PERIYAR CENTENARY POLYTECHNIC COLLEGE

PERIYAR NAGAR – VALLAM – THANJAVUR – 613 403

(AUTONOMOUS INSTITUTION)

DIPLOMA IN MECHANICAL ENGINERING

SYLLABUS

MED/21/00

SEMESTER SYSTEM

D– SCHEME

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PERIYAR CENTENARY POLYTECHNIC COLLEGE

PERIYAR NAGAR, VALLAM – 613 403, THANJAVUR

Department of Mechanical Engineering

Programme Advisory Committee (PAC)

Syllabus Revision

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PERIYAR CENTENARY POLYTECHNIC COLLEGE

Periyar Nagar - Vallam - 613 403 - Thanjavur, Tamil Nadu

VISION

Periyar Centenary Polytechnic College aspires to be recognized as one of the leaders in imparting quality technical education and strives to prepare rural students with excellent technical and life skills for the benefit of the stakeholders and society at large.

MISSION

M1: To impart quality technical education to the students and equip them with knowledge, skills and attitudes that will lead to successful employment in industry/business, entrepreneurship and higher education.

M2: To provide conducive learning environment and adopt well structured teaching – learning practices to make the students technically competent.

M3: To strengthen the collaboration with industry and community for career development, placement and extension services.

M4: To develop the personality of the students and identify themselves as good individuals, professionals and responsible citizens with ethical values.

M5: To inculcate lifelong learning skills to face challenges with innovations.

PROGRAMME OUTCOMES (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyse 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 analyse individual needs and engage in updating in the context of technological changes.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

Excellence in providing scientific and technical education, to develop intellectual, innovative and quality mechanical engineers and prepare them to face challenges of modern society.

MISSION

M1: To provide quality education and training through comprehensive curriculum and emphasis on engineering fundamentals and applications.

M2: To provide a conducive, creative and enjoyable ambience for effective Teaching- Learning practices.

M3: To strengthen soft skills especially for rural students through co-curricular and extra curricular activities.

M4: To inculcate a spirit of innovation in emerging technologies for projects, lifelong learning and startups.

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Our Diploma graduates will be able to exhibit technical skills in operating tools, machineries and equipment to meet industry requirements.

PEO2: Our Diploma graduates will have the ability to engage in professional development, through the execution of projects with innovative ideas by adopting emerging technologies.

PEO3: Our Diploma graduates will be able to develop the positive attitude towards lifelong learning and succeed in industry, entrepreneurship or higher education.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Apply the acquired technical knowledge in design, drafting, manufacturing, maintenance and documentation of mechanical components and processes.

PSO2: Associate the related to Energy Conversion, Fluid Mechanics, Strength of Materials, Design of Machine Elements, Thermal & Automobile Engineering to arrive at solutions to real world problems.

PSO3: Manage Mechanical engineering processes by selecting and scheduling relevant equipment, substrates, quality control techniques, and operational parameters.

OUTCOME BASED EDUCATION(OBE)

Our institution is practicing Outcome Based Education(OBE) which is student centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes.

In the OBE model, the required knowledge and skill sets for a particular diploma programme is predetermined and the students are evaluated for all the required parameters (Outcomes) during the course of the program.

The OBE model measures the progress of the graduate in four parameters, which are

- Program Educational Objectives (PEO)
- Program Specific Outcomes (PSO)
- Program Outcomes (PO)
- Course Outcomes (CO)

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. PEO's are measured 4-5 years after graduation.

Program Specific Outcomes (PSOs) are the statements that describe what the graduates of specific engineering program should be able to do.

Program Outcomes (POs) are narrower statements that describe what students are expected to know and be able to do by the time of graduation.

Course Outcomes (COs) are the measurable parameters which evaluates each students performance for each course that the student undertakes in every semester. The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. According to revised Bloom's taxonomy, the levels in cognitive domain are as follows:

Level	Descriptor	Level of attainment
1	Remembering	Recalling from memory of previously learned material
2	Understanding	Explaining ideas or concepts
3	Applying	Using information in another familiar situation
4	Analyzing	Breaking information into part to explore Understandings and relationships
5	Evaluating	Justifying a decision or course of action
6	Creating	Generating new ideas, products or new ways of Viewing things.

DIPLOMA PROGRAMME IN ENGINEERING / TECHNOLOGY
(Implemented from 2020 -2021)

D SCHEME

RULES AND REGULATIONS

1. Description of the Programme:

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 semesters***** and the First Year is common to all Engineering Branches.

b. Sandwich (3 1/2 years)

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

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

***Each Semester will have 16 weeks duration of studies with 35 hrs / Week for all Diploma Programmes.**

The Curriculum for all the 6 Semesters of Diploma Programme (Engineering & Special Diploma Programmes Viz. Modern Office Practice) have been revised and revised curriculum is applicable for the candidates admitted from 2020 - 2021 academic year onwards.

2. Condition for Admission:

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

(Or)

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

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

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

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

3. Admission to Second year (Lateral Entry):

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

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

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

- For the Diploma Programmes related with Engineering/ Technology, the related / equivalent subjects prescribed along with Practicals may also be taken for arriving the eligibility.
- Programme will be allotted according to merit through counseling by the Principal as per communal reservation.
- For admission to the Modern Office Practice Diploma Programme the candidates studied the related courses will be given first preference.
- Candidates who have studied Commerce courses are not eligible for Engineering Diploma Programmes.

4. Age Limit: No Age limit.

5. Medium of Instruction: English

6. Eligibility for the Award of Diploma:

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

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

Diploma Programme	Minimum Period	Maximum Period
Full Time	3 Years	6 Years
Full Time (Lateral Entry)	2 Years	5 Years
Sandwich	3 ½ Years	6 ½ Years

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

7. Courses of Study and Curriculum outline:

The courses 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.

8. Examinations:

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

The internal assessment marks for all the courses will be awarded on the basis of continuous internal assessment earned during the semester 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.

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)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**
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i) Course Attendance **5 Marks**

(Award of marks for course attendance to each course 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

3 tests each of 2 hours duration for a total of 50 marks are to be Conducted. Average of these 3 test marks will be taken and the marks to be reduced to: **05 Marks**

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

Test	Units	When to conduct	Marks	Duration
Test – I	Unit I & II	End of 6th week	50	2 hrs
Test – II	Unit III & IV	End of 12th week	50	2 hrs
Test – III	Unit V	End of 15th week	50	2 hrs
Test– IV	**Model Examination - Compulsory** Covering all the 5 units (Autonomous Examination – question paper pattern)	End of 16th Week	100	3 hrs

 # From the Academic Year 2020 – 2021 onwards.

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

For I Year

Question Pattern (Without Choice):

Part A Type Questions: 6 Questions x1 mark	:	06 marks
Part B Type Questions: 8 Questions x 2 marks	:	16 marks
Part CType Questions: 4 Questions x 7 marks	:	28 marks

Total	**:**	**50 marks**

For II & III Year

Question Pattern (Without Choice):

Part A Type questions : 5 Questions × 2 marks	:	10 marks
Part B Type questions : 4 Questions × 3 marks	:	12 marks
Part C Type questions : 2 Questions × 14 marks	:	28 marks

Total	**:**	**50 marks**
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iii) Assignment **05 marks**

For each course, three assignments are to be given each for 20 marks and the average marks scored should be reduced for 5 marks.

Assignment 1: Written notes in relevant topics from the courses in unit I& II.

Assignment 2: Written notes in relevant topics from the courses in unit III , IV &V.

Assignment 3: Objective type online test to understand the principles and thereby gain in-depth knowledge about the course.

iv) Seminar Presentation **05 Marks**

The students have to select the topics either from their courses or general courses which will help to improve their grasping capacity as well as their capacity to express the course 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 5 marks for each theory course. The respective course faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (2 1/2 marks for the material submitted in writing and 2 1/2 marks for the seminar presentation). For each course minimum of two seminars are to be given and the average marks scored should be reduced to 5 marks.

