIVES:

- Familiarize about measuring techniques of Metrology instruments.
- Select the range of measuring tools. Study of accuracy ofinstruments andcalibration of instruments.
- Obtain accurate measurements.
- Determine the least count of measuring instruments.
- Acquire knowledge about linear measurement.
- Acquire knowledge about angular measurement.

- Acquire knowledge about geometric measurements.
- Study of Linear Measuring Instruments:Vernier

Caliper,Micrometer,InsideMicrometer, Vernier Height gauge and SlipGauge.

- Study of Angular Measuring Instruments–Universal Bevel Protractor,SineBar.
- Study of Geometric measurement - Gear tooth Vernier, Thread Vernier.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

CO	Details	BTL
3F4302 -CO1	Ability to understand different measuring techniques of Metrology instruments	U
3F4302 -CO2	Ability to understand Least count of Measuring instruments and their calibration	U
3F4302 -CO3	Ability to estimate Linear measurements using devices	U
3F4302 -CO4	Ability to estimate angular measurements using devices	U
3F4302 -CO5	Ability to compare the given component using devices	U

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

Exercises

PART A: Linear Measurements.

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

2.Measure the diameter of a wire using micrometer and compare theresult with digital micrometer

3.Measure the thickness of ground MS plates using slip gauges

4.Measure the inside diameter of the bore of a bush cylindricalcomponent using inside micrometer compare the result with digital micro meter.

5.Measure the height of gauge blocks or parallel bars using vernier height gauge.

6.Measure the speed lathe spindle using stroboscope.

PART B: Angular measurements / Comparators

1. Measure the angle of a V-block / Taper Shank of Drill / Dovetail usinguniversal bevel protractor.

2. Measure the angle of the machined surface using sine bar with slip gauges.

3. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.

4. Measure the geometrical dimensions of spur gear.

5. Find out the measurement of given component and Compare with a standard component using mechanical comparator and slip gauge .

6. Compare the given component with a standard component using pneumatic comparator.

Allocation of Marks

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

LIST OF EQUIPMENTS

1. Vernier Caliper - 2 Nos.
2. Digital /dial Vernier Caliper. - 2 Nos.
3. outside micrometer - 2 Nos.
4. inside Micrometer - 2 Nos
5. Digital Micrometer - 2 Nos.
6. Slip gauges - 2 Nos.
7. Universal bevel protractor. - 2 Nos.
8. Sine bar - 2 Nos.
9. Digital inside micrometer - 2 Nos.
10. Surface plate - 2 Nos.
11. Vernier height gauge - 1No.
12. Thread Vernier - 1 No.
13. Stroboscope. - 2 Nos.
14. Gear tooth Vernier - 2 Nos.
15. Mechanical comparator - 2 Nos.
16. Dial indicator (0-10) - 2 Nos.
17. Pneumatic comparator - 1 No.

Consumable - Sufficient quantity

Autonomous examination

Note:

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the exercises should be given in the question paper and students are allowed to select by a lot.
- All regular students appearing for first attempt should submit record notebookfor the examination.
- The external examiner should verify the availability of the facility for the batchstrength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's /equipment before commencement of practical examination.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 4209

Term : IV

Course Name : Manufacturing Technology - II Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Manufacturing Technology - II Practical	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

With the recent trends in manufacturing industries, especially with the inception of CNC machines, the diploma holders should possess hands on experience on conventional and CNC machines.the different types of experiments in this practical aimed to give confidence to the diploma holders when they are engaged in manufacturing industries.

OBJECTIVES:

- Identify a milling machine and its parts
- Identify a cylindrical grinder, surface grinder and tool and cutter grinder
- Identify shaper, Slotter and its parts
- Identify the tools and instruments used in milling.
- Study the components of the CNC machine and setting.
- Handle the different types of work holding devices
- Machine a component using different machine tools.
- Calculate the indexing for a work
- Machine a gear using milling machine.

- Machine a cutting tool using Tool and Cutter grinder.
- Machine a plug gauge using Cylindrical grinding machine.
- Machine components by shaping machine
- Machine components by slotting machine.
- Demo components by the CNC machines.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

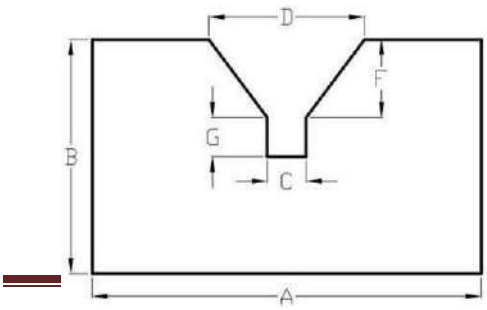
CO	Details	BTL
3F4209 -CO1	Ability to performance the operation in shaping machine ,v-block,dovetail	R
3F4209 -CO2	Ability to performance the operation in slotting machine,groove cut	U
3F4209 -CO3	Ability to performance the operation in milling machine,spur gear,helical gear,round to hexagon,slot cutting	U
3F4209 -CO4	Ability to performance the operation in cylindrical grinding machine,tool and cutter grinder,surface grinder	R
3F4209-CO5	Ability to identify the usage of CNC turning machine and CNC milling machine	U

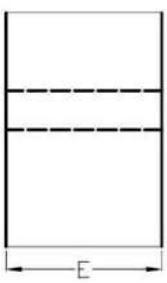
Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

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

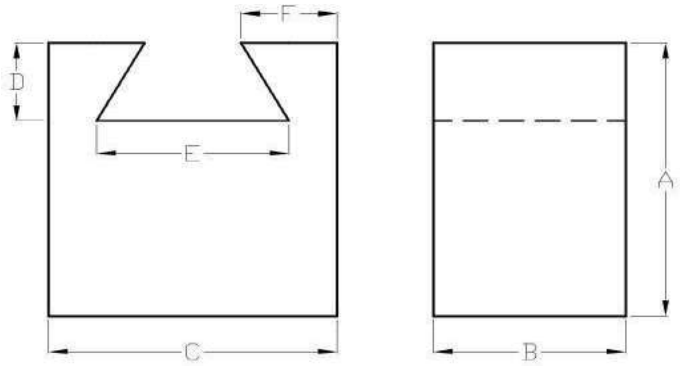
1.Make 'V' Block using shaping machine



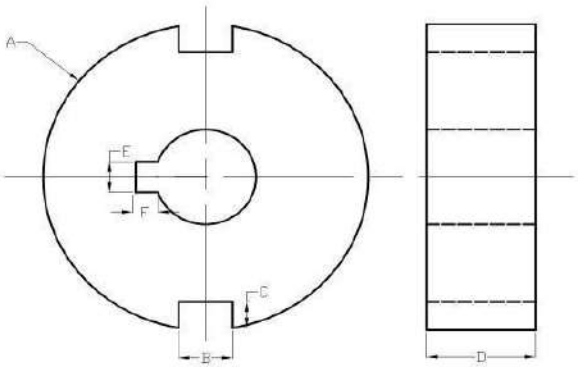


Dimensions			
Sl.No	Part Name	Actual	Obtained

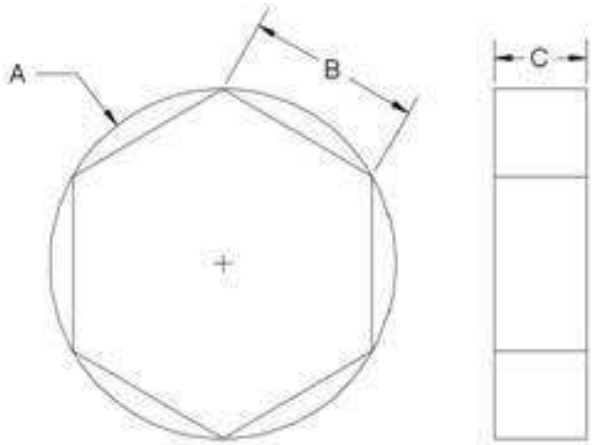
2. Make dovetail using shaping machine



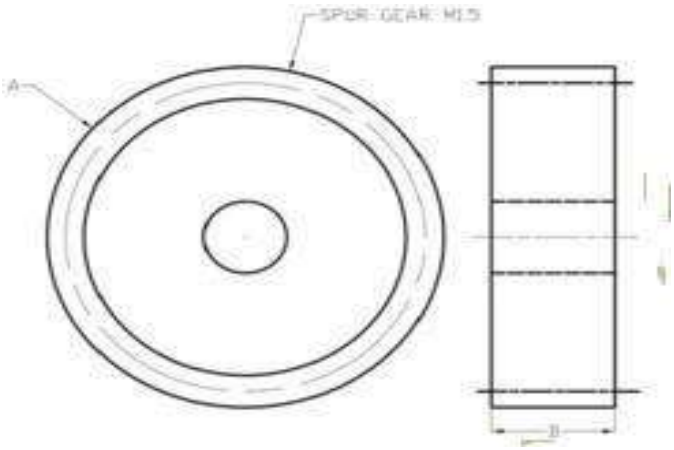
3. Make groove cut using slotting machine



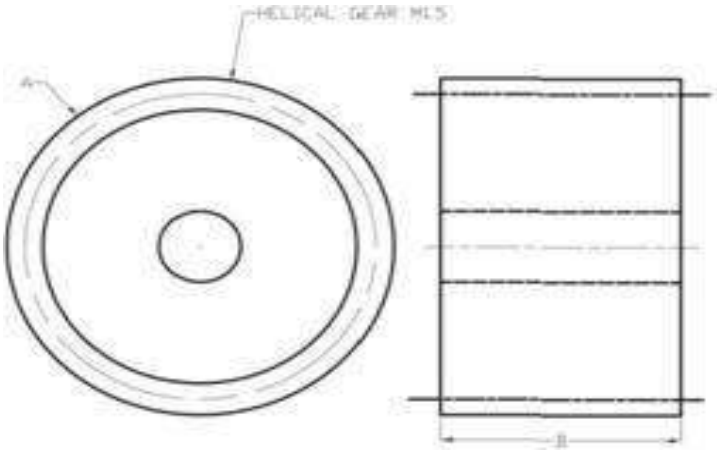
4. Make round to hexagon in milling machine.



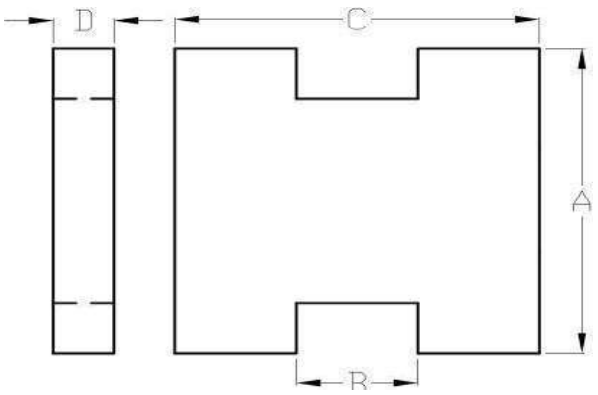
5. Make a spur gear using milling machine by differential indexing



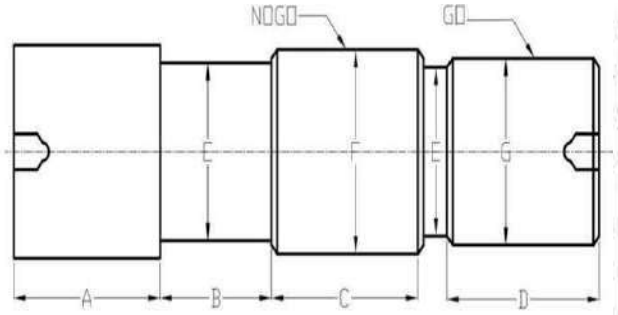
6. Make a helical gear using milling machine



7. Make slot cut using milling machine.

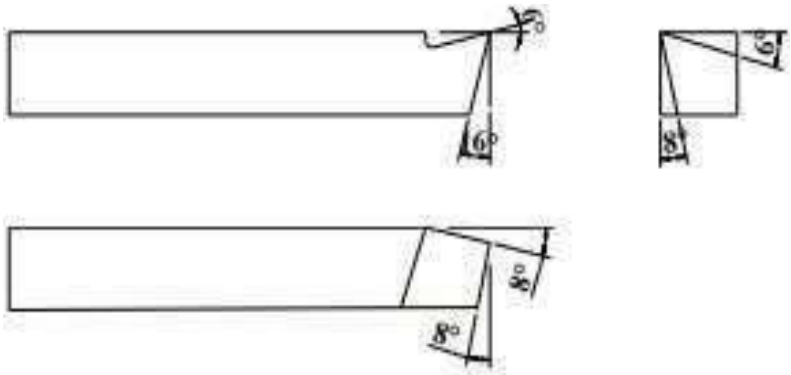


8. Make Progressive type Plug gauge using Cylindrical Grinding machine



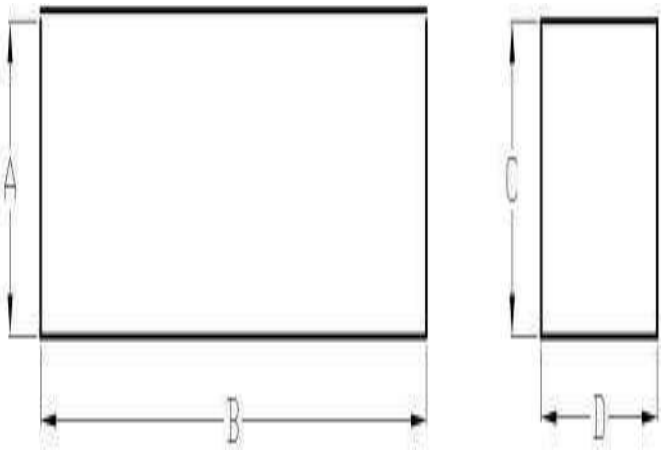
Dimensions			
Sl.No	Part Name	Actual	Obtained

9. Make a turning tool using Tool and Cutter Grinder

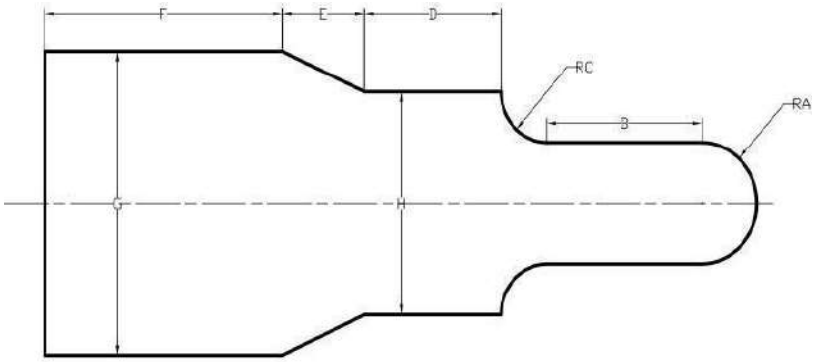


10.Make plain surfaces (four surfaces)using surface Grinder

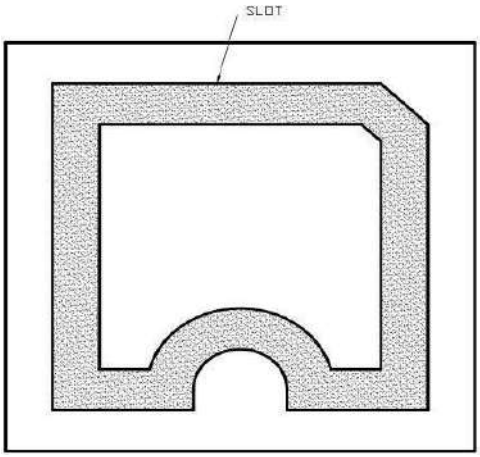
DEMO EXERCISES



1.Demo the component in the CNC turning centre



2.. Demo the component in the CNC milling centre



ALLOCATION OFMARKS

Procedure	10 Marks
Preparation of the Specimen	15 Marks
Setting and machining	30 Marks
Dimensions	25 Marks
Finishing	10 Marks
Viva voce	10 Marks
Total marks	**100 Marks**

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.CNC milling machine – 1 no

9.CNC turning machine – 1 no

10.Tools and Measuring instruments - Sufficient quantity.