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

B. For Practical Courses:

I, II and III Year

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

a) Attendance (Award of marks same as theory courses)	:	**05 Marks**
b) Procedure/ observation and tabulation/ Other Practical related Work	:	**05 Marks**
c) Tests#	:	**10 Marks**
d) Student Centered Learning (SCL) work sheet	:	**05 Marks**

TOTAL		**25 Marks**

 # Tests **10 Marks**

3 tests each of 2 hours duration for a total of 50 marks are to be Conducted. Average of these 3 test marks will be taken and the marks to be reduced to: **05 Marks**

The Test – IV is to be the Model Examination covering all the experiments and the marks so obtained will be reduced to: **05 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. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical course 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.
- At the end of the Semester, the average marks of all the exercises should be calculated for 20 marks (including Observation, Tests and SCL work sheet) and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Practical Autonomous 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 course. The marks awarded for Observation, SCL work sheet, Tests and Attendance should be entered periodically in the Personal Practical Log Book of the staff, who is handling the practical course.

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

11. Project Work and Internship:

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

i.e. institution wise, region wise and state wise**. The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.**

a) Internal Assessment Mark for Project Work & Internship:

Project Review I	:	**10 marks**
Project Review II	:	**10 marks**
Attendance	:	**05 marks** (Award of marks same as theory course pattern)

Total	**:**	**25 marks**

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Autonomous 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**
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*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 Centre / 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.

12. Industrial Training and Project Work (Architectural Assistantship(SW)

i. Industrial Training

In IV and VII semesters, students should undergo the industrial training under the registered architects without fail. During this period, they should have 80% of attendance. Candidates not fulfilling the above are not eligible to appear for the practical examinations and the candidates should redo the industrial training in the next academic year.

The internal Assessment is based on the monthly report, Weekly report and drawing works completed in training period.

Work diary (internal Assessment)	**25 marks**
Monthly report	5 Marks
Weekly report	5 Marks
Drawing works	10 Marks
Attendance	5 Marks

Total	**25 Marks**

Architect office and studio practice –I &II (IV & VII Sem)

Report writing	60 marks
Viva- voce	40 marks

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

ii. Project work

a) Internal Assessment Mark for Project Work

Project Review I	**10 marks**
Project Review II	**10 marks**
Attendance	**05 marks** (Award of marks same as theory course pattern)

Total	**25 marks**
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b) Project work & Viva voce – Autonomous Examination

Project Report	25 marks
Drawing &Presentation	25 marks
Viva Voce	30 marks
Model	20 marks

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

A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the project Work & Viva voce Autonomous Examination.

13. Scheme of Examinations:

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

14. Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed programme 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 courses 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 courses and 50% in practical courses out of the total prescribed maximum marks including both the Internal Assessment and the Autonomous Examinations marks put together, subject to the condition that he/she secures at least a minimum of 40 marks out of 100 marks in the Autonomous Theory Examinations and a minimum of 50 marks out of 100 marks in the Autonomous Practical Examinations.

15. 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 semesters in the first appearance itself and passes all courses within the stipulated period of study 2/3/3 ½ /4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time) without any break in study.

First Class with Distinction:

A candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters except the I and II semester in the first appearance itself and passes all courses within the stipulated period of study 2/3/3 ½ /4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time) without any break in study.

First Class:

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

Second Class:

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

The above classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in2020 -2021)

16. 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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'D' SCHEME
ANNEXURE–I

CURRICULUM OUTLINE

THIRD SEMESTER

Course Code	Course	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
MED310	Strength of Materials	5	-	-	5
MED320	Manufacturing Technology-I	5	-	-	5
MED330	Measurements and Metrology	5	-	-	5
MED340	Thermal Engineering –I	5	-	-	5
MED350	Machine Drawing and CAD Practical	-	2	2	4
MED360	Manufacturing Technology–I Practical	-	-	4	4
MED370	Measurements and Metrology Practical	-	-	4	4
		20	2	10	32
Extra/Co-Curricular activities					
Library		-	-	-	1
Physical Education		-	-	-	2
TOTAL					**35**

FOURTH SEMESTER

Course Code	Course	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
MED410	Fluid Mechanics and Fluid Power	5	-	-	5
MED420	Manufacturing Technology II	5	-	-	5
MED430	Electrical Drives and Controls	5	-	-	5
MED440	Production and Quality Management	5	-	-	5
MED450	Strength of Materials and Fluid Mechanics Practical	-	-	4	4
MED460	Manufacturing Technology II Practical	-	-	4	4
MED470	Electrical Drives and Control Practical	-	-	4	4
		20		12	32
Extra/Co-Curricular activities					
Library		-	-	-	1
Physical Education		-	-	-	2
TOTAL					**35**

FIFTH SEMESTER

Course Code	Course	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
MED510	Design of Machine Elements	6	-	-	6
MED520	Thermal Engineering–II	5	-	-	5
Elective I Theory					
MED531	Computer Integrated Manufacturing	5	-	-	5
MED532	Green Energy and Energy Conservation		-	-	
MED533	Mechatronics		-	-	
MED540	Process Automation Practical	-	-	4	4
MED550	Thermal Engineering Practical			4	4
Elective I Practical					
MED561	Computer Integrated Manufacturing Practical	-	-	4	4
MED562	Green Energy and Energy Conservation Practical	-	-		
MED563	Mechatronics Practical	-	-		
MED570	Entrepreneurship & Startup			4	4
		16	-	16	32
Extra/Co-Curricular activities					
Library		-	-	-	1
Physical Education		-	-	-	2
TOTAL					**35**

SIXTH SEMESTER

COURSE CODE	COURSE	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
MED610	Industrial Engineering and Management	6	-	-	6
MED620	E Vehicle Technology & Policy	4	-	-	4
Elective II Theory					
MED631	Industrial Robotics and 3DPrinting	5	-	-	5
MED632	Refrigeration and Air Conditioning		-	-	
MED633	Automobile Technology		-	-	
MED640	Solid Modelling Practical	-	-	6	6
Elective II Practical					
MED651	Industrial Robotics and 3DPrinting Practical	-	-	5	5
MED652	Refrigeration and Air Conditioning Practical	-	-		
MED653	Automobile Technology Practical	-	-		
MED660	Project Work and Internship	-	-	6	6
		15	-	17	32
Extra/Co-Curricular activities					
Library		-	-	-	1
Physical Education		-	-	-	2
TOTAL					**35**

ANNEXURE-II

SCHEME OF EXAMINATION

THIRD SEMESER

Course Code	Course	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	*Autonomous Examination	Total		
MED310	Strength of Materials	25	75	100	40	3
MED320	Manufacturing Technology-I	25	75	100	40	3
MED330	Measurements and Metrology	25	75	100	40	3
MED340	Thermal Engineering–I	25	75	100	40	3
MED350	Machine Drawing and CAD Practical	25	75	100	50	3
MED360	Manufacturing Technology–I Practical	25	75	100	50	3
MED370	Measurements and Metrology Practical	25	75	100	50	3

*Examinations will be conducted for 100 Marks and it will be converted to 75Marks.

FOURTH SEMESTER

Course Code	Course	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	*Autonomous Examination	Total		
MED410	Fluid Mechanics and Fluid Power	25	75	100	40	3
MED420	Manufacturing Technology II	25	75	100	40	3
MED430	Electrical Drives and Controls	25	75	100	40	3
MED440	Production and Quality Management	25	75	100	40	3
MED450	Strength of Materials and Fluid Mechanics Practical	25	75	100	50	3
MED460	Manufacturing Technology II Practical	25	75	100	50	3
MED470	Electrical Drives and Control Practical	25	75	100	50	3

*Examinations will be conducted for100 Marks and it will be converted to 75Marks.

FIFTH SEMESTER

Course Code	Course	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	*Autonomous Examination	Total		
MED510	Design of Machine Elements	25	75	100	40	3
MED520	Thermal Engineering– II	25	75	100	40	3
ELECTIVE–I THEORY						
MED531	Computer Integrated Manufacturing	25	75	100	40	3
MED532	Green Energy and Energy Conservation	25	75	100		
MED533	Mechatronics	25	75	100		
MED540	Process Automation Practical	25	75	100	50	3
MED550	Thermal Engineering Practical	25	75	100	50	3
ELECTIVE–IPRACTICAL						
MED561	Computer Integrated Manufacturing Practical	25	75	100	50	3
MED562	Green Energy and Energy Conservation Practical	25	75	100		
MED563	Mechatronics Practical	25	75	100		
MED570	Entrepreneurship & Startup	25	75	100	50	3

* Examinations will be conducted for100 Marks and it will be converted to 75Marks.

SIXTH SEMESTER

Course Code	Course	Marks			Minimum marks For pass	Duration of Exam Hours
		Internal Assessment	Autonomous Examination	Total		
MED610	Industrial Engineering and Management	25	75	100	40	3
MED620	E Vehicle Technology & Policy	25	75	100	40	3
ELECTIVE–II THEORY						
MED631	Industrial Robotics and 3D Printing	25	75	100	40	3
MED632	Refrigeration and Air Conditioning	25	75	100		
MED633	Automobile Technology	25	75	100		
MED640	Solid Modelling Practical	25	75	100	50	3
ELECTIVE–II PRACTICAL						
MED651	Industrial Robotics and 3D Printing Practical	25	75	100	50	3
MED652	Refrigeration and Air Conditioning Practical	25	75	`100		
MED653	Automobile Technology Practical	25	75	100		
MED660	Project Work and Internship	25	75	100	50	3

*Examinations will be conducted for100 Marks and it will be converted to 75Marks

List of Equivalent Subjects for C-Scheme to D–Scheme

THIRD SEMESTER

C-SCHEME		D-SCHEME	
Course code	**Name of the Course**	**Course code**	**Name of Course**
MEC310	Strength of Materials	MED310	Strength of Materials
MEC320	Manufacturing Processes	MED320	Manufacturing Technology–I
MEC330	Machine Drawing	-	No Equivalent
MEC340	Computer Applications and CAD Practical	-	No Equivalent
MEC350	Foundry and Welding Practical	-	No Equivalent
MEC360	Lathe and Drilling Practical	-	No Equivalent
MEC370	Metrology and Metallography Practical	-	No Equivalent

FOURTH SEMESTER

C-SCHEME		D-SCHEME	
Course code	**Name of the Course**	**Course code**	**Name of Course**
MEC410	Heat Power Engineering	MED340	Thermal Engineering–I
MEC420	Special Machines	MED420	Manufacturing Technology II
MEC430	Fluid Mechanics and Fluid Power	MED410	Fluid Mechanics and Fluid Power
MEC440	Electrical Drives &Control	MED430	Electrical Drives and Controls
MEC450	Strength of Materials and Fluid Mechanics Practical	MED450	Strength of Materials and Fluid Mechanics Practical
MEC460	Special Machines Practice	MED460	Manufacturing Technology II Practical
MEC470	Electrical Drives & Control Practical	MED470	Electrical Drives and Control Practical

FIFTH SEMESTER

C-SCHEME		D-SCHEME	
Course code	**Name of the Course**	**Course code**	**Name of the Course**
MEC510	Design of Machine Elements	MED510	Design of Machine Elements
MEC520	Thermal and Automobile Engineering	-	No Equivalent
MEC530	Process Planning and Cost Estimation	-	No Equivalent
ELECTIVE-ITHEORY			
MEC541	Total Quality Management	-	No Equivalent
MEC542	Press Tools	-	No Equivalent
MEC543	Renewable Energy Sources and Energy Conservation	MED532	Green Energy and Energy Conservation
MEC550	Process Automation Practical	MED540	Process Automation Practical
MEC560	Thermal and Automobile Engineering Practical	-	No Equivalent
MEC570	Life and Employability Skills Practical **	-	No Equivalent

SIXTH SEMESTER

C-SCHEME		D-SCHEME	
Course code	**Name of the Course**	**Course code**	**Name of the Course**
MEC610	Industrial Engineering and Management	MED610	Industrial Engineering and Management
MEC620	Computer Aided Design and Manufacturing	MED531	Computer Integrated Manufacturing
ELECTIVE-II THEORY			
MEC631	Mechanical Instrumentation	-	No Equivalent
MEC632	Robotics	-	No Equivalent
MEC633	Refrigeration and Air-conditioning	MED632	Refrigeration and Air Conditioning
MEC640	Computer Aided Design and Manufacturing Practical	MED561	Computer Integrated Manufacturing Practical
MEC650	Machine Tool Testing and Maintenance Practical	-	No Equivalent
ELECTIVE-IIPRACTICAL			
MEC661	Mechanical Instrumentation Practical	-	No Equivalent
MEC662	Robotics Practical	-	No Equivalent
MEC663	Refrigeration and Air-conditioning Practical	MED652	Refrigeration and Air Conditioning Practical
MEC670	Project Work	-	No Equivalent

MED310 - 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 Examination	Total	
Strength of Materials	5	80	25	100*	100	3 Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO. OF HOURS
I	Engineering materials	15
II	Deformation of metals	14
III	Geometrical properties of sections and thin shells	14
IV	Theory of torsion and springs	14
V	SF and BM diagrams of beams and theory of bending	14
Tests and Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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:

On completion of the course the students will be able to

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

COURSE OUTCOMES:

Course	**MED310 - STRENGTH OF MATERIALS**
After successful completion of this course the students should be able to	
D310.1	Describe about the engineering materials and Friction.
D310.2	Describe the deformation of metals
D310.3	Describe the geometrical properties of section and thin shell.
D310.4	Describe the torsion and spring properties.
D310.5	Identify the shear force and bending moment of the beam section.

MED310 - STRENGTH OF MATERIALS

DETAILED SYLLABUS

UNIT –I ENGINEERING MATERIALS **[15 Hrs]**

CHAPTER: 1.1: ENGINEERING MATERIALS:

Classification - definition of Mechanical properties - ferrous metals - cast iron - uses - advantages - types of cast iron [2 Hrs]

Properties and applications - effect of impurities on Cast iron. steel - classification - alloying elements - purpose of alloying [2 Hrs]

effect of alloying elements on steel - uses of steels - properties of mild steel - defects in steel – applications. [2 Hrs]

Properties of hard steel – market forms of steels – nonferrous metals - properties and uses. [1 Hr]

CHAPTER: 1.2: MECHANICAL TESTING OF MATERIALS: [2 Hrs]

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 [2 Hrs]

Breaking stress - ultimate stress - percentage of an elongation and percentage reduction in area - problems. [2 Hrs]

CHAPTER: 1.3: FRICTION

Introduction - definition - force of friction - limiting friction - static friction [1 Hr]

Dynamic friction - angle of friction - coefficient of friction - laws of static and dynamic friction. Description only. [1 Hr]

UNIT –II DEFORMATION OF METALS **[14 Hrs]**

CHAPTER: 2.1: SIMPLE STRESSES AND STRAINS

Definition - load, stress and strain - classification of force systems: Tensile, compressive and shear force systems. [1 Hr]

Hooke's law – definition Young's modulus - working stress, factor of safety, load factor, Shear stress and shear strain - modulus of rigidity. [1 Hr]

Linear strain – deformation due to tension and compressive forces - simple problems in tension, Compression and shear forces- thermal stresses. [2 Hrs]

CHAPTER: 2.2: ELASTIC CONSTANTS

Definition - lateral strain – poison's ratio - volumetric strain - bulk modulus [2 Hrs]

volumetric strain of rectangular and circular bars – problems connecting linear, lateral and volumetric deformations [2 Hrs]

Elastic constants and their relationship - problems on elastic constants. Composite bar [1 Hr]

Definition - problems in composite bars subjected to tension and compression. [1 Hr]

Temperature stresses and strains - simple problems.