11.Consumables - Sufficient quantity.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 0006

Term : IV

Course Name : UNIVERSAL HUMAN VALUES

Topics

Unit	Name of the Topics
I	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
II	Understanding Harmony in the Human Being - Harmony in Myself
III	Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship
IV	Personality Development and Leadership
V	Stress Management

OBJECTIVES:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To understanding the moral values that ought to guide engineering profession or practice, resolving moral issues in engineering, and justifying the moral judgments in engineering.
5. To Understand the concept of values, meaning of stress, various causes of stress and to manage stress.
6. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
7. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession

8. To help students understand the meaning of happiness and prosperity for a human being.
9. To understanding the moral values that ought to guide engineering profession or practice, resolving moral issues in engineering, and justifying the moral judgments in engineering.
10. To Understand the concept of values, meaning of stress, various causes of stress and to manage stress.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 0006**-CO1**	Ability to Understand the significance of value inputs in a classroom and start applying them in their life and profession.	**U**
3F 0006 **-CO2**	Ability to Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	**R**
3F 0006 **-CO3**	Ability to Understand the value of harmonious relationship based on trust and respect in their life and Profession.	**U**
3F 0006 **-CO4**	Ability to To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.	**U**
3F 0006**-CO5**	Ability to To understand the individual and organizational strategies to manage stress.	**U**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL- Bloom's revised taxonomy Level)

DETAILED SYLLABUS

UNIT	Topic	Hrs.
I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** Purpose and motivation for the course, recapitulation from Universal Human Values-I - Self-Exploration – what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration - Continuous Happiness and Prosperity- A look at basic Human Aspirations - Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario - Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	
II	**Understanding Harmony in the Human Being - Harmony in Myself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body'- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility-Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)- Understanding the characteristics and activities of 'I' and harmony in 'I'- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail- Programs to ensure Sanyam and Health.	
III	**Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship-	

	Understanding the meaning of Trust; Difference between intention and competence- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship-Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co- existence as comprehensive Human Goals- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	
IV	**Personality Development and Leadership** Introduction- Personality- Character- Determinants of Personality and Character Development - Measures to Develop the Personality - Measures to Improve Character – leadership - leadership traits Senses of engineering -Variety of moral issues-Types of inquiries - Moral dilemma -Moral autonomy -Moral development (theories)- Consensus and controversy -Profession -Models of professional roles- Responsibility - Theories about right action (Ethical theories)- control -Self-interest - Customs-Religion -Self-respect -Case study: Choice of the theory	
V	**Stress Management** Characteristics of Values- Meaning- Sources of Value Formation: Social institutions, Organisation, Colleagues, Work Need of studying values, Need for Studying Values- Stress -Meaning and Definition- Nature of Stress- Stress Level and Its Impacts- Causes of Stress- Stress Management- Individual Approaches- Organizational Approaches.	

ASSESSMENT:

- This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, etc.

will be used in evaluation.

Example:

- Assessment by faculty mentor: 10 marks
- Socially relevant project/Group Activities/Assignments: 15 marks
- Semester End Examination: 100 marks
- Question Pattern for End semester is 50 MCQ.
- Each question carries 2 points (10 MCQ's from Each Unit)
- The overall pass percentage is 40%.

Reference Books

1. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2. The Story of Stuff (Book).
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
5. Economy of Permanence - J C Kumarappa
6. Bharat Mein Angreji Raj - PanditSunderlal
7. Rediscovering India - by Dharampal
8. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
9. India Wins Freedom - Maulana Abdul Kalam Azad
10. Vivekananda - Romain Rolland (English)
11. IES Master Institute of Engineering.

V - TERM

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 5303

Term : V

Course Name : DESIGN OF MACHINE ELEMENTS

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Design Of Machine Elements	06	96	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Engineering Materials and Joints , Fasteners	18
II	Design of Shafts, Keys and Couplings	18
III	Design of Flat belts and V-belts	18
IV	Design of Bearings & Levers	18
V	Computer Aided Design (CAD) and Design of spur gears	17
Test & Model Exam		7
Total		**96**

RATIONALE:

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

machinesor components**.**

OBJECTIVES:

- Design of sleeve and cotter joint, knuckle joint and Welded joints.
- 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 hand lever, foot lever and cranked lever.
- Role of CAD in design and analysis.
- Design Spur gears.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F5301-**CO1**	Ability to review the basic concept of engineering materials.	R
3F5301-**CO2**	Ability to calculate the diameter of the shaft based on strength rigidity and design various types of coupling based on applications.	U
3F5301-**CO3**	Ability to design parameters of various types of belts	A
3F5301-**CO4**	Ability to evaluate parameters of various types of bearings and Design the levers.	U
3F5301-**CO5**	Ability to understand the Computer Aided Design (CAD) and Design the spur gears.	A

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**ENGINEERING MATERIALS, JOINTS AND FASTENERS** **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 weldedjoint. **Fasteners:** Design of bolted joints - eye bolts - cylinder cover with bolts, studs - pins.	18
II	**DESIGN OF SHAFTS, COUPLINGS AND KEYS** **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 keywaysonshaft-problems. **Couplings:** Requirements of good couplings – types - design of – rigid protected type flange couplings - marine couplings – pin type flexiblecoupling (Description only).	18
III	**DESIGN OF FLAT BELTS AND V-BELTS** **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 –	18

	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 AND Levers** **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.) **Levers:** Types of levers – applications - mechanical advantage– leverage - displacement ratio - design of-hand lever-foot lever- cranked lever - problems.	18
V	**Computer Aided Design (CAD) and Design of spur gear:** CAD – Roles of CAD in design – Development and uses - Applications – Advantages – Product cycle – Design process:, Pahl and Beitz Model – Design of spur gear **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)	17

Reference Books

1. Machine Design, Pandya & Shah, 20 Edn. 2015, Charotar Publishing House.
2. Machine Design, T. V. Sundararajamoorthy & N. Shanmugam, Revised Edition-2018–Anuradha Publications.
3. Design Data Book – by PSG College of Technology, DPV Printers.

4. A text book of Machine Design, R.S. Khurmi & J.K.Gupta, 2020,Eurosia Publishing House Pvt. Limited.
5. Machine Design, Bandari,2020
6. Theory and Problems of Machine Design, Holowenko, Laughlin, Schaum'soutline series.
7. R.Radhakrishnan, and S.Subramanian, "CAD/CAM/CIM", New Age International Pvt Limited

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 5210

Term : V

Course Name : THERMAL ENGINEERING - II

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours /Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
THERMAL ENGINEERING - II	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Formation and properties of steam & thermodynamic processes of vapour	15
II	Steam boilers and performance of boiler	15
III	Thermal power plant and steam turbines and condensers	15
IV	Conventional sources of energy and nuclear power plant	13
V	Air compressors and gas turbines	15
Test & Model Exam		7
Total		80

RATIONALE:

A diploma holder may get employment in power plants and other industries involving boilers and application of steam. With this back round ,the course is designed for the students to learn the properties of steam, steam cycle,

Performance of boilers, energy management ,air compressors and steam and gas turbine.

OBJECTIVES:

- Define various types of steam.
- Explain the working of Boiler.
- Compare various types of Boilers.
- Familiarize boiler mounting and accessories.
- Describe various circuits used in the thermal power plant.
- Explain working of steam turbine and condensers.
- Compare conventional energy sources with Non-Conventional Sources of energy.
- Explain working of nuclear power plant.
- Compare the different types of refrigeration & air conditioning system.
- Compare the properties and applications of various refrigerants.
- Describe the equipment used for air conditioning.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 5210-**CO1**	Ability to explain the formation and properties of steam.	**A**
3F 5210-**CO2**	Ability to classify different types of steam boilers, boiler mountings and their accessories, Indian Boiler Act.	**U**
3F 5210-**CO3**	Ability to Analyze the steam condensers, working of thermal power plant and classification of steam turbine	**A**
3F 5210-**CO4**	Ability to Describe the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it.	**R**
3F 5210-**CO5**	Ability to estimate power for air compressor and compare gas turbines.	**A**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**FORMATION AND PROPERTIES OF STEAM & THERMODYNAMIC PROCESSES OF VAPOUR** **FORMATION AND PROPERTIES OF STEAM** Steam-Properties– formation of steam– saturation temperature– enthalpy of water–enthalpy of evaporation– conditions of steam – wet, dry and superheated steam -dryness fraction –enthalpy of wet, dry and superheated steam -advantages of superheated steam –Property diagrams – p-v diagram - T-H diagram – T-V diagram – T-S diagram -phase diagram-H-S diagram – P-H diagram –critical conditions of water-specific volume of water and steam – density of steam – external work done during evaporation – internal latent heat – internal energy of steam – entropy of water and steam – steam tables-Mollier chart – problems. **THERMODYNAMIC PROCESSES OF VAPOUR** Determination of dryness fraction of steam – bucket calorimeter - combined separating and throttling calorimeters- problems. Expansion processes of steam - constant volume, constant pressure, constant temperature, hyperbolic, polytrophic, isentropic and throttling processes – problems.	15

II	**STEAM BOILERS AND PERFORMANCE** **OF BOILERSTEAM BOILERS** Introduction -Classification of boilers – comparison of fire tube and water tube boilers– high pressure boilers – advantages of high pressure boilers - Lamont and BHEL high pressure boilers – boiler mountings and function-construction and working – boiler accessories and function-construction and working – comparison of mountings and accessories – feed water treatment – internal and external treatments - starting boiler from cold condition – safety precautions in boiler operation – clauses of Indian boiler act. **PERFORMANCE OF BOILER** Evaporation rate- actual, equivalent and factor of evaporation – boiler efficiency – factors influencing boiler efficiency - boiler power - problems – boiler plant - efficiency of economizer and super heater - problems – boiler trial – heat losses in a boiler- heat balance sheet – problems.	15
III	**THERMAL POWER PLANT AND STEAM TURBINES AND CONDENSERS** **THERMAL POWER PLANT AND STEAM TURBINES** Selection of site for thermal power plant -Layout of thermal power plant – fuel and ash circuit – water and steam circuit – air and flue gas circuit – cooling water circuit – merits and demerits of thermal power plant — air pollution by thermal power plants – pollutants, effects and control– cyclone separator – wet scrubber – electrostatic precipitator – control of No2 and SO2. fiudised bed combustion- thermal and noise pollution.Basic steam power cycles – Carnot, Rankine and modified Rankine cycles.classification of steam turbine-Impulse and reaction turbines- Difference - necessity	15

	of compounding – Methods of compounding– special turbines. **STEAM CONDENSERS** Elements of condensing plant – classification of condensers – jet condenser – types – surface condensers –types – comparison of jet and surface condensers.	
IV	**CONVENTIONAL SOURCES OF ENERGY AND NUCLEAR POWER PLANT** Nuclear fuels –fissile and fertile fuels – Nuclear fission and fusion– chain reaction – radio activity – layout of nuclear power plant – merits and demerits – Nuclear reactors - Components–Reactor Core moderators – control rods – coolant – reflectors – biological shield-Reactor Vessels-Classification of Reactor- pressurized water reactor – boiling water reactor – Candu type reactor – fast breeder reactor –– effect of nuclear radiation – Fuel Cycle –Site selection – Safety-Floating Nuclear Power Plants- Uranium Enrichment – Methods-disposal of nuclear wastes- comparison of nuclear power plants with thermal power plants- Nuclear Power Plant in India. Conventional sources of energy – layout of hydel and diesel power plants – merits and demerits	13
V	**AIR COMPRESSORS AND GAS TURBINES** **AIR COMPRESSORS** Air Compressors-uses of compressed air – classifications of Air compressor–reciprocating compressor-single stage reciprocating compressor– compression processes – power required to drive the compressor (Neglecting clearance Volume)– clearance volume and its effects volumetric efficiency –power required to drive the compressor with clearance volume – problems –multi stage compression – merits and demerits - work input – ratio of cylinder diameters for minimum work input.rotary compressors – Roots blower - vane blowers – centrifugal and axial flow air compressors	15

	GAS TURBINES Gas turbines –uses - classifications – merits and demerits of gas turbines -constant pressure combustion gas turbine – gas turbine with – intercooler –reheater - regenerator - effects – closed cycle gas turbines - merits and demerits of open and closed cycle gas turbines Jet propulsion -turbojet engines– merits and demerits – turbo propeller engines – merits and demerits - ramjet–merits and demerits –Rocket.	

Reference Books

1. Thermal Engg, R.K . Rajput , ,10 th Edition,2018, Laxmi publications Pvt Ltd , New Delhi.
2. Applied Thermodynamics, P.K. Nag, ,2017, TATA Mcgraw – Hill Publishing Company, New Delhi .
3. Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition,2020 ,S.Chand &Co,NewDelhi
4. Thermal Engineering ,P.L Ballaney , 24th Edition ,Khanna Publishers,New Delhi.
5. Thermal Engineering ,B.K. Sarkar , 2017 , Dhanpat Rai & Sons New Delhi .
6. Applied Thermodynamics, Domkundwar and C.PKothandaraman, 2016,Edition Khanna publishers, New Delhi.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F5304 -1

Term : V

Course Name : COMPUTER INTEGRATED MANUFACTURING

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

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

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Computer Aided Design	15
II	Computer Aided Manufacturing	14
III	CNC programming	16
IV	FMS, AGV, AS/RS, Robotics	14
V	Advanced concepts of CIM	14
Test & Model Exam		7
Total		**80**

RATIONALE:

As per the latest requirements in the Industries this enables to learn the various concepts of Computer Aided Design and Manufacturing. They are able

to operate CNC machines and write part program. They are able to understand the advanced concepts adopted in automated industries.