CHAPTER: 2.3 STRAIN ENERGY

Definition – proof resilience – modulus of resilience – the expression for strain energy stored in a bar due to axial load [2 Hrs]

instantaneous stresses due to gradual, sudden, impact and shock loads [1 Hr]

Problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings. [1 Hr]

UNIT III GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS [14 Hrs]

CHAPTER: 3.1: PROPERTIES OF SECTIONS

Definition – Center of gravity and centroid - position of centroids of plane [1 Hr]

geometrical figures such as rectangle, triangle, circle and trapezium problems to determine the centroid of angle, channel, T and I sections only [1 Hr]

Definition - centroidal axis - Axis of symmetry. Moment of Inertia – Parallel axis theorem and perpendicular axis theorem (statement only). [2 Hrs]

Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections – Definition- Polar moment of Inertia [2 Hrs]

Radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections. [1 Hr]

CHAPTER: 3.2: THIN SHELLS

Definition – Thin and thick cylindrical shell – Failure of thin cylindrical shell subjected to internal pressure [1 Hr]

Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems [2 Hrs]

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 [2 Hrs]

Simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems. [2 Hrs]

UNIT IV THEORY OF TORSION AND SPRINGS [14 Hrs]

CHAPTER: 4.1: THEORY OF TORSION

Assumptions – torsion equation $T/J=fs/R=C\Theta/L$ - Strength of solid and hollow shafts [2 Hrs]

power transmitted – Definition – Polar modulus – Torsional rigidity [2 Hrs]

strength and stiffness of shafts – comparison of hollow and solid shafts in weight and strength considerations [2 Hrs]

Advantages of hollow shafts over solid shafts – Problems. [1 Hr]

CHAPTER: 4.2: SPRINGS

Types of springs – Laminated and coiled springs and applications [2 Hrs]

Difference between open and closely coiled helical springs – [1 Hr]

closely coiled helical spring subjected to an axial load – [2 Hrs]

Problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical spring. [2 Hrs]

UNIT V - SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING [14 Hrs]

CHAPTER: 5.1: SF AND BM DIAGRAMS

Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment [2 Hrs]

types of loadings – Relationship between load, force and bending moment at a section [1 Hr]

shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (UDL) – [2 Hrs]

Determination of Maximum bending moment in cantilever beam and simply supported beam when they are subjected to point load and uniformly distributed load. [2 Hrs]

CHAPTER: 5.2: THEORY OF BENDING

Theory of simple bending – Assumptions – Neutral axis – bending stress distribution – moment of resistance [2 Hrs]

bending equation – M/I=f/y=E/R – Definition [1 Hr]

section modulus - rectangular and circular sections – strength of beam [2 Hrs]

simple problems involving flexural formula for cantilever and simply supported beam. [2 Hrs]

Tests and Model Exam [9 Hrs]

TEXT BOOKS

Sl.No	Title	Author	Publishers & Edition
1.	Strength of Materials	R. S. Khurmi	S.Chand & Co., Ram Nagar, New Delhi
2.	Strength of Materials	S. Ramamrutham	DhanpatRai Pub.Co., New Delhi & 15th Edition 2004
3.	Strength of Materials	R.K. Bansal	Laxmi Publications Pvt. Ltd., New Delhi & 3rd Edition, 2010.

REFERENCE BOOKS

Sl.No	Title	Author	Publishers & Edition
1.	Strength of Materials	S.S.Rattan	Tata Mcgraw hill, New Delhi,2008
2.	Strength of Materials	B K Sarkar	I Edition, 2003Tata Mcgraw hill, New Delhi
3.	Engineering mechanics	R.K. Bansal	Laxmi Publications Pvt. Ltd., New Delhi,2nd Edition, 2007

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112103109/9
2. https://nptel.ac.in/courses/112107146/9
3. https://nptel.ac.in/courses/112105125/pdf/mod7les1.pdf
4. https://engineering.purdue.edu/~aprakas/CE297/CE297-Ch2.pdf
5. http://chettinadtech.ac.in/storage/15-02-05/15-02-05-16-22-57-3190-CCET0294.pdf
6. https://www.youtube.com/watch?v=7t06M0zXnlI

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	**-**	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D310.1	3	3	3	2	2	2	3	2	3	2
D310.2	3	3	3	2	2	2	3	2	3	2
D310.3	3	3	3	2	2	2	3	2	3	2
D310.4	3	3	3	2	2	2	3	2	3	2
D310.5	3	3	3	2	2	2	3	2	3	2
D310 Total	15	15	15	10	10	10	15	10	15	10
Correlation Level	3	3	3	2	2	2	3	2	3	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED320 – 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 Examination	Total	
Manufacturing Technology – I	5	80	25	100*	100	3 Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO. OF HOURS
I	Casting Processes	15
II	Joining Processes	15
III	Bulk Deformation Processes and Heat Treatment	14
IV	Manufacturing of Plastic Components and Powder Metallurgy	14
V	Centre Lathe and Special Purpose Lathe	13
Tests and Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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:

On completion of the course the students will be able to

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

COURSE OUTCOMES:

Course	**MED320 – MANUFACTURING TECHNOLOGY – I**
After successful completion of this course the students should be able to	
D320.1	Demonstrate the various molding techniques for manufacturing different components by using different pattern.
D320.2	Explain the principles, types & application of welding processes like Arc welding, Gas welding, etc.
D320.3	Recognize about various metal forming methods and heat treatment process.
D320.4	Understand the plastic components manufacturing and powder metallurgy
D320.5	Describe about function of centre lathe, semi-automatic lathe and automatic lathe

MED320 – MANUFACTURING TECHNOLOGY - I

DETAILED SYLLABUS

UNIT I CASTING PROCESSES **[15 Hrs]**

CHAPTER: 1.1: PATTERNS

Definition – pattern materials – factors for selecting pattern materials [1 Hr]

Types of Pattern - solid piece, split patterns, loose piece, match plate, Sweep, skeleton, segmental, shell – pattern allowances – core prints. [2 Hrs]

CHAPTER: 1.2: MOULDING

Definition – moulding boxes, moulding sand – ingredients – silica – clay – moisture and miscellaneous materials – properties of moulding sand [2 Hrs]

sand additives – moulding sand preparation - moulding tools – mixing – tempering and conditioning – types of moulding – green sand -dry sand [2 Hrs]

Machine moulding –Top and bottom squeezer machines – Jolting Machines – sand slinger- core – CO2 core making – types of core – core boxes-ceramic mould [2 Hrs]

CHAPTER: 1.3: CASTING

Definition – sand casting using green sand and dry sand – gravity die casting – pressure die casting – hot and cold chamber processes [2 Hrs]

centrifugal casting – continuous casting – chilled casting – malleable casting – melting of cast iron – cupola furnace – melting of nonferrous metals [1 Hr]

crucible furnace melting of steel - arc furnaces – induction furnaces – instrument for measuring temperature – optical pyrometer – thermo electric pyrometer [2 Hrs]

Cleaning of casting – tumbling, trimming, sand and shot blasting – defects in casting – causes and remedies – safety practices in foundry. [1 Hr]

UNIT-II JOINING PROCESSES **[15 Hrs]**

CHAPTER: 2.1: ARC WELDING

Definition – arc welding equipment – arc welding methods [2 Hrs]

carbon arc, metal arc, Metal Inert gas (MIG), Tungsten inert gas (TIG), [1 Hr]

Atomic hydrogen, Plasma arc, Submerged arc and Electro slag welding. [2 Hrs]

CHAPTER: 2.2: GAS WELDING

Definition Gas Welding Equipment– Oxy and acetylene welding – Three types of flame– resistance welding – classification of resistance welding [2 Hrs]

butt – spot – seam – projection welding – welding related processes – oxy and [2 Hrs]

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 [2 Hrs]

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 [2 Hrs]

radiographic and ultrasonic test defects in welding – causes and remedies – safety Practices in welding. [2 Hrs]

UNIT III BULK DEFORMATION PROCESSES AND HEAT TREATMENT [14 Hrs]

CHAPTER: 3.1: FORMING

Hot working, cold working – advantages of hot working and cold working– hot working operations – rolling, forging, [2 Hrs]

smith forging, drop forging upset forging, press forging – roll forging Press working : Types of presses – Mechanical and Hydraulic presses [1 Hr]

press tool and accessories – press working operations – bending operations [1 Hr]

Angle bending – chemical bending – curling – drawing – shearing operations – Blanking, piercing, trimming – notching – lancing. [2 Hrs]

CHAPTER: 3.2: HEAT TREATMENT

Heat treatment processes – purpose – procedures – applications of various heat treatment processes [2 Hrs]

Iron – carbon equilibrium diagram – full annealing – process annealing stress relief annealing [2 Hrs]

Spherodising annealing – isothermal annealing – normalizing – hardening – tempering -quenching medium [2 Hrs]

different types and their relative merits – case hardening – pack carburizing – cyaniding – nitriding – induction hardening and flame hardening. [2 Hrs]

UNIT IV MANUFACTURING OF PLASTIC COMPONENTS AND POWDER METALLURGY [14 Hrs]

CHAPTER: 4.1: PLASTIC COMPONENTS

Types of plastics-Engineering plastics – thermosets [1 Hr]

Composite - structural foam, elastomers - polymer alloys and liquid crystal polymers. [2 Hrs]

CHAPTER: 4.2: PROCESSING OF PLASTICS

Extrusion-general features of single screw extrusion -twin screw extruders and types [1 Hr]

Injection moulding types : Plunger type.- Reciprocating screw injection [1 Hr]

details of injection mould - structural foam injection mould - sandwich moulding - gas [2 Hrs]

injection moulding

Injection moulding of thermosetting materials calendaring and rotational moulding. [2 Hrs]

Design consideration for plastic components.

CHAPTER: 4.3: POWDER METALLURGY

Methods of manufacturing metal powders – atomization [1 Hr]

Reduction and electrolysis deposition – compacting [1 Hr]

sintering – sizing – infiltration – mechanical properties of parts made by powder metallurgy [2 Hrs]

Design rules for the power metallurgy process. [1 Hr]

UNIT V CENTRE LATHE AND SPECIAL PURPOSE LATHES [13 Hrs]

CHAPTER: 5.1: CENTRE LATHE

Centre lathe: specifications – simple sketch with principal parts. Headstock: back geared type – all geared type - description only [1 Hr]

Working principle of tumbler gear mechanism, quick change gear box, apron mechanism, carriage cross slide. Feed mechanism: automatic feed, [1 Hr]

longitudinal feed and cross feed. Construction and working of tail stock. work holding device: face plate – three jaw chuck – four jaw chuck – catch plate and carrier [2 Hrs]

center. Operations: straight turning – step turning - taper turning – knurling-Thread cutting - Facing – Boring – chamfering. Cutting speed – feed - depth of cut. [1 Hr]

CHAPTER: 5.2: SEMI-AUTOMATIC LATHES

Types of semi-automatic lathes – capstan and [2 Hrs]

Turret lathes – difference between turret and capstan. [2 Hrs]

CHAPTER: 5.3: AUTOMATIC LATHES

Automatic lathe – Construction and working principle of single spindle automatic lathe [2 Hrs]

Automatic screw cutting machines – multi spindle automatic lathes. [2 Hrs]

Tests And Model Exam [9 Hrs]

TEXT BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Elements of workshop Technology Volume I & II	Hajra Chowdry & Bhattacharaya	IIth Edition - Media Promoters & Publishers Pvt. Ltd., Seewai Building `B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
2	Introduction of basic manufacturing processes and workshop technology	Rajendersingh	New age International (P) Ltd. Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi – 110002.
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.

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Workshop Technology	Raghuwanshi	Khanna Publishers. Jain & Gupta
2	Production Technology	Edn. XII	Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi 110 006 - 2006
3	Production Technology	P. C. SHARMA	Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 - 2006
4	Production Technology	HMT	Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008. – 2001

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112107144/
2. https://nptel.ac.in/courses/112105127/
3. https://nptel.ac.in/courses/112104195/
4. https://nptel.ac.in/courses/112107144/13

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D320.1	2	-	2	3	2	3	3	3	-	2
D320.2	2	-	2	3	2	3	3	3	-	2
D320.3	2	-	2	3	2	3	3	3	-	2
D320.4	2	-	2	3	2	3	3	3	-	2
D320.5	2	-	2	3	2	3	3	3	-	2
D320 Total	10	-	10	15	10	15	15	15	-	10
Correlation Level	2	-	2	3	2	3	3	3	-	2

Correlation level 1 – Slight (low)

Correlation level 2 – Moderate (Medium)

Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED330 MEASUREMENTS AND METROLOGY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

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

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO. OF HOURS
I	Basic Concepts of Measurements	15
II	Linear and Angular Measurements	14
III	Form Measurement	14
IV	Advances in Metrology	14
V	Measurement of Mechanical Parameters	14
Tests & Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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

OBJECTIVES

On completion of the course the students will be able to

- 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 OUTCOMES:

Course	**MED330 MEASUREMENTS AND METROLOGY**
After successful completion of this course the students should be able to	
D330.1	Learn about the knowledge and basics concepts of measurements
D330.2	Understand the concepts of linear and angular measurement system
D330.3	Learn about measurement of Screw threads and gears.
D330.4	Describe the principles, types, applications of laser and computer metrology
D330.5	Understand the equipment and suitable technique to measure force, power, flow

MED330 MEASUREMENTS AND METROLOGY

DETAILED SYLLABUS

UNIT I BASIC CONCEPTS OF MEASUREMENTS [15 Hrs]

CHAPTER: 1.1: INTRODUCTION

Basic units - system concepts used in measuring technology - measuring instruments [2 Hrs]

length, angles and surface - scope of Metrology - standardization - international standardization, the bureau of Indian standards [2 Hrs]

legal Metrology - definition - applications - important elements of measurements [2 Hrs]

methods of measurements - needs for inspection - need for measurement - important terminology. [1 Hr]

CHAPTER: 1.2: PRECISION AND ACCURACY

Precision - definition - accuracy - definition - difference between precision and accuracy [2 Hrs]

factors affecting the accuracy of the measuring system - general rules for accurate measurements [2 Hrs]

precautions for use of instruments so as to avoid in accuracy in measurements - reliability - definition - error - definition - sources of errors [2 Hrs]

classification of error - compare systematic error and random error - selection of measuring instruments - symbols for metallurgical terms (ASME and ISO). [2 Hrs]

UNIT II LINEAR AND ANGULAR MEASUREMENTS [14 Hrs]

CHAPTER: 2.1: LINEAR MEASUREMENTS

Classification of linear measurement instrument - construction and the principles only - Steel rule - calipers [2 Hrs]

outside caliper, inside caliper, Jenny caliper - combination set - feeler gauge - pitch screw gauge - Vernier caliper - digital caliper - [2 Hrs]

Vernier height gauge micrometer -inside micrometer - thread micrometer – optical micrometer - light wave micrometer - possible sources of errors in micrometers [1 Hr]

slip gauges - requirements – precision tool -Indian standard – care and use. [1 Hr]

CHAPTER: 2.2: ANGULAR MEASUREMENTS

Introduction - vernier bevel protractor - universal bevel protractor - optical bevel protractor. Sine bar - types - uses and limitations - [2 Hrs]

working principle of clinometer, autocollimator, angle dekkor. Comparators - uses - application - classification of comparator - [2 Hrs]

mechanical comparator, optical comparator, electrical comparator, pneumatic comparator - principles - advantages and disadvantages - [2 Hrs]

compare comparator with measuring instruments – compare electrical and mechanical comparators. [2 Hrs]

UNIT III FORM MEASUREMENT **[14 Hrs]**

CHAPTER: 3.1: MEASUREMENT OF SCREW THREADS

Screw thread terminology - error in thread - measurement of various elements of thread (description only) - [2 Hrs]

thread gauges – classification - plug screw gauges, ring screw gauges, caliper gauges – [1 Hr]

adjustable thread gauge - gauging of taps - function of various types of gauges - floating carriage micrometer. [1 Hr]