OBJECTIVES:

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

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F5304-1-CO1	Ability to explain the geometric modeling, uses of standard for GKS, open GL and the steps involved in FEA.	U
3F5304-1-CO2	Ability to describe the concept of manufacturing with computer assistance in process planning, different aspects of planning system and control systems.	U
3F5304-1-CO3	Ability to explain the method of CNC programming with international codes and principle of latest manufacturing techniques like RPT & RT.	U
3F5304-1-CO4	Ability to write the flexible manufacturing system components, Automated Guided Vehicle System, AS/RS and Robot anatomy.	A
3F5304-1-CO5	Ability to discuss the product cycle design process, sequential and concurrent engineering.	U

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's re revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**Computer Aided Design** Computer Aided Design: Introduction – definition – Shigley's design process – CAD activities – benefits of CAD - CAD software packages – point plotting, drawing of lines, Bresenham's circle algorithm, Transformations: 2D & 3D transformations – translation, scaling, rotation and concatenation. Geometric modelling: Techniques - Wire frame Modelling – applications – advantages and disadvantages. Surface modelling – types of surfaces – applications – advantages and disadvantages – Solid modelling – entities – advantages and disadvantages – Boolean operations - Boundary representation – Constructive Solid Geometry – Comparison. Graphics standard: Definition– Need - GKS –IGES – DXF. Finite Element Analysis:Introduction – Development - Basic steps – Advantages.	15
II	**Computer Aided Manufacturing** CAM – Definition - functions of CAM – benefits of CAM. Introduction of CIM– concept of CIM - evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM. Group technology: Part families - Parts classification and coding - Coding structure – Opitz system, MICLASS system and CODE System. **Process Planning:** Introduction – Computer Assisted Process Planning ,(CAPP) – Types of CAPP - Variant type ,Generative type – advantages of CAPP. Production	14

	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** NC in CAM, tooling for CNC – ISO designation for tooling – CNC operating system. Programming for CNC machining – part program - Manual part programming - coordinate system – Datum points: machine zero, work zero, tool zero - reference points - NC dimensioning – G codes and M codes – linear interpolation and circular interpolation - CNC program procedure - sub-program – canned cycles - stock removal – thread cutting– mirroring – drilling cycle – pocketing. Rapid prototyping: Classification –subtractive – additive – advantages and applications –materials – Virtual machining.	16
1V	**FMS, AGV, AS/RS, Robotics** FMS: Introduction – FMS components – FMS layouts – Types of FMS: Flexible Manufacturing Cell (FMC) – Flexible Turning Cell (FTC) – Flexible Transfer Line (FTL) – Flexible Machining System (FMS) – benefits of FMS- introduction to intelligent manufacturing system. Material handling in CIM environment: Types – AGV: Introduction – AGV- working principle – types– benefits. AS/RS – working principle – types – benefits. Robotics: Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical grippers – vacuum grippers – robot programming concepts - Industrial applications of Robot: Characteristics - material transfer	14

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

Reference Books

1. CAD / CAM / CIM R.RadhaKrishnan, S.Subramanian New Age International Pvt, Ltd,4 th edition 2018.
2. CAD / CAM Mikell P.Groover, Emory Zimmers, Jr.Premtice Hall of India Pvt., Ltd
3. NC programming S.K.Sinha Galgotia Publications Pvt. Ltd,9 th edition 2011.
4. CAD/CAM principles and applications, Dr.P.N.Rao Tata Mc Graw Hill publishing companyltd
5. CAD / CAM Ibrahim Zeid Mastering Tata McGraw- Hill Publishing company Ltd,New Delhi
6. Computer control of manufacturing systems yoram koren McGraw Hill Book,new edition 2009.
7. Dr.Sadhu Singh, “Computer Aided Design and Manufacturing,”, KhannaPublishers,NewDelhi, Second Edition, 2000.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Code : 3F 5304-2

Term : V

Course : AUTOMOBILE ENGINEERING

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Automobile Engineering	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
i	Automotive engines parts, engine lubrication and cooling system	14
ii	Fuel feed system, combustion chambers alternate fuel & vehicles andpollution control	14
iii	Transmission and power trains	15
iv	Front axle, steering system, suspension system, braking system, wheelsand tire	15
v	Auto electrical and autotronics	15
Test & model exam		7
Total		**80**

RATIONALE:

These days, automobiles have become a necessity instead of luxury. At present, there is exponential development in automobile industry with regard to

pollution control. The diploma holders in Mechanical Engineering are required to supervise the manufacture, repair and maintenance of vehicles. Hence, knowledge and skills are to be imparted to them regarding automobile industry as a whole.

OBJECTIVES:

- Explain about the constructional details of an IC engine including cooling andlubrication system.
- Describe fuel feed systems with all devices involved in it (Both for petrol and dieselengines).
- Explain the construction and functional features of the power transmission systemsand various parts involved in it.
- Explain the functions of different types of steering and brake systems.
- Familiarize electrical and electronic equipment used in automobile.
- Describe the different types of chassis and their functions.
- Appreciate the techniques for automobile pollution control.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 5304-2 **-CO1**	Ability to **summarize** the constructional details of an IC engine including cooling and lubrication system.	**R**
3F 5304-2 **-CO2**	Ability to **explain** the fuel feed systems with all devices involved in it (Both for petrol and diesel engines) and techniques for automobile pollution control.	**U**
3F 5304-2 **-CO3**	Ability to **describe** the construction and functional features of the power transmission systems and various parts involved in it.	**U**
3F 5304-2 **-CO4**	Ability to **compare** the different types of chassis, steering and brake systems and their functions.	**U**
3F 5304-2 **-CO5**	Ability to **identify** the starting system, generator and advanced auxiliary systems.	**U**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**Automotive Engines Parts, Engine Lubrication And Cooling System** **Automotive engine parts** Principal mechanism and parts of an engine—cylinder head, block, crank case, sump, liner, piston, piston rings, connecting rod, crank shaft, cam shaft, timing gears, valves and valve operating mechanism (L-head, I head and OHC only) Air cleaner-Intake and Exhaust manifold. **Engine lubrication AND cooling** Friction in engines—purpose of lubrication—splash—pressure—semi pressure--wet sump and dry sump lubrication—oil filters—crank case ventilation—Troubles, causes and remedies.Necessity for cooling—effects of inadequate cooling and overheating of engine parts—-forced circulation system—pressure sealed cooling—radiator—water pump—thermostat—antifreeze solutions—troubles,causes and remedies. **Fuels** volatility characteristic—vapour lock tendency—crank case oil dilution—gum formation—knocking—pre-ignition—detonation—octane requirement factors—gasoline additives—smoke formation—diesel knock—detonation.	14
II	**Fuel Feed System, Alternate Fuel & Vehicles And Pollution Control** **FUEL FEED SYSTEM**	

	S.I. engine fuel feed pump combustion chamber—Air fuel ratio C.I. Engine diesel combustion chamber—open, swirl, and pre-combustion chambers—Types of injection system—Jerk type fuel injection pump— Distributor type fuel injection DTSI – VTI – CCVTI – PGMFI – MPFI system**.** Governors—mechanical and pneumatic governors—Description of super charging and Turbo charging—Troubles, causes and remedies of petrol and diesel fuel system. **ALTERNATE FUEL** Alternate fuels—Brief description of alternate fuels—alcohol— natural gas—LPG—hydrogen—vegetable oil and biogas-Operation with Hydrogen- Fuel Cells- Fuels Cell Vehicle-Electric Vehicle-Drive System. **POLLUTION CONTROL** Pollution control—Air pollution—Emission from automobiles— Nitrogen oxides—Soot—carbon monoxide—Hydrocarbons—aldehydes— other exhaust components—Emission regulation for cars—pollution control techniques—noise pollution—vehicle noise—noise specifications—Effects of noise on human beings—Noise reduction.	14
III	**TRANSMISSION AND POWER TRAINSCLUTCH AND GEARBOX** General arrangement of power transmission system—Four wheel drive—Forces acting on a motor vehicle— Air, Rollingand gradient Bresistance—tractive effort—clutch—Necessity for a clutch—Types-single plate, Diaphragm, multi plate wet clutch, fluid coupling—clutch linkages— fault diagnosis and remedies. Gear box—Necessity for a gear box—Types of gear box—sliding mesh gear box—Constant mesh gear box—synchromesh device – Epi-cyclic gear trains—Gear box troubles, causes and remedies.	15

	FINAL DRIVE Propeller shaft and universal joints—Function of the propeller shaft—Universal joint—constant velocity joint (Cross type only)—Telescopic propeller shaft—Hotch kiss drive—Torque tube drive. Final drive—Functions and applications—Differential—purpose— construction and operation—purpose and brief description of double reduction, Non-slip, self-locking differential—Fault diagnosis and remedies. Axles—Types of axles and applications—Floating axles—Semi-floating—Three quarter floating and full floating—rear hub construction— bearing arrangements.	
IV	**Front Axle, Steering System, Suspension System, Braking System, Wheels And Tire** **FRONT AXLE, STEERING SYSTEM** Front axle—stub axle and wheel mountings—Elliot, Reverse Elliot and lemoine types—steering system requirements and functions—Ackerman principle—steering system components—steering gears—Rack and pinion, cam and roller, screw and lever, recirculating ball type—power steering— wheel alignment—king pin inclination—camber—castor—Toe in and Toe out—steering troubles—possible causes and remedies.-Power Steering. **SUSPENSION SYSTEM** Suspension system—Function—Front independent suspension—Rear independent suspension—stabilizer rod—torsion bar—shock absorber—purpose—Telescopic type—construction and working—Anti roll bar—leaf spring suspension—Air suspension (Brief description only)—suspension system fault diagnosis and remedies. **BRAKING SYSTEM** Brake system—Need—Classification of brakes—drum brake—	15

	Disc brake—mode of operations—mechanical, hydraulic, pneumatic—Air assisted hydraulic brake—servo action and self energisation—brake Adjustment —brake fault diagnosis and remedies. **WHEELS** Wheels—types—Spoke, disc and cast wheels—tires—Tubeless tire –purpose and construction of tire—bias ply and radial ply tire— tire maintenance—Effect of over and under inflation.	
V	**Auto Electricals And Autotronics** **Auto Electricals** (motor, generator, sparkplug, lightings and power window) Distributor—Spark plug—cold and hot plugs. Starter motor and the cranking circuit—Types of starter motor—Series, shunt and compound motors—Starter drives—Bendix drive—Over running clutch—solenoid operated starters. Generator and the charging circuit—D.C. generator—A.C Generator [Alternator]—current regulators—Voltage regulator and cut-outrelay -cable colors. Lighting and signaling circuit: Lighting—sealed-beam head lights— composite head lights—Halogen sealed Beam Head lights—Dimmer switches—Brake lights—Directional [Turn] signals—courtesy lights. Windshield wipers—Horns—Cruise control—Power windows— Power seats—Electric power door locks—Electronic stability Program. **ADVANCE DEVELOPMENT AND EMISSION STANDARDS** Developments in Automobile Vehicles-Variable valve Timing- Electronics in Automobiles-Engine Management System-Control System Components-Sensors- Sensor Types-Electronic Control Unit-Actuators- Control System-Electronically Controlled Carburettor-Gasoline Injection System. Electronic Diesel Control-Pilot Injection-Unit Injector-Common Rail Fuel Injection System. Automatic Transmission-Electronic Transmission Control-Electronic Automatic Gear Box-	15

	Air Bags--Drive By Wire-ABS- Sensotronic Braking Control-Wind Screen-Lighting System-Alloy Wheels- Tubeless Tires. Awareness on Computerized Engine test Rig-Awareness on Noise Vibration, Emission and Harshness in Automobile. EMISSION STANDARDS: EuroI, II, III and IV norms, BharatStage II, III, Vand VI norms.	

Reference books:

1. Motor manuals volume I to IV a.w.judge, chapman & hall ltd., 37, Essex st.,w.c.2.
2. Automotive mechanics William h.crouse, Tata McGraw hill publishing companyltd. Newdelhi.
3. Motor vehicles, Newton and steeds.new edition , 2000
4. Practical automobile engineering staton abbey, odhams press ltd., longacre,London, U.K.
5. Automobile engineering theory and practice k.k.ramalingam scitech publications, chennai.
6. Automobile electrical and electronic systems, james.d.halderman, prenticehall,Englewood liffs, New Jersey.

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Code : 3E 5304 -3

Term : V

Course : Green Energy and Energy Conservation

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

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

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

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Fundamentals of Energy, Geothermal energy, Wind energy	15
II	Bio mass energy, Solar Energy	15
III	Photovotaic (PV)	15
IV	PV Technologies, Applications	15
V	Energy conservation	13
Test And Revision		7
Total		**80**

RATIONALE:

There is an ever increasing demand for energy in spite of the rising prices ofoil & other fossil fuel / depletion of fossil fuels. Energy demand, in particular electricity production has resulted in creation of fossil fuel based power plants that let out substantial greenhouse gas / carbon emission into the atmosphere

causing climate change and global warming. We have various forms of renewable energy sourcesviz., Wind, Solar, Biomass, Biogas, etc. Municipal and Industrial wastes could also be useful sources of energy while ensuring safe disposal. This subject is introduced to learn about the major renewable energy sources and more focus on the PV module solar energy. The government act and guidelines are discussed for the benefit of the Diploma Engineers.

OBJECTIVES:

- Study about the fundamentals of Energy.
- Study of construction and principle of Wind energy, Solar energy,Geo thermaland Bio energy.
- Understand the solar energy.
- Understand the PV design and its components.
- Study the energy conservation process.
- Understand the Government Policies and Acts.
- Study the TEDA projects in Tamil Nadu.

Course Outcome

On successful completion of the cour se, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F 5304 –3 –CO-1	Ability to Understand the fundamentals of Energy.	U
3F 5304 –3 –CO-2	Ability to Understand the construction and principle of solar energy and Bio energy.	U
3F 5304 –3 –CO-3	Ability to Understand the PV design and its components.	U
3F 5304 –3 –CO-4	Ability to Understand the PV Technologies and its applications.	U
3F 5304 –3 –CO-5	Ability to Knowledge the energy conservation and energy management	R

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

UNIT	Name of the Topics	Hrs.
I	**Fundamentals of Energy, Geothermal energy, Wind energy Energy:** Introduction – Energy need and trends - Forms of Energy - First Law of Thermodynamics - Second Law of Thermodynamics energy requirement and supply – Fossil fuels and climate changes – need of renewable energy sources – Current renewable energy uses – Renewable energy policies in India. **Geothermal energy:** Introduction – Essential characteristic – Sources – Power Plants – Single flash power plant – double flash power plant – Flow diagram and principle only. **Wind energy:** Introduction – energy conversion – site selection considerations – Components of wind energy conversion system – Classification. Wind mill: Horizontal axis machines - Vertical axis machines – working principle, advantages and disadvantages. Schemes for electric generation.	15
II	**Bio mass energy, Solar Energy** **Bio mass energy:** Introduction – conversion technologies: Wet processes – dry processes. Bio gas generation – factors affecting the bio gas generation – classification of bio gas plants – Bio gas plant – construction - advantages and disadvantages. Materials used for bio gas generation – factors to be considered for the selection of site. **Solar Energy:** Introduction – Sun's energy: advantages – conversion challenges– The Sun-Earth movement - Solar radiation- Different angles - optimal angle for fixed collector, in summer andwinter. Sun tracking - measuring instruments of solar radiation – methods to estimate solar radiation.	15

III	**Photovotaic (PV)** Photovotaic (PV): Semiconductors as solar cell – types of unit cells- electronic arrangement of silicon atom – intrinsic semiconductor– extrinsic semiconductor – Description only. P-N junction diode - forward bias - reverse bias. Solar cell - characteristics - descriptionof short circuit current, open circuit voltage, fill factor and efficiency- losses in solar cells. Growth of solar PV and silicon (Si) requirement – production of metallurgical grade (MGS) – production of electronic grade (EGS)Production of Si wafers: ingot making - monocrystalline - multicrystalline – wafer dicing. Si sheets. Solar grade silicon (SoG)refining processes – Si usage in Solar PV. Process flow ofcommercial Si cell technology – Description of saw damage removal and surface texturing, diffusion process, thin-film layers for anti reflection coating and surface passivation, metal contacts and their deposition.	15
IV	**PV Technologies, Applications** PV Technologies: Thin film Technologies – materials for thin film technologies – Thin film deposition techniques: Physical vapour deposition – Evaporation – Sputtering. Chemical vapour deposition– Low pressure – plasma enhanced. Advantages of thin film Si solar cell technologies. Solar cell structures – substrate arrangement – superstrate arrangement. Solar PV module: series and parallel connections of cells – mismatch in cell / module- Design and structure of PV module. Batteries for PV systems – factors affecting battery performance – DC to DC converters – Charge controllers – DC to AC converter(inverter) (Description only). Applications: Flat plate collector - concentrating solar collectors – solar pond – solar water heating – space	15

	heating and cooling – solar pumping – solar cooking – solar green house. principle and applications only.	
V	**Energy conservation** Energy conservation act 2001 - Power of state government to facilitate and enforce efficient use of energy and its conservation - Finance, Accounts and Audit of bureau - Penalties and Adjudication - Appellate tribunal for energy conservation – Energy Conservation Guidelines for Industries by BEE, Govt of India - Guide lines – heating, cooling and heat transfer – waste recovery and usage – conversion of heat to electricity – Prevention of energy loss due to heat radiation and electric resistance – Industry energy management system. Net-metering policies – Tamil Nadu Energy Development Agencies – Projects in Tami Nadu: Solar energy, Bio energy and Wind energy – Tamil Nadu Solar policy 2019.	13

Reference Books

1. Non Conventional Energy Sources, G.D.Rai, Khanna Publishers.
2. Non Conventional Energy Sources and Utilisation, R.K.Rajput,S.Chand &Company Ltd.new edition -2012
3. Renewable Energy, Stephen Peake, Oxford press.4 th edition2017
4. Non Conventional Energy Resources, B.H.Khan, Tata Mc Graw Hill.2009
5. Industrial energyconservation- D. A. Ray- Pergaman Press
6. Energy resource management, Kirpal Singh Jogi, Sarup and sons.
7. Solar Photovltaics, Chetan Singh Solanki, PHI Learning Pvt. Ltd.
8. Renewable Energy Engineering and Technology, V V N Kishore, TERI.2010
9. Principles of Solar Engineering, D.Yogi Goswami, Frank Kreith, Jan F.Kreider,Taylor & Francis.2 nd edition 2000
10. Energy conservation act 2001, Government of India.
11. Energy Conservation Guidelines for Industries, Bureau of energy

Efficiency,Ministry of Power, Government of India.2017.

12. Tamil Nadu Solar policy 2019
13) https://teda.in/achievements/solar-energy-4/
14) https://teda.in/achievements/bio-energy-2/
15) https://teda.in/achievements/wind-energy-2/

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Code : 3F 5305

Term : V

Course : SOLID MODELLING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
Solid Modelling Practical	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

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

OBJECTIVES:

- Prepare 2D Drawing using sketcher or part modelling of any parametric CADsoftware.
- Generate 3D Solid models from 2D sketch or part modelling of any Parametric CAD software.
- Prepare assembly of part models using assembly of any

parametric CAD software.

- Generate orthographic views of 3D solid models/assemblies using drafting of any parametric software.
- Plot a drawing for given part model/assembly.

Course Outcome

On successful completion of the cour se, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F 5305-CO-1	Ability to analyze parametric modeling & Parametric software.	A
3F 5305 -CO-2	Ability to illustrate the part modeling and assembly of parts	A
3F 5305 -CO-3	Ability to analysis the basic part models of CAD Software.	A
3F 5305 -CO-4	Ability to illustrate Orthographic views of 3D solid models	A
3F 5305- CO-5	Ability to evaluate the Plot a drawing for given part model / assembly	E

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Introduction

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

Exercises

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

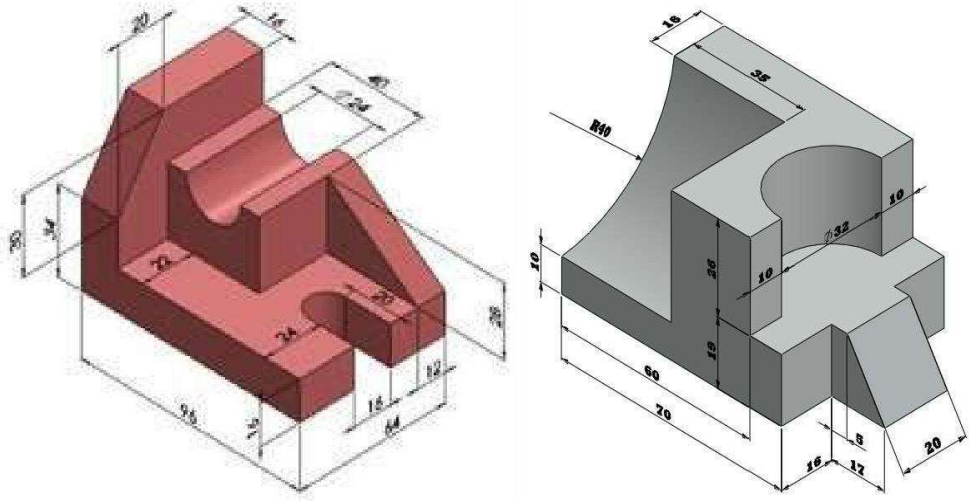
1. Model 1
2. Model 2
3. Model 3
4. Model 4
5. Model 5
6. Model 6

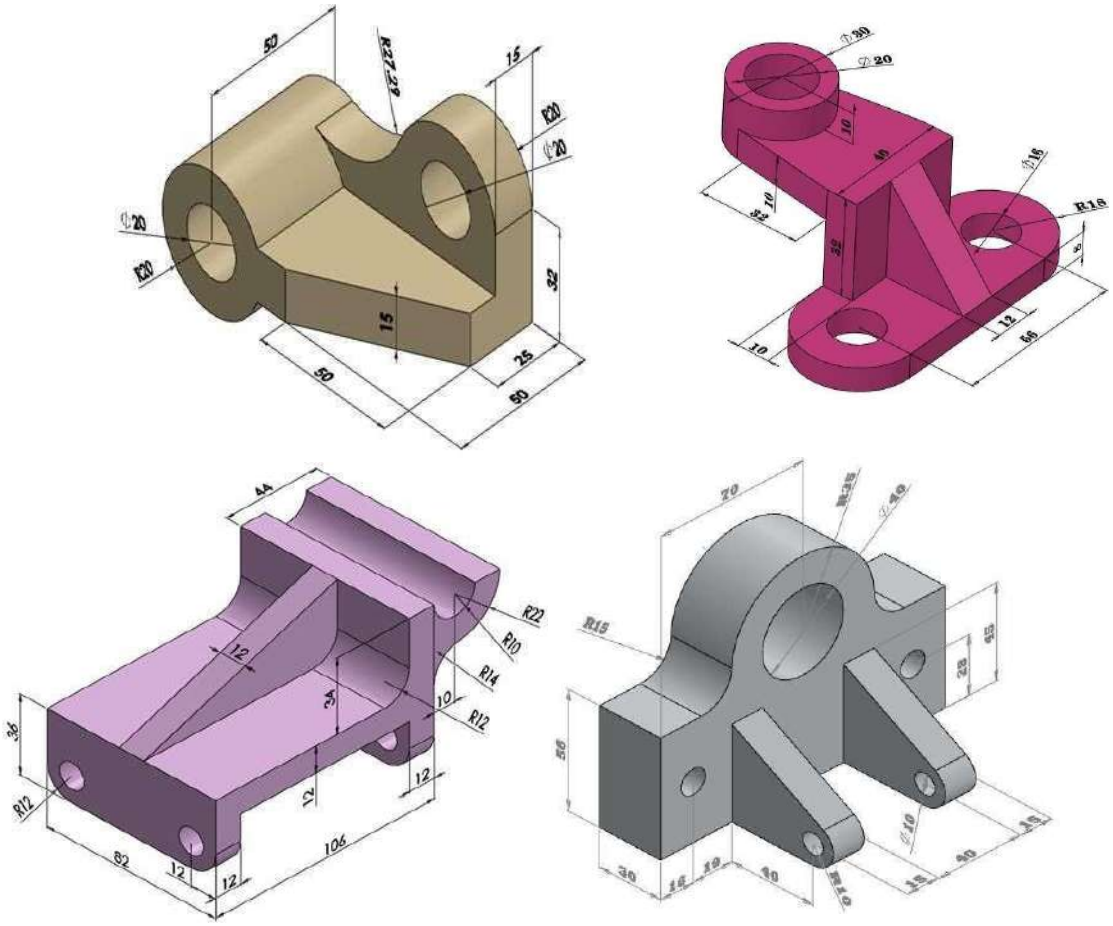
PART B: Draw the part models and assemble the components using 3D modelling.

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

Exercises

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





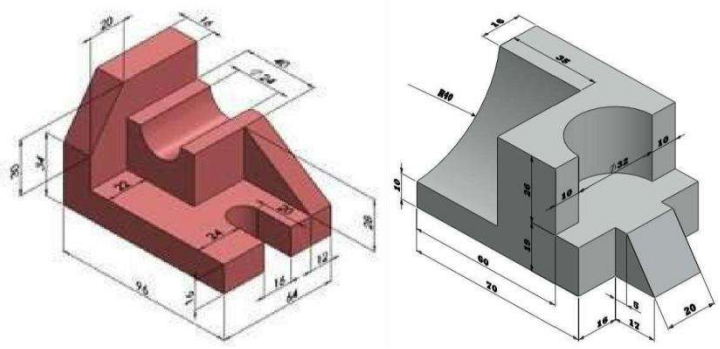
DETAILLED ALLOCATION OF MARKS

Sl. No.	DESCRIPTION	Marks
Part A – 3D Component Modelling		
1	Sketching	15
2	3D Modelling	15
Part B – Assemble Drawing Modelling		
3	Sketching / Part modelling	20
4	Assembly	30
5	Solid Model / Views	10
6	Vivavoce	10
Total		100

MODEL QUESTION PAPER

1.A. Draw the given 3D drawing using 3D modelling commands.

B. Draw the part models of **Revolving centre** and assemble the components

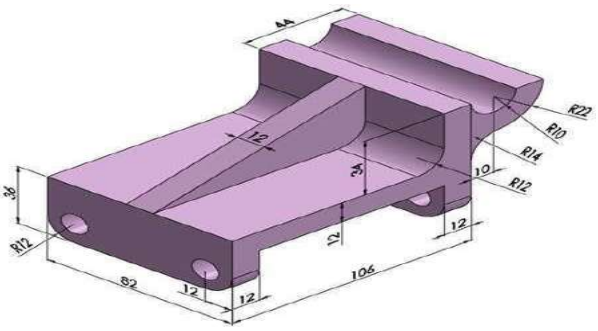


using 3D modelling.

2.A. Draw the given 3D drawing using 3D modelling commands

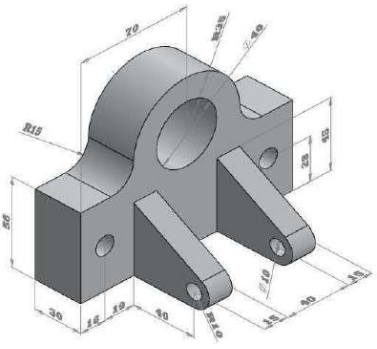
B. Draw the part models of **Tail stock** and assemble the components using 3D modelling.

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



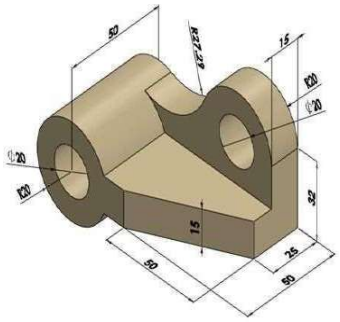
B. Draw the part models of **Machine vice** and assemble the components using 3D modelling.

4.A. Draw the given 3D drawing using 3D modelling commands.



B. Draw the part models of **Crane hook** and assemble the components using 3D modelling.

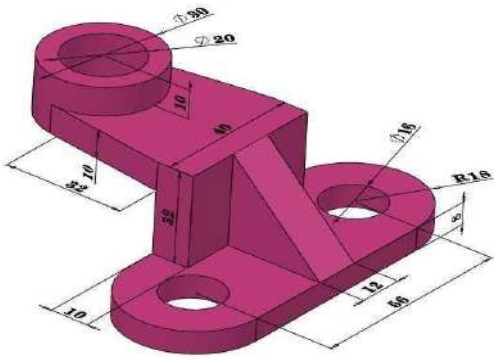
5.A. Draw the given 3D drawing using 3D modelling commands.



B. Draw the part models of **Petrol engine connecting rod** and assemble the components using 3D modelling.

6.A. Draw the given 3D drawing using 3D modelling commands

B. Draw the part models of **Pipe vice** and assemble the components using 3D modelling.



List of equipments

1.personal computer - 30 Nos

2.laser printer - 1 No

3.software - GUI system software, modeling AUTOCAD package (sufficient to the strength)

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Code : 3F 5211

Term : V

Course : THERMAL ENGINEERING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
THERMAL ENGINEERING PRACTICAL	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

Diploma holders in this course are required to experience the performance of air compressors, internal combustion engines and vapor compression refrigerator. The knowledge thus acquired helps them in understanding the concepts of basic thermodynamics.

OBJECTIVES:

- Determine the flash point, power point and viscosity of oil.
- Identify the parts of petrol engine and their functions.
- Identify the parts of diesel engine and their functions.
- Conduct performance test on petrol engines.
- Conduct performance test on diesel engines.
- Identify the parts of a high pressure boiler and their applications.

- Prepare heat balance sheet for an I.C. Engine.
- Calculate calorific value of fuels.
- Conduct of C.O.P of Refrigerators
- Measure the thermal conductivity
- Draw the valve timing diagram of four stroke petrol and diesel engine.

Course Outcome

On successful completion of the cour se, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F 5211-CO-1	Ability to calculate the different properties of oil	A
3F 5211-CO-2	Ability to calculate the absolute pressure and saturation temperature of mercet boiler and calorific value of junker's gas calorimeter	A
3F 5211-CO-3	Ability to evaluate the volumetric efficiency of air compressor	E
3F 5211-CO-4	Ability to evaluate the performance of petrol and diesel engines	E
3F 5211- CO-5	Ability to evaluate the COP of refrigerator and thermal conductivity measurement	E

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Part – A:

1. Determining flash and fire points of the given oil using open cupapparatus.
2. Determining flash and fire points of the given oil using closed cup apparatus.
3. Determining the absolute viscosity of the given lubricating

oil using Redwoodviscometer.

4. Determining the absolute viscosity of the given lubricating oil using Sayboltviscometer.
5. Determining the saturation temperature of water at different absolute pressuresusing Mercet boiler.
6. Determining the higher calorific value and lower calorific value of the given gaseous fuel with junkers gas calorimeter.
7. Draw the valve timing diagram for four stroke petrol engine

Part – B:

1. Load test (performance test) on petrol engine.
2. Load test (performance test) on diesel engine.
3. Morse test on multicylinder petrol engine.
4. Heat balance test on I.C. engine.
5. Volumetric efficiency of air compressor.
6. COP of refrigerators.
7. Thermal Conductivity measurement using guarded plate apparatus

Detailled Allocation of Marks	MARKS	
Part A:		
Observation and Tabular Column	5	
Calculations	20	
Result / Graph	10	
Part B:		**35**
Observation and Tabular Column	10	
Formulae, Calculations	30	
Result / Graph	15	
		55
Viva Voce		**10**
Total		**100**

LIST OF EQUIPMENTS

1. Open cup apparatus to determine Flash and fire points – 2 No
2. Close cup apparatus to determine Flash and fire points – 2 No
3. Redwood viscometer – 2 No.
4. Saybolt viscometer – 2 No.
5. Mercet boiler - 1 No.
6. Junker's gas calorimeter – 1 No.
7. 4 stroke cycle petrol engine Model – 1 No.
8. 4 stroke cycle diesel engine Model – 1 No.
9. Guarded plate apparatus – 1 No
10. Petrol (or) Diesel engine of any make with following arrangements – 2 No.Load test arrangement Heat balance test arrangement
11. Multi cylinder petrol engine of any make with Morse test setup – 1 No

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F5306-1

Term : V

Course Name : COMPUTER INTEGRATED MANUFACTURING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Computer Integrated Manufacturing Practical	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

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

OBJECTIVES:

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

Course Outcome

On successful completion of the cour se, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F5306-1 –CO1	Ability to illustrate the solid modeling of the Geneva Wheel, Bearing Block, Bushed bearing,Gib and cotter joint, Screw Jack, Universal Coupling, and connecting rod and assemble the parts by using CAD.	A
3F5306-1 –CO2	Ability to develop the part program, edit and execute in CNC Turning machine.	C
3F5306-1 -CO3	Ability to develop the part program, edit and execute in CNC milling machine.	C

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Practical

PART A: SOLID MODELLING

Introduction to part modelling – Datum plane – constraint – sketch – dimensioning – extrude

– revolve – sweep – blend – protrusion – extrusion – rib – shell – hole – round – chamfer – copy – mirror – assembly – align – orient – drawing and detailing – creating assembly views.