CHAPTER: 3.2: MEASUREMENT OF GEARS

Introduction - types of gear - gear terminology - gear errors – spur gear measurement - [2 Hrs]

run out, tooth measurement, profile measurement, lead checking, backlash checking, tooth thickness measurement - vernier gear tooth caliper - [2 Hrs]

David brown tangent comparator - constant chord method - measurement of concentricity, alignment checking - Parkinson gear tester - Rolling gear testing machine - [2 Hrs]

radius measurement - radius of circle - surface finish measurement - classification of geometrical irregularities – elements of surface texture - [2 Hrs]

methods of measuring surface finish - measuring surface roughness - tracer type profilogram – double microscope. [2 Hrs]

UNIT IV ADVANCES IN METROLOGY **[14 Hrs]**

CHAPTER: 4.1: LASER METROLOGY

Basic concepts of lasers - types of lasers - uses, advantages and applications - laser telemetric system - laser and LED based distance measuring instruments - [2 Hrs]

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 - [2 Hrs]

interferometry - use of laser in interferometry - interferometer - standard interferometer, single beam interferometer, AC interferometer, Michelson interferometer, [2 Hrs]

dual frequency laser interferometer - Twyman green interferometer - applications. [1 Hr]

CHAPTER: 4.2: COMPUTER IN METROLOGY

Coordinating measuring machine - introduction - types of measuring machines - types of CMM - futures of CMM - [2 Hrs]

causes of errors in CMM - 3 co-ordinate measuring machine - performance of CMM - [2 Hrs]

applications - advantages disadvantages - computer controlled coordinating measuring

machine -

mechanical system of computer controlled CMMs - trigger type probe system, [2 Hrs]
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. [1 Hr]

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS [14 Hrs]

CHAPTER: 5.1: FORCE Measurement of force - Direct methods - equal arm [2 Hrs]
balance, unequal arm balance, multiple lever system, pendulum scale - indirect methods -

electromagnetic balance - load cells – hydraulic load cell, pneumatic load cell, strain [2 Hrs]
gauge load cell, shear type load cell, electronic weighing system.

Torque measurement – torque measurement using strain gauge - laser optical torque [2 Hrs]
measurement - stroboscope for torque measurement.

CHAPTER: 5.2: MEASUREMENT OF POWER Mechanical dynamometer - DC [2 Hrs]
dynamometer – inductor dynamometer - hydraulic dynamometer -

diaphragm pressure sensor - deform cage with LVDT - diaphragm gauge with strain [2 Hrs]
gauges - piezoelectric sensors.

CHAPTER: 5.3: MEASUREMENT OF FLOW Types of flow metres - rotameter, [2 Hrs]
electromagnetic flow metre, hot wire anemometer.

ultrasonic flow metre, laser Doppler anemometer (LDA) - reference beam mode, [2 Hrs]
interference French mode.

Tests And Model Exam [9 Hrs]

TEXT BOOKS

Sl.No	Title	Author	Publisher and editor
1	Mechanical Measurements and Instrumentation	Rajput R K	Laxmi publications Pvt Ltd , New Delhi
2	Mechanical Measurement and Control	Jalgaonkar R.V	Everest Publishing House.

REFERENCE BOOKS

Sl.No	Title	Author	Publisher and editor
1	Mechanical and Industrial Measurements	Jain R K	Khanna Publications
2	Instrumentation Devices and Systems	Narang C S	Tata McGraw Hill Publications.
3	Instrumentation, Measurement and Analysis	Nakra B.C	Chaudhary K.K,Tata McGraw Hill Publications.

LEARNING WEBSITE

1. https://nptel.ac.in/courses/112/106/112106179/
2. http://www.nptelvideos.in/2012/12/mechanical-measurements-and-metrology.html
3. https://freevideolectures.com/course/2370/mechanical-measurements-and-metrology
4. https://nptel.ac.in/courses/112/104/112104250/
5. https://www.digimat.in/nptel/courses/video/112106179/L01.html
6. https://www.youtube.com/watch?v=HpIEeBtJupY&list=PLbMVogVj5nJSZiwuh_tp50dKry8mCxzKA

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs Mapping matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D330.1	3	-	2	3	2	2	3	3	2	3
D330.2	3	-	2	3	2	2	3	3	2	3
D330.3	3	-	2	3	2	2	3	3	2	3
D330.4	3	-	2	3	2	2	3	3	2	3
D330.5	3	-	2	3	2	2	3	3	2	3
D330 Total	15	-	10	15	10	10	15	15	10	15
Correlation Level	3	-	2	3	2	2	3	3	2	3

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED340 THERMAL ENGINEERING - I

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	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 for result.**

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO. OF HOURS
I	Basics of Thermodynamics and Thermodynamic Processes of Perfect Gases	15
II	Thermodynamic Air Cycles and Heat Transfer	15
III	Internal Combustion Engines	14
IV	Fuels & Combustion of Fuels and Performance of IC Engines	14
V	Refrigeration and Air Conditioning	13
Tests and Model Exam		09
TOTAL		**80**

COURSE DESCRIPTION:

The growth of industries in the areas of Automobile and thermal power generation is the contemporary need of the present day. For these industries Knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation and study of fuels, IC Engines and performance of IC Engines are vital.

OBJECTIVES:

On completion of the course the students will be able to

- Explain the basics of systems and laws of thermodynamic and
- Thermodynamic processes.
- Explain different type of fuels and their combustion phenomenon.
- Explain the types, functions and the performance tests of IC engines.
- Explain vapour compression refrigeration system.
- Explain vapour absorption refrigeration system.
- Compare the properties and applications of various refrigerants.
- Describe the equipment used for air conditioning

COURSE OUTCOMES:

Course	**MED340 THERMAL ENGINEERING – I**
After successful completion of this course the students should be able to	
D340.1	Express the basic concepts of thermodynamics and its various processes
D340.2	Distinguish of thermodynamic air cycles, heat transfer process and steady flow system
D340.3	Explain the working principle of IC engines process, cooling system and lubrication
D340.4	learn about fuels, combustion of fuels and performance of IC engines
D340.5	Understand the process of refrigeration and air conditioning

MED340 THERMAL ENGINEERING - I

DETAILED SYLLABUS

UNIT I BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES **[15 Hrs]**

Introduction – definitions and units of mass, weight, volume, density, work –power-energy – types- specific weight, specific gravity and specific volume – pressure [1 Hr]

units of pressure –temperature - absolute temperature – S.T.P and N.T.P conditions – heat –specific heat capacity at constant volume and at constant pressure – law of conservation of energy [2 Hrs]

thermodynamic system– types – thermodynamic equilibrium - properties of systems – intensive and extensive properties –State of System [1 Hr]

process – cycle – point and path functions - zeroth, first and second laws of thermodynamics. Description of basic concepts only. [1 Hr]

Perfect gases – laws of perfect gases – Boyle's, Charles', Joule's, Regnault's and Avogadro's laws –General Gas Equation characteristic gas equation [1 Hr]

relation between specific heats and gas constant – universal gas constant – Thermodynamic Processes- Change in Internal Energy [2 Hrs]

Enthalpy –change in enthalpy – entropy – change in entropy – general equations for change in entropy. Description only. [2 Hrs]

Constant volume, constant pressure, isothermal, isentropic (reversible adiabatic) – Description and problems [2 Hrs]

Polytropic (derivation only), hyperbolic (derivation only) – P-V and T-S diagrams, work done, change in internal energy [1 Hr]

heat transfer, change in enthalpy, change in entropy for various processes - Free expansion and throttling processes-Maxwell relation. [2 Hrs]

UNIT II THERMODYNAMIC AIR CYCLES AND HEAT TRANSFER **[15 Hrs]**

Air cycles – air standard efficiency – reversible and irreversible processes –assumptions in deriving air standard efficiency [2 Hrs]