Exercise No. 1. Geneva Wheel

Exercise No. 2. Bearing Block

Exercise No. 3. Bushed bearing

Exercise No. 4. Gib and Cotter joint

Exercise No. 5. Screw Jack

Exercise No. 6. Universal coupling

Exercise No. 7 Connecting Rod

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

PART B: CNC PROGRAMMING AND MACHINING

Introduction:

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

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

CNC Turning Machine:

Material: M.S / Aluminium / Acrylic fibre / Plastic

1. Using Linear and Circular interpolation - Create a part program and produceComponent in the Machine.
2. Using Stock removal cycle – Create a part program for multiple turning operationsand produce component in the Machine.
3. Using canned cycle - Create a part program for thread cutting, grooving andProduce 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 forgrooving and produce component in the Machine.
5. Using canned cycle - Create a part program for drilling, tapping, counter sinkingand produce component in the Machine.
6. Using subprogram - Create a part program and produce component inthe Machine.

DETAILLED ALLOCATION OF MARKS

PART A: Solid Modelling	
Creation of sketch	15
Modelling	25
Accuracy	5
	45
PART B: CNC Programming	
Program writing	15
Editing and Machining	25
Finish	5
	45
Viva voce	10
Total	100

LIST OF EQUIPMENTS

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

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 5306-2

Term : V

Course Name : AUTOMOBILE ENGINEERING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Automobile Engineering practical	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

Mechanical engineering diploma holders are placed in the supervisor category at the automotive industries. The study of mechanic tools and hands on experience in dismantling, overhauling and assembling of all components will enhance their performance in the manufacturing and service sectors of automobile.

OBJECTIVES:

- Identify the various tools and their applications used in Automobile.
- Dismantle and assemble parts of petrol engine.
- Dismantle and assemble parts of diesel Engine.
- Service oil pump and water pump.

- Service AC fuel pump.
- Service carburetor.
- Dismantle and assemble fuel injection pump.
- Dismantle and assemble of power transmission and differential system.
- Overhauling of starter motor and dynamo.
- Troubleshoot the Electrical circuit in automobile.

Course Outcome

On successful completion of the cour se, the students will be able to attain below Course Outcome (CO):

Course outcome		**BTL**
3F 5306-2 -CO1	Ability to classify the tools used for repair IC engines	U
3F 5306-2 -CO2	Ability to Identify the components of an IC engine including cooling and lubrication system.	U
3F 5306-2 -CO3	Ability to analyze the construction and parts of the power transmission systems and various components involved in it.	A
3F 5306-2 -CO4	Ability to Differentiate types of chassis, steering and brake systems and their functions.	A
3F 5306-2 -CO5	Ability to evaluate the ignition system, generator and auxiliary systems.	A

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Practical

Module No.	**Experiments Name**

1	Study of mechanics tools—double ended, spanner, ring spanner, sockets, screwdrivers, torque wrench, feeler gauge, cutting pliers, etc. Study of gauges - height gauge, bore gauge, inside and outside micrometers.
	PART- A
2	Engine dismantling, overhauling and assembling (Both S.I. and C.I. engines).
3	Dismantling, overhauling and assembling of sliding mesh, constant meshand synchromesh gearboxes.
4	Dismantling, overhauling, assembling of propeller shaft (universal joint and slip joint) and adjusting backlash, correct teeth contact of crown and pinion ofdifferential unit.
5	Removing rear axle and hub assembly, re-greasing, assembling andadjusting axle and hub endplay
6	Dismantling, overhauling, assembling and adjusting steering gears and checking steering column and play cross shaft end play and backlash of different types of steering gears.
7	Adjusting valve clearance of 'I' head and 'L' type engines.
8	Removing, overhauling and replacing of Lubrication oil pump.
9	Removing, overhauling and replacing of water pump.
10	Dismantling, overhauling, assembling and testing of mechanical fuel pump.
	PART - B
11	Dismantling, inspecting and re-assembling of single cylinder F.I. pump andinjectors (Different types).
12	Dismantling, overhauling and assembling of Solex carburetor.
13	Dismantling, overhauling, assembling and adjusting of clutches, use of clutchadjusting fixture.
14	Dismantling, overhauling, assembling and bleeding of hydraulic brakesystem.
15	Removing, overhauling, replacing and adjusting of ignition distributor settingand ignition timing.
16	Dismantling, testing and assembling of starter motor.

17	Dismantling, inspecting, overhauling and assembling of alternator.
18	Dismantling, inspecting, testing and charging the battery (Specific gravitytest, high rate discharge test).
19	Dismantling, inspecting, overhauling and replacing and adjusting of ignitiondistributor and spark plugs setting-ignition timing.
20	Trace the automobile electrical system with respect to (i) horn relay circuit, (ii) Wiper circuit & explain with neat circuit diagram.
21	Garage equipment-Hydraulic lift, Wheel balancing equipments, tyre changer,Auto scrubbers and High pressure jet cleaner.

DETAILED ALLOCATION OF MARKS

DESCRIPTION		MARKS
PART A		
Dismantling Procedure	-	20
Tools handling methods	-	10
Assembly / Report	-	20
PART B		
Dismantling Procedure	-	20
Tools handling methods	-	10
Assembly / Report	-	10
Viva voce	-	10
TOTAL	**-**	**100**

LIST OF EQUIPMENTS

1. Automobile Mechanic's tools-Complete Set - 2 Set
2. 4 stroke petrol engine- with all accessories - 1No
3. 4 stroke Diesel engine- with all accessories - 1 No
4. Internal circlip plier, bearing puller - 1 No
5. Feeler gauge to check valve clearance, hammer and accessories - 1 No
6. SOLEX carburetor - 1 No

7. MPFI. - 1 No
8. Inline Fuel Injection Pump - 1 No
9. CRDI - 1 No
10. Injectors. - 1 No
11. Clutch set arrangement with tools - 1 No
12. Complete gear box with tools - 1 No
13. Complete steering arrangement - 1 No
14. Differential unit with axles - 1 No
15. Battery - 1 No
16. Battery Charger - 1 No
17. Battery Testing unit (Specific gravity) - 1 No
18. Starter Motor - 1 No
19. Alternator - 1 No
20. Dynamo - 1 No

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 5306-3

Term : V

Course Name : Green Energy and Energy Conservation Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
Green Energyand Energy Conservation Practical			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

In reducing green house gas emissions , renewable energy sources play an important role.especially the solar energy being the main contribution from renewable energy , it is needless to say that the students must be aware of the performance of solar energy derived from solar panel under different conditions of the day.added to this the course provides an idea about wind and bio gas power generation so that the students will get clear picture on renewable sources.

Objectives:

- To demonstrate the I-V and P-V Characteristics of PV module .
- To show the effect of variation in tilt angle on PV module power.
- To study the characteristics of battery.
- To understand how a solar PV standalone system works
- To workout power flow calculations of standalone PV system AC loadDC loadwith battery.

- To understand how to use various electrical measuring equipments.
- To study the different electrical parameters of a monocrystalline andpolycrystalline silicon solar panel
- To study the effect of shading on the output of solar panel.
- To understand and determine the power flow in a solar DC system.

Course Outcome

On successful completion of the cour se, the students will be able to attain below Course Outcome (CO):

UNIT	Course outcome	BTL
3F 5306-3 -CO1	Ability to analyze I-V and P-V characteristics of PV module	A
3F 5306-3 -CO2	Ability to understand characteristics of battery	U
3F 5306-3 -CO3	Ability to calculate power flow calculations of standalone PV system	A
3F 5306-3 -CO4	Ability to understand the different electrical parameters of a monocrystalline and polycrystalline silicon solar panel	U
3F 5306-3 -CO5	Ability to understand effect of shading on the output of solar panel	U

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Experiments

PART A

1. Study and demonstrate the I-V and P-V Characteristics of PVmodule with varying radiation and temperature level.
2. Study and demonstrate the I-V and P-V characteristics of seriesand parallel

combination of PV modules.

3. Study and demonstrate the effect of shading on module output power.
4. Do a shading analysis on the site where solar PV system needs to be setup.
5. Study the wind power generation status in Tamilnadu.
6. Study the biogas generation status in Tamilnadu.

PART B

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

DETAILED ALLOCATION OF MARKS

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

Equipment / Tools Required

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

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 5404

Semester : V

Course name : Entrepreneurship & Startup Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
Entrepreneurship & Startup Practical	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
	4	64	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	Entrepreneurship – Introduction and Process	10
II	Business Idea and Banking	10
III	Start Ups, E-Cell and Success Stories	10
IV	Pricing and Cost Analysis	10
V	Business Plan Preparation	10
	Field Visit for Case study	14
	Total	**64**

RATIONALE:

Development of a diploma curriculum is a dynamic process responsive tothe society and reflecting the needs and aspiration of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity

of opportunity and participation and finally promoting concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs, relevant to social prosperity and thereby ensure good means of living for every individual, provides jobs and develop Indian economy.

OBJECTIVES:

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

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

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
1	**Entrepreneurship – Introduction and Process** • Concept, Functions and Importance • Myths about Entrepreneurship • Pros and Cons of Entrepreneurship • Process of Entrepreneurship • Benefits of Entrepreneur • Competencies and characteristics • Ethical Entrepreneurship • Entrepreneurial Values and Attitudes • Motivation • Creativity • Innovation • Entrepreneurs - as problem solvers Mindset of an employee and an entrepreneur • Business Failure – causes and remedies • Role of Networking in entrepreneurship	12
2	**Business Idea and Banking** • Types of Business: Manufacturing, Trading and Services. • Stakeholders: sellers, vendors and consumers andCompetitors • E- commerce Business Models • Types of Resources - Human, Capital andEntrepreneurial tools and resources • Selection and utilization of human resources andprofessionals, etc. • Goals of Business; Goal Setting	12

	• Patent, copyright and Intellectual property rights • Negotiations - Importance and methods	
	• Customer Relations and Vendor Management • Size and capital based classification of business enterprises • Various sources of Information • Role of financial institutions • Role of Government policy • Entrepreneurial support systems • Incentive schemes for state government • Incentive schemes for Central governments	
3	**Start ups, E-cell and Success Stories** • Concept of Incubation centre's • Visit and report of DIC , financial institutions and otherrelevance institutions • Success stories of Indian and global business legends • Field Visit to MSME's • Study visit to Incubation centers and start ups • Learn to earn • Startup and its stages • Role of Technology – E-commerce and Social Media • Role of E-Cell • E-Cell to Entrepreneurship	**12**
IV	**Pricing and Cost Analysis** • Unit of Sale, Unit Price and Unit Cost - for single product orservice • Types of Costs - Start up, Variable and Fixed	**12**

	• Income Statement • Cash flow Projections • Break Even Analysis - for single product or service • Taxes • Financial Business Case Study • Understand the meaning and concept of the term • Cash Inflow and Cash Outflow Price • Calculate Per Unit Cost of a single product • Operational Costs • Understand the importance and preparation of IncomeStatement • Prepare a Cash Flow Projection • Projections • Pricing and Factors affecting pricing. Launch Strategies after pricing and proof of concept	
V	Business Plan Preparation • Generation of Ideas. • Business Ideas vs. Business Opportunities • Opportunity Assessment – Factors, Micro and MacroMarket Environment • Selecting the Right Opportunity • Product selection • New product development and analysis • Feasibility Study Report – Technical analysis, financialanalysis and	**12**

	commercial analysis • Market Research - Concept, Importance and Process • Market Sensing and Testing • Marketing and Sales strategy • Digital marketing • Branding - Business name, logo, tag line • Promotion strategy • Business Plan Preparation • Social Entrepreneurship as Problem • Solving - Concept and Importance • Risk Taking-Concept Types of business risksExecution of Business Plan	

DETAILED ALLOCATION OF MARKS

Sl. No	DescriptIonP	Marks
Part A	Written Examination - Theory Question and answer (10 questions x 3 marks:30 marks & (3 questions x5 marks: 15 marks)	45
Part B	Practical Examination – Submission on Business Plan/Feasibility Report or Report on Unit 4 & 5	40
Part C	Viva voce	15
	Total	100

REFERNCE BOOKS:

1. Dr. G.K. Varshney, Fundamentals of Entrepreneurship, SahityaBhawanPublications, Agra – 282002
2. Dr. G.K. Varshney, Business Regulatory Framework , SahityaBhawanPublications, Agra - 282002
3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship ,McGraw Hill (India) Private Limited, Noida – 201301,11 th edition 2013.
4. M.Scarborough, R.Cornwell, Essentials of Entrepreneurshipand smallbusiness management, Pearson Education India, Noida – 201301,2018
5. CharantimathPoornima M. Entrepreneurship Development and SmallBusiness Enterprises, Pearson Education, Noida – 201301,2018
6. Trott, Innovation Management and New Product Development, PearsonEducation, Noida – 201301,2009
7. M N Arora, A Textbook of Cost and Management Accounting, VikasPublishing House Pvt. Ltd., New Delhi-110044,2012
8. Prasanna Chandra, Financial Management, Tata McGraw Hill educationprivate limited, New Delhi
9. I. V. Trivedi, RenuJatana, Indian Banking System, RBSA Publishers,Rajasthan,2010.
10. Simon Daniel, HOW TO START A BUSINESS IN INDIA, BUUKS,Chennai -600018
11. RamaniSarada, The Business Plan Write-Up Simplified - A practitioners guideto writing the Business Plan, Notion Press MediaPvt. Ltd., Chennai 600095, 2017 edition.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 0005

Term : V

Course Name : CONCURRENT CAREER DEVELOPMENT

Topics

Unit	Name of the Topics
I	National Integration and Awareness
II	Social Awareness and Community Development
III	Health and Hygiene
IV	Environmental awareness and Conservation
V	Traffic Control Organization

OBJECTIVES:

1. To promote harmony and the spirit of common brotherhood amongst all the people of the country. To safe guard public property and abjure violence.
2. To develop the idea of ability and better thinking to work for the betterment of community.
3. To prevent illness and have positive health attitude, correct and complete knowledge of health is necessary.
4. To develop a world population that is aware of, and concerned about, the environmental and its associated problems
5. To provide for the safe, rapid, comfortable efficient, convenient, and environmentally compatible movement of people, goods, and services.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 0006**-CO1**	Ability to Students to know the responsibility to see that injustice, inequality, oppression; exploitation, corruption, misuse of public money etc. are done away with. Students play a vital role in the society. They are the guardians of freedom, Justice, equality, ethics and social equilibrium.	**R**
3F 0006 **-CO2**	Ability to To understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.	**U**
3F 0006 **-CO3**	Ability to Students have the knowledge or skills to develop good personal hygiene habits on their own.	**R**
3F 0006 **-CO4**	Ability to To understand the fragility of our environment and the importance of its protection.	**U**
3F 0006**-CO5**	Ability to The students will get a vast understanding on various traffic enforcements rules and regulations.	**U**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL- Bloom's revised taxonomy Level)

DETAILED SYLLABUS

UNIT	Topic	Hrs.
I	**National Integration and Awareness** Introduction – Importance of National Integration – Essence of national integration : Cultural Integration, Economic Integration, Political Integration, Religious Integration, Social Integration- Necessity of National Integration : Maintenance of peace and harmony, Growth and development of the nation, Law and Order, Culture and religious development, dignity	

	and self respect, welfare and wellbeing of the people-Role of NCC in nation Building.	
II	**Social Awareness and Community Development** Need of social awareness – Types of Social Awareness : Empathy, Organizational awareness- Service – How to build Social Awareness – Aims of Social Awareness – Different Social Awareness Programmes – Aims of Community development – Different community awareness programmes	
III	**Health and Hygiene** Introduction to the structure of the body – Personal hygiene - Food hygiene –water supply and its purification – Sanitisation – Waste Product/Refuse – Types of waste product – Sources of refuse – Collection and removal of refuse – Preventable diseases – Classification of disease – Preventive measures Yoga –Definition and meaning of Yoga-Principles of Yoga-Asana – Definition, Types, Benefits - Effect of various yogic practices on Respiratory and Circulatory system-Method of performing various asanas –Padmasana, Siddhasana, Gyan Muthra, Suryanamaskar. Physical and Mental heath – Elements of good health – Objectives and scopes of health education – Characteristics of healthy mind, Measures to secure mental health	
IV	**Environmental awareness and Conservation** Introduction- Human activities and the environment – Depletion and deterioration – Deforestation – Forest and wild life – Water Resources – Global Warming – Depletion of Ozone layer – Role of the NCC cadets towards the environment – Ecology – Definition and componentsConservation of environment and ecology – Resource depletion – Resource pollution – Environmental damage – Environment, life and ecology – Conservation	

	measures – Methods of managements and conservation of natural resources.	
V	**Traffic Control Organization** Understanding Road Safety – Importance or road safety: Major causes of road accident – Role of Education sector in road safety – Role of general Community in road safety – Road Safety tips – Safety Devices – Safe and Responsible driving : Getting ready to drive before driving, Physical and mental alertness, Know your vehicle, Know your blind spots, Fasten Your seat belt, Turn on head lights at night and in poor light conditions – Driving License.	

ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, etc. will be used in evaluation.

- Final marks = 25% of Assignment mark + 50% of Online exam mark (proctored) + 25 % of External exam (unproctored).
- Unproctored means candidate will be taking the exam from college.
- The overall pass percentage is 40%.

Reference :

1. Cadet's Hand Book.
2. Public Health And Hygiene, Dr.Sudhar R.Wagh.
3. Question Answers Of Environment And Road Safety Awareness Kindle Edition By Brijesh Pathak (Author) .
4. Environment And Road By Naresh Kumar (Author).
5. Traffic Safety And Environment: Conflict Or Integration Author Links Open Overlay Panelburkhard E.Horn(Professor)A. Hh.Jansson.

VI TERM

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6307

Term : VI

Course Name : INDUSTRIAL ENGINEERING AND MANAGEMENT

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Industrial Engineering and Management	6	96	25	100*	100	3 Hrs.

*

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Plant engineering and plant safety	18
II	Work study, method study and work measurement	18
III	Production planning and quality control	18
IV	Principles of management and personnel management	18
V	Material Management and Professional Ethics	17
Test & Model Exam		7
Total		**96**

RATIONALE:

In the Indian Economy, Industries and enterprises always find prominent place. After globalization, the government of India has announced liberalization policy of starting an enterprise which is resulted in the mushroom growth of industries. The present day students should be trained not only in manufacturing processes but also in managing activities of industries. Training must be imparted to students not only to shape them as technicians but also as good managers.

The knowledge about plant, safety, work study techniques, personnel management and financial management will definitely mould the students as managers to suit the industries. Due to the presence of such personalities the industries will leap for better prosperity and development.

OBJECTIVES:

- Explain the different types of layout and compare them.
- Appreciate the safety aspects and its impacts on an organization.
- Compare different productivity improvement technique.
- Explain different work measurement techniques.
- Estimate standard time for a job.
- Explain production planning and control and its functions.
- Study the role of PPC as a tool for cost control.
- Prepare process control charts.
- Explain the principles of management and functions of management.
- Compare different organizational structure.
- Explain the selection and training of staff.
- Create an awareness about the social responsibilities of students.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F6301 **-CO1**	Ability to report productivity concept to engineering application.	**R**
3F6301 **-CO2**	Ability to Describe the implementation of work and time study at a work place.	**R**
3F6301**-CO3**	Ability to Recognize the objectives, functions, applications of process planning control and forecasting techniques.	**U**
3F6301 **-CO4**	Ability to estimate job evaluation for personal management.	**U**
3F6301**-CO5**	Ability to Discuss about material management and professional rights, employee rights and intellectual property rights, safety and risk involved in engineering projects.	**U**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**Plant Engineering**: Plant - Introduction—Selection of a site of industry -Plant Layout - Principles of good layout – Types – Process, product fixed position layout - Techniques to improve layout - Principles of material handling equipment - Plant maintenance – Importance - Breakdown maintenance, Preventive maintenance and Scheduled maintenance. **Plant Safety:** Importance – accident – causes and cost of an accident – accident proneness – Personal factors – prevention of accidents – safetyawareness measures - industrial disputes – settlement of industrial disputes – Collective bargaining, Conciliation, Meditation, arbitration – Indian Factories act 1948 and its provisions related to health, welfare andsafety.	18

II	**Work Study**: Productivity – Standard of living – method of improving productivity – objectives – Importance of good working conditions. **Method study**: Definition – objectives –selection of 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. Process Orientation, Various Stages in process, Overall Management. **Work measurement**: Definition - Basic procedure in making a time studyemploys 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).	18
III	**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 – Massproduction, Batch production and job order production - Characteristics – Economic Batch Quantity (EBQ) - break even analysis - Principle of product and process planning - make or buy decision - problems. **Quality Control:** Definition – Objectives – Types of inspection – First piece, Floor and centralized inspection – Advantages and disadvantages. Quality control – statistical quality control –	18

	types of measurement – 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 reliability, reliability vs quality reliability frequency, MTBF, MTTR availability – bath tub curve – Concept of ISO 9001:2008 Quality management system registration / Certification procedure – Benefits of ISO to the organization. TQM, FMEA., Continuous Improvement Process	
IV	**Principle of Management:** Definition of management – Administration – Organization – F.W.Taylor's and Henry Fayol's Principles of Management – Functions of manager – Types of organization – Line, staff, Taylor's pure functional types – Line and staff and committee type – 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. **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	18
V	**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	17

	management – Introduction – Purchasing procedure – store keeping – Bin card. **Professional Ethics:** Basic human values – truth, right conduct, love, non-violence and peace – humanity and character. (iii)Core areas of ethics: social ethics, personal ethics integrity and trustworthiness, honesty, loyalty. (iv)Character: definition, individuality of a person from 'good' and bad qualities. (v)Traits of good character: Sense of duties and obligation to one's own profession. Adherence to truth and principle, excellence team work with a good rapport with teachers, colleagues and subordinate. Self-discipline, responsibilities and accountabilities, selflessness.	

Reference Books

1."O.P.Khanna" "Industrial Engineering and Management", Revised Edition publications (P) Ltd -2004, New Delhi – 110002.

2.T.R.Banga & S.C.Sharma, Engineering Economics and Management, Mc graw Hil,New Delhi

3.Heinz Weihrich, Harold Koontz, Management, A global perspective, McGraw Hill,New Delhi,New edition 2006.

4. Joseph L.Massie, Essentials of Management, Prentice – Hall of India, New Delhi

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6308

Term : VI

Course Name : MECHATRONICS

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examinations	Total	
Mechatronics	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Name of the Topic	Hours
I	Introduction, sensors & transducers	14
II	Signal conditioning and data presentation systems	14
III	Actutation systems, input/output systems	14
IV	Programmable logic controller (plc)	14
V	Design examples & advanced applications in mechatronics	14
	Revision	3
	Cycle Tests and Model Examination	7
	Total	80

RATIONALE

Today the technical field seeks interdisciplinary approach for all engineering applications. This subject imparts knowledge on different input, Processing, outputdevices with examples, automated systems so that a student can solve

any interdisciplinary problems in most efficient manner by interlinking all disciplines

OBJECTIVES

- Define Mechatronics and state its role in industries.
- Compare the different types of sensors/transducers Describe the basic
- actuation systems and their importance.
- Describe various basic Mechanical and Electrical actuation systems.
- Explain the various basic pneumatic and hydraulic actuation systems.
- Construct the basic mechanical system building blocks.
- Construct basic electrical system building blocks.
- Construct basic fluid system building blocks.
- Explain the structure of PLC and its functions.
- Write PLC program for simple applications.
- Apply Mechatronics design to real life case studies.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F6308 **-CO1**	Ability to identify the specifications and characteristics of sensors and sensors for real time applications.	**R**
3F6308 **-CO2**	Ability to summarize signal conditioning processes and data presentation device	**U**
3F6308**-CO3**	Ability to describe actuation system and interface requirements	**U**
3F6308**-CO4**	Ability to describe the ladder logic circuits for simple automation system	**U**
3F6308**-CO5**	Ability to recognize mechatronics system with the help of microprocessor , PLC and other electrical and electronic circuits.	**R**

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**INTRODUCTION, SENSORS & TRANSDUCERS** 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**.**	**14**
II	**SIGNAL CONDITIONING AND DATA PRESENTATIONSYSTEMS.** **Signal Conditioning;** Introduction-Signal Conditioning Processes Operational Amplifier-Inverting Amplifier, summing amplifier, integrating amplifier, differential amplifier and Comparator. Amplification Errors. Protection- Filtering-Wheatstone Bridge. Digital Signals-Analogue to Digital Conversion, Digital to Analogue Conversion. Multiplexers-Digital Multiplexers, Time Division Multiplexing. **Data Presentation:** Introduction- Data Presentation Elements –Analogue to Digital Meters, Analogue Chart Recorders-Cathode Ray Oscilloscope. Visual Display Unit. Printers-Magnetic Recording-Magnetic Disks. Light Indicators-LED displays, Liquid Crystal Displays, Data Logger	**14**
III	**ACTUTATION SYSTEMS INPUT/OUTPUT SYSTEMS** **Actutation systems:** Mechanical actuation systems - Introduction – type of motion – freedom and constrains. Kinematic chain – the four – bar chain– the slider crank mechanism, mechanical aspects	**14**

	of motor selection. Electrical actuation systems- Introduction – Mechanical switches – relays, solid – state switches – diodes, thyristors and triacs, bipolar transistors, solenoids. **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 adecoder.	**14**
IV	**PROGRAMMABLE LOGIC CONTROLLER (PLC)** 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.	**14**
V	**DESIGN EXAMPLES & ADVANCED APPLICATIONS INMECHATRONICS** **Design Examples** 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. **Advanced Applications In Mechatronics** Sensors for condition monitoring systems of production systems – Examples of monitoring methods: Vibration monitoring, Temperature monitoring, Wear behavior monitoring - Mechatronics control in automated manufacturing: Monitoring of manufacturing processes, On-line quality monitoring, Model- based systems, Hardware-in-the-loop simulation, Supervisory control in manufacturing inspection, Integration of heterogeneous systems.	**14**

Reference Books :			
Sl. No.	**Name of the Book**	**Author**	**Publisher**
1.	Introduction to Mechatronics	V.Bolton	New edition – 2015. Addsion Wesley Longman Inc.
2.	A Text Book of Mechatronics	R.K.Rajput	Tata mcgraw Hil
3.	Mechatronics System Design	Devdas Shetty & Kolk	New edition – 2010. Pws publishing co
4.	Electromechanics	James H.Harter	New edition – 1995. Prentice-Hal of India
5.	Control system Engineering	Colin D.Simpson,	New edition – 1995 Prentice Hall of India

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6309-1

Term : VI

Course Name : WELDING TECHNOLOGY

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Welding Technology	05	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

Unit	Name of the Topic	Hours
I	Welding Processes and Equipment	14
II	Special Welding Processes	14
III	Metallurgy of Welding	14
IV	Weldability of Ferrous and Non – Ferrous Metals	14
V	Welding Economy, Applications and Testing	14
	Revision	3
	Cycle tests and model examination	7
	Total	80

RATIONALE

Diploma technicians have a wide scope in fabrication industries. The knowledge about welding equipments, processes, weld metallurgy, nonferrous metal joining processes and testing of weldments are pre requests for the fabrication industries.

OBJECTIVES

- Explain the different types of welding process and equipments.
- Appreciate the safety aspects of welding.
- Compare different welding technique.
- Study the special welding process.
- Explain heat flow and temperature distribution around weldment.
- Explain heat affected zone and grain size control.
- Study the welding economy and principles of weld design.
- Explain the defects in welds.
- Compare various non-destructive testing methodologies.
- Analyze quality control for quality assurance.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 6309-1-1	Ability to Understand the different types of welding process and equipments, special welding process.	U
3F 6309-1-2	Ability to Compare different welding technique.	A
3F 6309-1-3	Ability to Understand the concepts of heat flow and temperature distribution around weldment, heat affected zone and grain size control.	U
3F 6309-1-4	Ability to Knowledge of defects in welds.	R
3F 6309-1-5	Ability to Compare various non-destructive testing methodologies.	A

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**WELDING PROCESSES AND EQUIPMENTS** Classification of welding processes - Gas welding – oxy – acetylene welding– gas welding techniques – gas welding equipment –– welding torch – types. Cutting torch – types. Manufacturing of oxygen gas and acetylene gas – Arc welding – Arc stability – Arc blow - mechanism of arc blow - factors affecting arc blow - Arc welding power sources – Phenomenon of arching - arc voltage – characteristics of welding power source. Resistance welding – spot welding – seam welding – projection welding - Gas cutting, Plasma cutting, Gouging - Brazing – Soldering. Welding safety – safety recommendations for installation and operation of arc welding and cutting equipment, gas welding and cutting equipment.	**14**
II	**SPECIAL WELDING PROCESSES** Submerged arc welding –TIG welding –MIG welding –CO_2 welding – Comparison between MIG and MAG welding - Electro slag welding –Electro gas welding - Plasma arc welding –Friction welding – Friction stir welding - Principle of operation –equipment –merits and demerits – applications. Ultrasonic welding – explosive welding - atomic hydrogen welding – electron beam welding -laser beam welding –definition, concept principle of operation and applications. Under water welding.	
III	**METALLURGY OF WELDING** Welding arc – Heat flow and temperature distribution in and around weld metal –temperatures zones –metallurgical effects of welding –weld metal solidification – absorption of gases by welds and their	**14**

	effects- gas metal reactions – porosity in welds – thermal effects of welding on parent metal – heat affected zones – grain size control –weld cracking – types. Corrosion of welds, weld decay, dilution. Residual stresses – types – causes –effects of thermal stresses- control of thermal stresses. Stress relief heat treatment- need for treatment.	
IV	**WELDABILITY OF FERROUS AND NON – FERROUS METALS** Concept of weldability – Welding Processes used for welding wrought iron – welding of grey cast iron , malleable cast iron, nodular cast and alloy cast iron - Welding of low carbon steels, high carbon steels – welding of steel castings – welding of alloy steels , stainless steels. Welding of Aluminium and its alloys, copper and its alloys, magnesium and its alloys – welding of Inconel, cadmium – welding of dissimilar metals – welding of plastics.	**14**
V	**SITE WELDING AND TESTING OF WELDS** Welding at open site. Site welding - Site welding Vs. Shop welding - Environmental effects in site welding - Site welding Quality control. Defects in welds –causes and remedies – welding distortion – control of welding distortion. Testing of welds – stages of weld inspection and testing – inspection before welding, during welding and after welding - Destructive testing of weld – tensile test, bend test, impact test, nick break test , hardness test, etch test – Non –destructive testing of weld – visual inspection, leak test, radiography inspection, magnetic particle inspection, liquid penetrant inspection, ultrasonic inspection, eddy current testing	**14**