Carnot cycle – Otto cycle –Joule cycle – Diesel cycle [1 Hr]

comparison of Otto cycle and Diesel cycle -Comparison of ideal and actual p-V diagrams of Otto and Diesel cycles –problems. [2 Hrs]

Modes of heat transfer – heat transfer by conduction [1 Hr]

Fourier's Law – heat transfer by convection –heat exchanger [2 Hrs]

Parallel flow and Counter flow– heat transfer by radiation – Description only. [2 Hrs]

Steady flow system – control volume – steady flow energy equation [2 Hrs]

assumptions –Engineering applications of steady flow energy [2 Hrs]

Equation – non flow energy equation. Description only. [1 Hr]

UNIT III INTERNAL COMBUSTION ENGINES [14 Hrs]

Internal combustion engines. Classifications of I.C Engines – components of I.C Engines and functions material and method of manufacturing [2 Hrs]

four stroke cycle petrol and diesel engines – two stroke cycle petrol and diesel engines - comparison of four stroke and two stroke engines [1 Hr]

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 [2 Hrs]

supply system in petrol engines - A.C. mechanical fuel pump – simple carburetor – layout of fuel supply system in diesel engine [2 Hrs]

Single acting fuel feed pump – CAV fuel injection pump – fuel injectors – types of nozzles [1 Hr]

Fuel filters. Ignition systems – battery coil ignition systems – magneto ignition system - MPFI and CRDI System. [1 Hr]

Governing of I.C. engines - quantity and quality governing – cooling systems [2 Hrs]

Air cooling – water cooling. Lubrication system – properties of lubricants [1 Hr]

Types of lubrication systems – high pressure Lubrication system - oil pump (Gear & Rotor Pumps) and oil filters. [2 Hrs]

UNIT IV FUELS &COMBUSTION OF FUELS AND PERFORMANCE OF I.C ENGINES [14 Hrs]

Classifications of fuels - merits and demerits – requirements of a good fuel – combustion equations [2 Hrs]

stoichiometric air required for complete combustion of fuels – excess air – products of combustion [2 Hrs]

Analysis of exhaust gases - Exhaust gas analyser - calorific value of fuels [1 Hrs]

higher and lower calorific values – Dulong’s formula – determination of calorific value – Bomb and Junker’s calorimeter. Description only [2 Hrs]

Testing - thermodynamic and commercial tests – indicated power – [2 Hrs]

Brake power – friction power -efficiencies of I.C. engines [1 Hr]

indicated thermal ,brake thermal, mechanical and relative efficiencies [2 Hrs]

Specific fuel consumption – problems - Morse test – heat balance sheet – Procedure and problems. [2 Hrs]

UNIT V REFRIGERATION AND AIR CONDITIONING [13 Hrs]

Refrigeration – refrigerators and heat pumps – types and applications of refrigeration Systems – refrigerating effect – unit of Refrigeration [2 Hrs]

C.O.P. – actual C.O.P. Air Refrigeration System – reversed Carnot cycle – C.O.P of refrigerator, heat pump & Heat Engines [1 Hr]

Bell Coleman cycle – Vapour compression refrigeration system – vapour absorption system – Comparison - refrigerants – properties. Description only. [2 Hrs]

Psychrometric - psychometric properties – dry air – moist air – water vapour – saturated air [1 Hr]

dry bulb temperature – wet bulb temperature – wet bulb depression – dew point temperature – dew point depression [1 Hr]

humidity – specific and relative humidity – psychrometric chart – psychrometric processes – sensible heating and cooling [2 Hrs]

Bypass Factor - humidification – dehumidification –Mixing of Air Stream [1 Hr]

Air conditioning – classification and applications of air conditioning system – room air conditioning – central air conditioning- Comparison – comfort and industrial air conditioning [2 Hrs]

factors to be considered in air conditioning – loads encountered in air conditioning systems. Description only. [1 Hr]

Tests and Model Exam **[9 Hrs]**

TEXT BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Thermal Engg	R.K.Rajput	8th Edition, Laxmi publications Pvt Ltd , New Delhi
2	Applied Thermodynamics	P.K. Nag	2nd Edition, TATA Mcgraw – Hill Publishing Company, New Delhi
3	Thermal Engineering	R.S. Khurmi and J.K. Gupta	18th Edition, S. Chand &Co, New Delhi

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1.	Thermal Engineering	P.L Ballaney	24th Edition Khanna Publishers, New Delhi.
2.	Thermal Engineering	B.K. Sarkar	3rd Edition , Dhanpat Rai & Sons New Delhi.
3.	Applied Thermodynamics	Domkundwar and C.P Kothandaraman	2ndEdition Khanna publishers, New Delhi

LEARNING WEBSITES

1. https://nptel.ac.in/courses/112106133/
2. https://nptel.ac.in/courses/112105123/
3. https://nptel.ac.in/downloads/112108148/

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs Mapping matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D340.1	3	3	2	2	-	2	3	2	3	2
D340.2	3	3	2	2	-	2	3	2	3	2
D340.3	3	3	2	2	-	2	3	2	3	2
D340.4	3	3	2	2	-	2	3	2	3	2
D340.5	3	3	2	2	-	2	3	2	3	2
D340 Total	15	15	10	10	-	10	15	10	15	10
Correlation Level	3	3	2	2	-	2	3	2	3	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

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% to be included	90%	10%

MED350- MACHINE DRAWING AND 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 Examination	Total	
Machine Drawing and CAD Practical	4	64	25	100*	100	3 Hrs

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

DETAILED ALLOCATION OF MARKS

Manual Drawing in Drawing sheet	**: 30 marks**	
Assemble Front View	:	30
Computer Aided Drafting	**: 55 marks**	
Drafting	:	20
Assembly	:	20
Dimensioning	:	15
Viva–Voce	:	5
Mini Project	:	10
TOTAL	**:**	**100**

Mini Project Evaluation (10 marks)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

COURSE DESCRIPTION:

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

OBJECTIVES:

On completion of the course the students will be able to

- To learn the parts and assembly of the machine components.
- To appreciate the need for sectional view and types of sections.
- To draw sectional views.
- To practice manual drawing
- To use Computer Aided Drafting.
- To prepare geometrical model of various machine elements.
- To draw the different views of machine elements.
- To interpret the drawing in engineering field and illustrate three dimensional objects.

LIST OF EQUIPMENTS (For a batch of 30 students)

S.No	Name of the Equipments	Required Nos
1	Personal computer	30 Nos
2	Printer	01 No
3	Required Software's: CAD Package – Sufficient to the strength.	

COURSE OUTCOMES:

Course	MED350- MACHINE DRAWING AND CAD PRACTICAL
After successful completion of this course the students should be able to	
D350.1	Elaborate the concepts of machine drawing and know about the sectioning, fits and tolerance
D350.2	Explain about various surface texture and Develop sectional views of fasteners, joints, couplings
D350.3	Draw the detailed assembly drawing of machine parts
D350.4	Practice on CADD commands in making 2D Drawings and Draw the assembled drawings using CADD.
D350.5	Draw sectional views using different types of sections and develop the mini projects and report

MED350- MACHINE DRAWING AND CAD PRACTICAL

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 with dimensions. Front View /Full Section / Half Section Front View and Top View / Left Side View / Right Side View.