Reference Books :			
Sl.No.	**Name of the Book**	**Author**	**Publisher**
1.	AWS Welding handbook Vol I & Vol II	Arthur L. Phillips	New edition – 1960 American welding society
2.	Arc Welding	R.J Sacks	New edition – 2004 American welding society
3.	Welding Methods Metallurgy	Jackson	Griffin publisher
4.	Welding Technology	O.P Khanna.	New edition – 2015. Dhanpat Rai & Sons
5.	Welding Technology	Richard L. Little.	New edition – 2017. McGraw Hill Publishers

1.	**www.nptel.ac.in**
2.	**www.me.emu.edu.tr/me364/ME364_combining_fusion.pdf**
3.	**www.slideshare.net**

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6309-2

Term : VI

Course Name : REFRIGERATION AND AIR-CONDITIONING

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Refrigeration And Air - Conditioning	05	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Refrigeration system and refrigerationEquipments	14
II	Vapour compression refrigeration system and Vapour absorption refrigeration system	14
III	Refrigerant flow controls, refrigerants and Lubricants, applications of refrigeration	14
IV	Psychrometry and comfort air conditioning	13
V	Air conditioning systems and cooling load Calculations	13
Test & Model Exam		7
Total		**75**

RATIONALE:

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

OBJECTIVES:

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

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F6309-2**-CO1**	Ability to evaluate tonnes of refrigeration.	U
3F6309-2**-CO2**	Ability to estimate the C.O.P of vapour compression system, vapour absorption system with different vapour cycles and equipments.	U
3F6309-2**-CO3**	Ability to discuss the working principle , types and applications of a refrigeration system.	U
3F6309-2**-CO4**	Ability to solve psychometric properties with different process.	A
3F6309-2**-CO5**	Ability to interpret the cooling load calculations, winter and summer air conditioning.	U

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**REFRIGERATION SYSTEM** Thermodynamic state of a pure substances, modes of heat transfer –laws of heat transfer - mechanisms of production of cold - unit of refrigeration –types of refrigeration –reversed Carnot cycle - C.O.P of heat engine-heat pump- refrigerating machine – principle of working of open and closed air system of refrigeration – advantages and disadvantages – problems. **REFRIGERATION EQUIPMENTS** Compressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors- condensers-principle of working and constructional details of air cooled and water cooled condensers, evaporative condensers-advantages and disadvantages - natural and forced draught cooling towers. Evaporators- natural circulation and forced circulation type – principle of working constructional details	**14**
II	**VAPOUR COMPRESSION REFRIGERATION SYSTEM** Principle of working of vapour compression system – analysis of vapour compression cycle using T-s diagram and p-H diagram- refrigerating effect-compression work - C.O.P - effect of superheating and under cooling - problems – effect of – evaporative pressure - condenser pressure - liquid –vapour refrigeration heat exchangers - advantages and disadvantages of superheating and under cooling–use of flash chamber and accumulator	14

	VAPOUR ABSORPTION REFRIGERATION SYSTEM Simple absorption system – Electrolux system – Solar absorption system –NH3 & lithium Bromide system - absorption system comparison with mechanical refrigeration system.	
III	**REFRIGERANT FLOW CONTROLS,LUBRICANTS ANDAPPLICATION OF REFRIGERATION** Capillary tube-automatic expansion valve-thermostatic expansion valve-solenoid valve-evaporator pressure regulator –suction pressure regulator-selection of a refrigerant-properties and applications of following refrigerants SO_2 , CH_4 , F_{11}, F_{12} ,F_{22}, and NH_3 –lubricants used in refrigeration and their applications-Cryogenics. **APPLICATIONS OF REFRIGERATION** Slow freezing –quick freezing- cold storage-frozen storage- freeze drying –dairy refrigeration –ice cream cabinets-ice making – water cooler, milk cooler, bottle cooler-frost free refrigeration, Cooling Laptops and other electronic Gadgets	14
IV	**PSYCHROMETRY AND COMFORT AIR CONDITIONING** Definitions of dry air, moist air, water vapour, Avogadro's law, Dalton's law of partial pressure - dry and wet bulb temperature - dew point - humidity - specific and absolute - relative humidity - degree of saturation - enthalpy of moist air- adiabatic saturation of air by evaporation of water- psychometric chart and its uses – psychometric processes – sensible heating and cooling - humidifying and heating - dehumidifying and cooling - adiabatic cooling with humidification - total heating or cooling processes -sensible heat factor	13

	- by pass factor with simple problems –IAQ principles - governing optimum effective temperature – comfort chart- design consideration	
V	**AIR CONDITIONING SYSTEMS** Equipment for air conditioning and insulation factors – air purification – temperature control – humidity control – dry and wet filters- centrifugal dust collector – air washer humidifier – dehumidifier - fans and blowers – grills and registers – summer and winter air conditioning, window type air conditioner – central plant system – properties of ideal insulator, types of insulating materials –air distribution and duct systems– tools and installation, servicing and maintenance of R & AC systems. **COOLING LOAD CALCULATIONS** Different heat sources – conduction heat load – radiation load of sun – occupants load – equipment load - infiltration air load – miscellaneous heat sources –fresh air load - simple problems.	13

Reference Books

1. Refrigeration and air conditioning, P.L. Ballaney, Khanna Publishers,2B,North Market, Naisarak, New Delhi 110 006.
2. Refrigeration and air conditioning, V.K. Jain, new edition ,2019.
3. Industrial Refrigeration Hand Book, Wilbert F. Steocker, new edition ,1995.
4. A course in refrigeration and air conditioning, Domkundwar, new edition ,2018.
5. Principles of refrigeration, Dossat ,
6. Home refrigeration and air conditioning, Audels, Theo.Audel & Co. publisher, 199 Edn.49, West 23rd Street, New York. – 1998
7. Refrigeration and air conditioning, C.P Arora, new edition ,2017.
8. Cryogenic systems Randell Fd Barron. new edition ,1985

PROGRAMME : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6309-3

Term : VI

Course name : Industrial Robotics and 3D Printing

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
Industrial Robotics and 3DPrinting	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Fundamentals of Robot Technology	12
II	Drive Systems, End Effecters, Sensors and Machine Vision System	12
III	Robot Programming, Robot Applications in Maufacturing	12
IV	Introduction and Design for Additive Manufacturing	18
V	Additive Manufacturing Processes	19
	TEST AND REVISION	07
Total		**80**

RATIONALE:

Rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to implement flexible manufacturing systems where Robotic technology plays major role. Hence study of robotic technology is very essential. 3Dprinting is often utilized when manufacturers need to create a product accurately,

quickly and at a low quantity. This has lead to 3D printers being brought in to prototype industrial robots, helping to aid the development of better, more efficient robots in the industrial sector.

OBJECTIVES:

- Understand fundamentals of robotics
- Acquire knowledge structure and elements of robot
- Gain knowledge on controller and various drives used in robotics
- Develop knowledge on role of sensors and vision system
- Acquire skill to program and control robot
- Understand to adopt robot to various industrial applications.
- To acquire the knowledge on 3D Printing and design principles for additive manufacturing
- To understand the principles of latest manufacturing processes in AdditiveManufacturing

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 6309-CO1	Ability to explain Basic configuration of Robotics, Robot components, Degrees of freedom ,Links and joints, Classification of robots , Work envelope and Work Volume, and PUMA robot	U
3F 6309-CO2	Ability to describe the Pneumatic drives , Hydraulic drives Mechanical drives, End effecters , Grippers , Position sensors Proximity sensors, Touch Sensors and Range Sensors	U
3F 6309-CO3	Ability to explain Forward kinematics, Inverse kinematics, Robot programming, Robot programming languages and Robot applications.	U
3F 6309-CO4	Ability to write Additive Manufacturing, Principle of AM Process, Direct and Indirect process, Prototyping and Manufacturing and Tooling,	U
3F 6309-CO5	Ability to discuss Photo polymerization, Powder Bed Fusion, Extrusion Based System, Sheet Lamination Process, Droplet formation technologies, Three Dimensional Printing, Beam Deposition Process, Applications of AM technologies in Automotive	U

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**Fundamentals of Robot Technology** Introduction – History of robot– Definitions– Basic configuration of Robotics – Robot Components – Manipulator, End effecter, Driving system, Controller and Sensors – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope and Work Volume – Effect of structure on Control ,Work envelop and Work volume- Introduction to PUMA robot- Robot controller Configuration - Four types of controls – Open loop and closed loop controls – Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability.	12
II	**Drive Systems, End Effecters, Sensors and Machine Vision System** Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – Stepper motors, DC Servo motors and AC Servo motors– Applications and Comparisons of Drives. End effecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers- Selection and design considerations in robot gripper- Requirements of Sensors – Position sensors: LVDT, Resolvers, Optical encoders- Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical proximity sensors- Touch Sensors – Range Sensors- Machine Vision System: Sensing & Digitizing Image Data – Image Processing and Analysis –Application	12
III	Robot Programming, Robot Applications In Manufacturing Forward kinematics, Inverse kinematics and differences – Forward	12

	kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom – Derivations. Robotprogramming –Lead through programming, Textual programming– Teach Pendant for Robot system– Robot programming languages – Motion commands, Sensor commands, End effecter commands. Robot applications – Material handling- Spot welding – Arc welding – Spray painting –Assembling – Finishing-AGV-RGV.	
IV	**Introduction and Design for Additive Manufacturing** **Introduction to AdditiveManufacturing** Additive Manufacturing – 3D Printing – Rapid prototyping – Overview – Need – Additive manufacturing Vs CNC Machining - Development of Additive Manufacturing Technology – Principle of AM Process – Generalised Additive Manufacturing Process Chain- Classification - Benefits – Direct and Indirect process,Prototyping, Manufacturing and Tooling **Design for Additive Manufacturing** Design tools: Data processing - CAD model preparation – STL file- Part orientation and support structure generation - Model slicing-Tool path generation. Design for Additive Manufacturing: Concepts and objectives - AM unique capabilities - DFAM for part quality improvement – strategies – Design Rules – Quality aspects – Software for AM – MIMICS, etc.	**18**
V	**Additive Manufacturing Processes Photo polymerization and Powder Bed Fusion Processes Photo polymerization:** SLA - Photo curable materials - Process - reaction rates – scan patterns - Advantages and Applications. Powder Bed Fusion: SLS - Process description - powder fusion mechanism – material feed system - Process Parameters - Materials and Applications . Electron Beam Melting ,Extrusion Based And Sheet Lamination Processes.	**19**

	Extrusion Based System: FDM – Introduction - Basic Principle – plotting and path control - Materials - Applications and Limitations- Bio-extrusion. Sheet Lamination Process: LOM – Materials - Gluing or Adhesive bonding - Thermal bonding – Ultrasonic AM. Printing Processes And Beam Deposition Processes Droplet formation technologies - Continuous mode - Drop on Demand mode - Three Dimensional Printing – Advantages – Bio- plotter - Beam Deposition Process: LENS- Process description - Material delivery - Process parameters – Materials –Benefits. Applications of AM technologies in Automotive, Manufacturing, Architectural, Healthcare, and Consumer products.	

Reference Books:

1. Industrial Robotics – Technology, Programming and Applications, P.Groover,MCGraw Hill, 2001
2. Chua C.K., Leong K.F., and Lim C.S., **"**Rapid prototyping: Principles andapplications**"**, Third edition, World Scientific Publishers, 2010. Ian Gibson, David W. Rosen, Brent Stucker **"**Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing**"** Springer, 2010.
3. Robotics Control, Sensing, Vision and Intelligence, Fu.K.S.Gonzalz.R.C., and Lee C.S.G, McGraw-Hill Book Co., 1987
4. Robotics for Engineers, Yoram Koren, McGraw-Hill Book Co., 1992
5. Robotics and Image Processing, Janakiraman.P.A, Tata McGraw-Hill, 1995
6. Andreas Gebhardt **"**Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing**"** Hanser Gardner Publication 2011.

7. Kamrani A.K. and Nasr E.A., **"**Rapid Prototyping: Theory and practice**"**, Springer, 2006.

8. Liou L.W. and Liou F.W., **"**Rapid Prototyping and Engineering applications: A tool box for prototype development**"**, CRC Press,2007.

9. Tom Page, **"**Design for Additive Manufacturing**"** LAP Lambert Academic Publishing, 2012.

10. Amit Bandyopadhyay, and Susmita Bose, "Additive Manufacturing", CRC Press. new edition ,2015.

11. John O Milewski., "Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewellery", Springer Series in Materials Science. new edition ,2017.

12. Sabrie Soloman. "Additive Manufacturing: Advanced Manufacturing Technology in 3d Print Deposit", new edition ,2014.

13. David Ian Wimpenny and Pulak M Pandey, "Advances in 3D Printingand Additive Manufacturing Technologies" new edition ,2019.

14. Andreas Gebhardt, Hanser, "Understanding Additive Manufacturing" new edition ,

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6310

Term : VI

Course Name : PROCESS AUTOMATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Process Automation Practical	5	80	25	100*	100	3 Hrs.

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

RATIONALE:

The Automation is being the order of the day to improve the production with high quality consciousness. Such automation involves the use of programmable logic controllers. This course aims to impart knowledge about automatic operations using programmable logic controllers with pneumatic kits.

OBJECTIVES:

- Use PLC system and its elements for process control
- Write ladder logic for logic controls such as AND, OR
- 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

- Control Sequential operation of pneumatic cylinder using PLC
- Sense the physical quantities by using sensors.
- Dismantle and assemble fuel injection pump.
- Dismantle and assemble of power transmission and differential system.
- Overhauling of starter motor and dynamo.
- Troubleshoot the Electrical circuit in automobile.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F6310-**CO1**	Ability to observe the pneumatic system operation and its Components	U
3F6310-**CO2**	Ability to Contrast the PLC system and its elements for process Control.	A
3F6310-**CO3**	Ability to apply the logic, timer and counter operation.	A
3F6310-**CO4**	Ability to test the control the automatic and sequential operations using PLC.	A
3F6310-**CO5**	Ability to compare the physical quantities by using sensors.	A

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Practical

Module No.	Experiments Name
1	Study of PLC systems and its elements
	PART-A
2	Direct operation of a motor using latching circuit.
3	Operation of a motor using 'AND' logic control.
4	Operation of a motor using 'OR' control.
5	On – Delay control of a motor.

6	Off – Delay control of a motor
	PART-B
7	Automatic operation of a Double acting cylinder – single cycle
8	Automatic operation of a Double acting cylinder – Single cycle – forward, time delay, return.
9	Automatic operation of Double acting cylinder – Multi Cycles
10	Automatic operation of Double acting cylinder – N cycles (using counter functions block).
11	Sequential operation of a Double acting cylinder and a motor.
12	Sequential operation of a two double acting cylinders for the sequence A+,B+,B-,A-
	PART-C
13	Measurement of Temperature using sensors Thermocouple.
14	Measurement of Flow using sensors.
15	Measurement of Displacement using sensors
16	Measurement of Temperature using sensors Thermistor

DETAILLED ALLOCATION OF MARKS

SCHEME OF VALUATION

DESCRIPTION		MARKS
PART A		
Procedure / Circuit diagram	-	05
Ladder diagram / Programming	-	10
Execution	-	10
PART B		
Procedure / Circuit diagram	-	10
Ladder diagram stimulation/ wiring	-	20
Execution	-	15
PART C		
Procedure	-	10
Observation & Result	-	10
Viva voce	-	10
TOTAL	**-**	**100**

LIST OF EQUIPMENTS

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

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6311 – 1

Term : VI

Course Name : WELDING TECHNOLOGY PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessmen	Board Examination	Total	
Welding Technology Practical	5	80	25	100*	100	3 Hrs.

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

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F6311-**CO1**	Ability to Understand the fundamental principles of special arc welding process	U
3F6311-**CO2**	Ability to Understand the principles of metal joining process for arc and gas welding	A
3F6311-**CO3**	Ability to use of various types tools, equipment for different operations in the welding shop	R
3F6311-**CO4**	ability to knowledge know the weldability of engineering materials like metals, non-metals, ferrous metals and non-ferrous metals.	A
3F6311-**CO5**	ABILITY TO Understand the knowledge of plasma arc in metal joining and cutting process	A

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

EXERCISES DETAILS – JOB PRACTICE:

Practice of different methods of gas welding

1. Left hand welding and Right hand welding.
2. Vertical welding.
3. Welding of Thin section.
4. Tube Butt joint – 1G and 5G

BRAZING:

1. Square butt joint – D.H. position
2. Square butt joint Copper to brass or S.S. to MCS – by Brazing.

DEMO EXERCISES

1. Soldering the component made in the sheet metal section.
2. Brazing the component fabricated in the sheet metal section.
3. Preparation of pipe joints using gas welding
4. Repair of Steel, Aluminum alloy and Copper alloy.

II. ARC

Review about the various types Arc welding equipment and accessories. Demonstration about selection of electrodes and setting the current, how to start an arc.

EXERCISES DETAILS – JOB PRACTICE:

1. Butt joints by both polarities to identify the weld difference.
2. Single V Butt welding – Down hand position.
3. Double V Butt welding – Down hand position.
4. Single V Fillet welding – Vertical position.
5. Fillet welding – Vertical position.
6. Butt welding – Overhead position.
7. Tube Butt joint – 1G.

8. Tube Butt joint – 2G.
9. Tube Butt joint – 3G.
10. Welding of Cast Iron / Aluminium / Stainless Steel.
11. Flare – V-groove butt weld (Two Rods).
12. Flare – bevel-groove butt weld (Rod over plate).
13. Repairing of defect weld bead by “Gouging” operation.

DEMO TOPICS:

1. Welding of High carbon steel.
2. Welding of dissimilar materials -SS and MS joints.
3. NDT testing LP, MP.
4. Discussion on X-ray samples.

III. MIG WELDING

Introduction to TIG welding equipment and its parts.

EXERCISES DETAILS – JOB PRACTICE:

1. Square butt joint on position horizontal
2. Fillet weld outside & inside corner position vertical
3. Square butt joint – over head position.

IV.TIGWELDING

Introduction to TIG welding equipment and its parts.

Various gases used in TIG welding operations.

EXERCISES DETAILS – JOB PRACTICE:

1. Square Butt joint – Down hand position.
2. Corner Butt joint –Vertical position.
3. Tube Butt joint – 1 G / 2 G / 5 G.
4. Square butt joint on aluminum sheet.
5. Welding of Stainless steel.

DEMO EXERCISES

1. Welding of High carbon steel by gas welding.
2. Repairing of C.I. shaft by ARC welding.
3. Spot welding.
4. Metal spraying.
5. Welding Simulation practice.
6.

V. PROFILE

PROFILE CUTTING PRACTICE:

1. Gas cutting - Triangle
2. Plasma cutting - Half round, Step cutting.
3. C.I. cutting - Gas cutting process.

SCHEME OF EVALUATION

Note: All the exercises have to be completed. Two exercises will be given for examination. 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.

ARC / GAS Welding	**: 45 marks**
Edge preparation	: 15
Welding / Cutting	: 15
Penetration / Reinforcement	: 10
Joint / Finish	: 05
SPECIAL WELDING / CUTTING	**: 45 marks**
Edge preparation	: 15
Welding / Cutting	: 15
Penetration / Reinforcement	: 10
Joint / Finish	: 05
Viva-voce	**: 10 marks**
Total	**: 100 marks**

LIST OF EQUIPMENTS

01.	Hand Gloves	-	10 pairs
02.	Leather Apron	-	10 nos
03.	Welding helmet	-	10 nos.
04.	Welding hand shield	-	10 nos.
05.	Wire brush	-	15 nos.
06.	Gas welding Goggles with Colour glass	-	10 nos.
07.	White glass	-	25 nos.
08.	Colour glass	-	25 nos.
09.	Arc welding colored glasses 11 A	-	25 nos.
10.	Arc welding colored glasses 12 A	-	25 nos.
11.	Chipping hammer	-	10 nos.
12.	Chipping blade	-	10 nos.
13.	Earth clamp	-	10 nos.
14.	Electrode holder	-	6 nos.
15.	Tongs	-	10 nos.
16.	Hammer ball peen 1 kg with handle	-	10 nos.
17.	Spark lighter	-	3 nos.
18.	Scriber 150 mm	-	10 nos.
19.	Chisel cold flat 19 mm x 150mm	-	15 nos.
20.	Centre punch 9 mm x 127 mm	-	6 nos.
21.	Dividers 200 mm	-	3 nos.
22.	Caliper outside 150 mm	-	3 nos.
23.	Hacksaw frame fixed 300 mm	-	6 nos.
24.	Number punch 6 mm	-	1 set.

25.	set letter punch 6 mm	-	1 set.
26.	File half bastard 350 mm.	-	15 nos.
27.	C- Clamps	-	6 nos.
28.	Swage block	-	1 no.
29.	Steel rule	-	10 nos.
30.	Tip cleaner set	-	3 nos.
31.	Weld measuring gauge fillet and butt	-	3 nos.
32.	H.P. Welding torch No. 2 with nozzle nos. 1,2,3, 5 & 7 2 sets	-	1 no.
33.	H.P. Cutting blow pipe with cutting nozzles	-	1 no.
34.	Welding rubber hose, oxygen 8mm. dia x 5mts. long	-	2 set
35.	Welding rubber hose Acetylene 8mm. dia x 5mts. long	-	2 set
36.	Gas Pressure regulator oxygen double stage	-	1 no.
37.	Gas Pressure regulator acetylene double stage	-	1 no.
38.	Oxygen Cylinder	-	3 nos.
39.	Acetylene Cylinder	-	3 nos.
40.	CO_2 Cylinders	-	3 nos.
41.	Argon Cylinders	-	3 nos.
42.	CO_2 regulator with flow meter	-	1 set
43.	Argon regulator with flow meter		1 set
44.	Welding Generator DC rotary set 200-300 amps with all accessories		1 no.
45.	Welding Transformer (or) Inverter based welding machine with all accessories (300A , OCV 60 – 100 V, 60% duty cycle)		4 nos.

46.	Thirstier based welding machine		1 no.
47.	TIG welding power source with water cooled torch		2 nos.
48.	MIG welding power source		2 nos.
49.	Plasma cutting Power source		1 no.
50.	Air compressor suitable for above air plasma cutting system.		1 no.
51.	AG 7 Grinder		5 nos.
52.	Pedestal grinder fitted with coarse and medium grain size grinding wheels dia. 300 mm		1 no.
53.	Oven, electrode drying 0 to 250°C, 10 kg capacity		1 no.
54.	Spot welding machine to 15 KVA with all accessories		1 no.
55.	Bench vice		10 nos.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6311 -2

Term : VI

Course Name : REFRIGERATION AND AIR- CONDITIONING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Refrigeration and Air conditioning practical	5	80	25	100*	100	3 Hrs.

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

RATIONALE:

Since the use of refrigerators and air conditioning systems for domestic, commercial and industrial application increases day by day, diploma technicians are expected to know the construction features, test procedures and service procedures of them.

OBJECTIVES:

- Identify the various tools used in R & AC
- Demonstrate the construction and working of window air conditioner
- Demonstrate the construction and working of split type air conditioner
- Set parameters for comfortable operation of an air conditioner.

- Determine the C.O.P of air conditioner.
- Determine the capacity of window air conditioner.
- Describe the wiring of refrigerator and coolers.
- Perform servicing on air conditioner.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F6311-CO1	Ability to observe the various types of tools, size of copper, steel tubes and various operations.	U
3F6311-2-CO2	Ability to discuss the construction , features of the refrigeration & air conditioning system.	A
3F6311-2 -CO3	Ability to calculate the C.O.P of various types of refrigeration system.	A
3F6311-2-CO4	Ability to estimate the efficiency and capacity of air conditioner , cooling tower.	A
3F6311-2 -CO5	Ability to analyse the defects in refrigeration & air conditioning system.	A

Legends: R = Remember U= Understand; A= Apply and above levels (BTL- Bloom's revised taxonomy Level)

DETAILED SYLLABUS

Contents: Practical

PART A:

Introduction to Test procedures – C.O.P of thermostatic expansion valve, automatic expansion valve ,capillary tube – C.O.P of sealed system from electrical measurements – Capacity of a Window AC - Efficiency of a Cooling tower – leaks test in a Spilt AC - Remedies –Detect the failures – Flush test – Recharge.

Exercise No. 1. Determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with Thermostatic expansion valve, Capillary tube, Automatic Expansion Valve.

Exercise No. 2. Determine the C.O.P of sealed system by using electrical measurements.

Exercise No. 3. Determine the capacity of a window air conditioner.Exercise No.

4. Determine the efficiency of a cooling tower.

Exercise No. 5. Conduct Leak tests in a split air conditioning system, detect the failures and suggest the remedies. Conduct the Refrigerant Charge Test.

Exercise No. 6. Conduct the flush test to remove the contaminants of refrigerationsystem And Recharge.

PART B:

Introduction: Introduction to Copper & steel tube - basic workshop operations – basic tools – construction & features of the Domestic refrigerators , Water cooler , Window AC – Proper methods of setting & adjust of Thermostats ,Low pressure and high pressure cut-outs ,Thermostatic expansion valve ,Automatic expansion valve –Wiring – Service tools – Maintenance – Causes –Common faults in R &AC.

Exercise No. 1. Study the various sizes of copper and steel tubing. To study thevarious tools used for operations..

Exercise No. 2. Study and carry out the various operations on copper and steeltubing–Flaring, Swaging and Soldering methods used in R& A.C.

Exercise No. 3. Study the methods of construction & features of the following:

a)Domestic Refrigerators. b)water cooler c)Window ac

Exercise No. 4. Study the methods to set and adjust the following a) Thermostats, b)Low pressure and high pressure cut-outs c) Thermostatic expansion valve d)Automatic Expansion Valve.

Exercise No. 5.Conduct the Wiring of refrigerator, water cooler, desert cooler, RoomAC, Packaged AC ,Panel board etc.,

Exercise No. 6. Conduct the service to change refrigerant into service cylinder fromStorage cylinder.

Exercise No. 7. Conduct the service to Evaluate the entire system.

Exercise No. 8. Conduct the service to pump down the system and to purge air fromthe system.

Exercise No. 9. Conduct the service to check the oil level in the compressor and tracethe common faults in R& A.C units and their remedies.

DETAILED ALLOCATION OF MARKS

PART A

Procedure	- 10
Formulae / Observation	- 20
Calculation /Result	- 20

PART B

Description / Procedure	- 15
Tool handling	- 15
Conclusion / Report	- 10
Viva voce	- 10
TOTAL	- 100

TOOLS:

1. Mechanics tool set - Tube cutter - Tube bender type - Tube bender spring - Swagingtool - Flaring block - Flaring nut - Pinching tool - Capillary tube testing gauge - Blow Lamp

SERVICE TOOLS:

Gas cylinder with receiver valve and key - Charging System - Blow lamp - Stem key -Spring remover - Service valve - 't' connector - High pressure gauge - Compound gauge - Leak detector - Soldering and Brazing

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6311 -3

Term : VI

Course Name : INDUSTRIAL ROBATICS & 3D PRINTING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

COURSE	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examinations	Total	
Industrial Robotics and 3D Printing Practical	5	80	25	100*	100	3 Hrs.

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

RATIONALE

The evolution of 3D printing has been a rapid growth in the number of companies adopting the technology.soft robos have received an increasing attention due to their advantages of high flexibility and safety for human operators but the fabrication is a challenge.recently 3D printing has been used a key technology to fabricate soft robots because of high quality and printing multiple materials at the same time.th experiments offered in this practical will achieve the above objective.

OBJECTIVES

- Study of Robot / Study of robot simulation software
- To study the components required.
- To study the techniques of programming for various industrial manufacturing applications.
- Prepare a record of work done.

- Acquire knowledge in the field of Additive Manufacturing
- Explain the various concepts of Solid Modelling
- Create STL files to manufacture components using 3D Printer

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course outcome		BTL
3F 6311–CO1	Ability to develop the robot program, simulation and execution of the Position recording using Cartesian co-ordinate system, Position recording using Polar co-ordinate system.	C
3F 6311–CO2	Ability to Create the model of Gear Train , Sun-planetary gear mechanism , Geneva Gear & Ratchet mechanism and Slide-crank mechanism by GUI System Software and produce the above by using 3D Printing.	C
3F 6311–CO3	Ability to develop the Pick and place the objects, Pick and stack the objects, Spray painting practice, Spot welding practice, Arc welding practice, Assembling practice, Profile cutting practice and Machine loading and unloading practice with time delay in 6 Axis Robot.	C

Legends: R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

DETAILED SYLLABUS

3D Printing : Getting to know the User Interface of the Modelling software – Home Screen – Navigating the main Screen – Options Bar – Application Menu& Quick Access Toolbar – Describe the function of a sketch - Describe the various types of sketches. Create sketches of 3D models. Basic Modelling Considerations – Describepart creation within the design process. Add placed features to existing parts. Createcomplex shapes by sweeping or lofting profiles. Assemblies - Managing the assemblies - Assemble a mechanical piece of equipment using constraints. STL files – introduction – conversion of parts from other file formats to STL file – AdditiveManufacturing – types of 3D Printers – orientation and positioning of parts - producing 3D working models using 3D Printers

PART A- Robot Programming

1. Position recording using Cartesian co-ordinate system - (No. of positions - 9)
2. Position recording using Polar co-ordinate system –

   (No. of positions - 9)
3. Pick and place the objects - No. of objects - 6)
4. Pick and stack the objects - (No. of objects - 6)
5. Spray painting practice - (Area - 300mm x 300mm)
6. Spot welding practice - (No. of spots - 9)
7. Arc welding practice – (Length of weld 50 mm)
8. Assembling practice - (Minimum 3 Components)
9. Profile cutting practice - (Complicated profile – combination of lines and arcs)
10. Machine loading and unloading practice with time delay - (No. of times - 9)

PART B - 3D Printing

1. Create the model and produce the Gear Train in 3D printing.
2. Create the model and produce the Sun-planetary gear mechanism.
3. Create the model and produce the Geneva Gear & Ratchet mechanism.
4. Create the model and produce the Slide-crank mechanism.

Note: Every student is asked to design and produce only one component of an assembly. After the completion of the product, individual parts are checked for its precision and matting in the assembly. Hence group exercises can be given. The models can be scaled according to the print area of the 3D Printer

DETAILLED ALLOCATION OF MARKS

Sl. No.	Performance Indicator	Marks
Part A – Robot Programming		
1	Robot Program	20
2	Simulate / Execution	30
3	Result	10
Part B – 3D Prinitng		
4	CAD - Modelling	15
5	3D Printing	15
6	Vivavoce	10
Total		100

LIST OF EQUIPMENTS

Personal computer : 10Nos.6 Axis Robot : 1 No.

3D Printer : 1 No.

Software : GUI System Software

: Modelling package / 3DPrinter– Sufficient to the strength.

Programme : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 3F 6405

Term : VI

Course Name : PROJECT WORK AND INTERNSHIP

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

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

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

RATIONALE:

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

OBJECTIVES:

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

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

Project Work and Internship:

The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise.

The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.

a) Internal assessment mark for Project Work and Internship:

Project Review I	. . .	**10 marks**
Project Review II	. . .	**10 marks**
Attendance	. . .	**05 marks**
Total	. . .	**25 marks**

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

b) Allocation of Marks for Project Work and Internship in

Autonomous Examinations:

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

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

c)Internship Report:

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

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

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