PART–B: COMPUTER AIDED DRAFTING (CAD)

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

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

EXERCISE:

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

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

The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper

TEXT BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Machine Drawing	Pritam SinghGill	S.K.Kataria& Sons
2	Machine Drawing	N.D.Bhatt	Charoter Publishing House

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1.	Introducing Auto cad 2010 and Auto cad LT 2010	George Omura	Wiley IndiaPvt. Ltd.
2.	Engineering Drawing	R.B.Gupta	Satya Prakasan, Technical India Publications.
3.	Engineering Drawing	D.N. Ghose	Dhanpat Rai &Sons, Delhi

CONTINUOUS INTERNAL ASSESSMENT

Note:

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

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

Drawing Sheet (Six Exercise Average)	- 10 Marks
Observation	- 05 Marks
Test	- 05 Marks
Attendance	- 05 Marks
Total	- **25 Marks**

AUTONOMOUS EXAMINATION

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

PART A: Manual Drawing in the Drawing sheet

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

PART B: Computer Aided Drafting in the CAD package

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

LEARNING WEBSITES

1. https://grabcad.com/library/screw-jack-autocad-2014-3d-machine-drawing-assembly-1
2. https://www.unm.edu/~bgreen/autocad/AutoCAD%208.pdf
3. http://machinedrawing.blogspot.com/2006/04/chapter-6.html
4. http://site.iugaza.edu.ps/aabuzarifa/files/METRO20152_CH52.pdf
5. http://textofvideo.nptel.ac.in/112106179/lec19.pdf
6. https://nptel.ac.in/syllabus/syllabus_pdf/112106075.pdf

CO – PO & PSO's MAPPING MATRIX

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D350.1	3	2	3	-	-	3	3	3	2	2
D350.2	3	2	3	-	-	3	3	3	2	2
D350.3	3	2	3	-	-	3	3	3	2	2
D350.4	3	2	3	-	-	3	3	3	2	2
D350.5	3	2	3	-	-	3	3	3	2	2
D350 Total	15	10	15	-	-	15	15	15	10	10
Correlation Level	3	2	3	-	-	3	3	3	2	2

Correlation level 1 – Slight (low)

Correlation level 2 – Moderate (Medium)

Correlation level 3 – Substantial (high)

MED350- MACHINE DRAWING AND CAD PRACTICAL

MODEL QUESTION PAPER

PART A: Manual Drawing in the Drawing sheet.

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

S.NO	EXERCISE	CO	PO
1.	Sleeve & Cotter joint	D350.1	PO1,PO2,P03
2.	Screw jack	D350.1	PO1,PO2,P03
3.	Plummer Block	D350.2	PO1,PO2,P03
4.	Simple Eccentric	D350.2	PO1,PO2,P03
5.	Machine Vice	D350.3	PO1,PO2,P03
6.	Protected type flanged coupling	D350.3	PO1,PO2,P03
7.	Knuckle Joint	D350.3	PO1,PO2,P03

PART B: Computer Aided Drafting in the CAD package

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

1.	Sleeve & Cotter joint	D350.4	PO1,PO2,P03
2.	Screw jack	D350.4	PO1,PO2,P03
3.	Plummer Block	D350.4	PO1,PO2,P03
4.	Simple Eccentric	D350.4	PO1,PO2,P03
5.	Machine Vice	D350.5	PO1,PO2,P03
6.	Protected type flanged coupling	D350.5	PO1,PO2,P03
7.	Knuckle Joint	D350.5	PO1,PO2,P03
MINI PROJECT		D350.1 to D350.5	PO1,PO2,P03

MED360- 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 Examination	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 marks for result.**

DETAILED ALLOCATION OF MARKS

PART-A	**: 50 MARKS**	
Procedure / preparation	:	10
Machining / dimensions	:	30
Finishing	:	10
PART-B	**: 35 MARKS**	
Procedure / preparation	:	10
Machining / dimensions	:	20
Finishing	:	5
Viva–Voce	:	5
Mini Project	:	10
Total	**:**	**100**

Mini Project Evaluation (10 marks)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

COURSE DESCRIPTION:

Manufacturing Technology Laboratory is a well-equipped laboratory which provides ideas on the practical knowledge of several steps of casting, pattern usage, mould creation, gating design, produce a casting and check casting defects. In the laboratory experimental setups are there which helps the students to enhance their knowledge. Students also get opportunity to implement their ideas through various application oriented micro projects.

OBJECTIVES:

On completion of the course the students will be able to

- 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

LIST OF EQUIPMENTS: (For a batch of 30 students)

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

29	Spot welding machine	1 No
30	Shovel	10 Nos
31	Rammer set	10 Nos
32	Slick	10 Nos
33	Strike-off bar	10 Nos
34	Riddle	10 Nos
35	Trowl	10 Nos
36	Lifter	10 Nos
37	Sprue pin	20 Nos
38	Brush	10 Nos
39	Vent rod	10 Nos
40	Draw spike	10 Nos
41	Gate cutter	10 Nos
42	Cope box	10 Nos
43	Drag box	10 Nos
44	Core box	10 Nos
45	Runner & riser	20 Nos
46	Moulding board	10 Nos
47	Patterns	5 Nos each

COURSE OUTCOMES

Course	**MED360 MANUFACTURING TECHNOLOGY I PRACTICAL**
After successful completion of this course, the students should be able to	
D360.1	Understand the parts of a lathe and the necessary cutting tools and work holding devices for lathe machine.
D360.2	Practice and operate the lathe machine component.
D360.3	Understand the tools and equipments used in foundry and Prepare sand moulds for different patterns.
D360.4	Practice welding operation to make different types of joints
D360.5	Identify the different welding defects and mini projects with report.

MED360- MANUFACTURING TECHNOLOGY - I PRACTICAL

DETAILED SYLLABUS

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

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

Welding Exercises

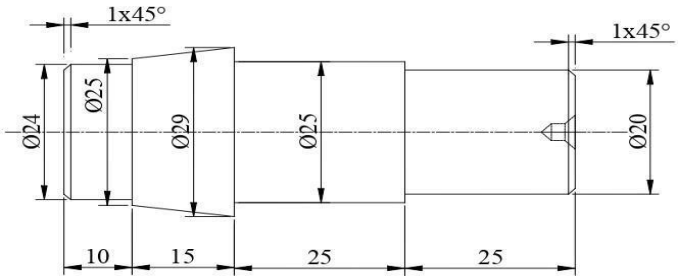
Arc welding principles and components - Arc Welding - Lap Joint - Butt Joint, T Joint, Corner joint. Gas welding equipments – components - Gas welding - Lap Joint, Butt Joint, T Joint, Corner Joint. Gas cutting - Spot Welding

EXERCISES

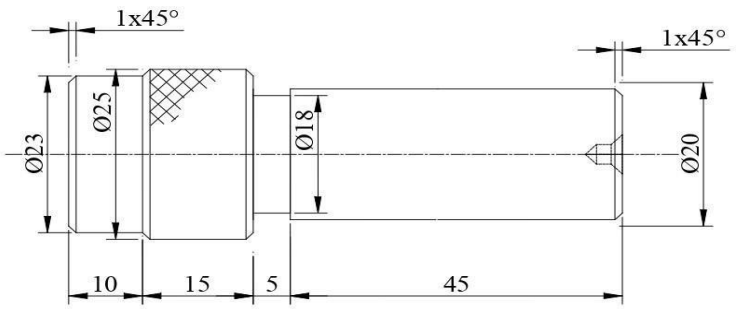
PART A – Lathe Exercises

Note**:** All Dimensions are in mm. All linear dimensions in ± 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).

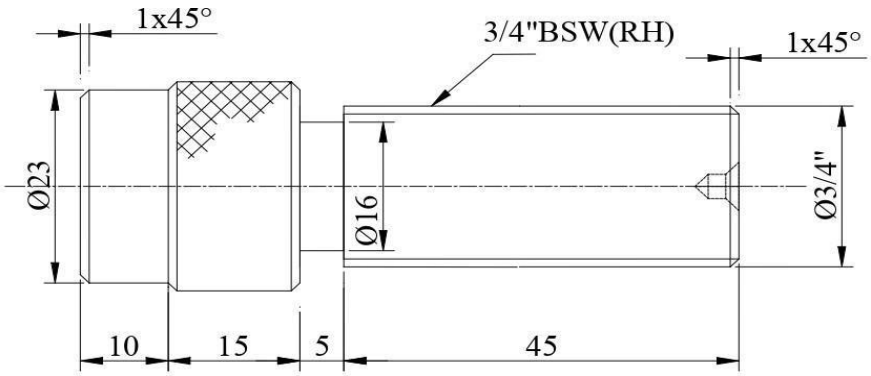
1. Prepare the specimen and make the Step turning & Taper turning as shown infigure using the Lathe.



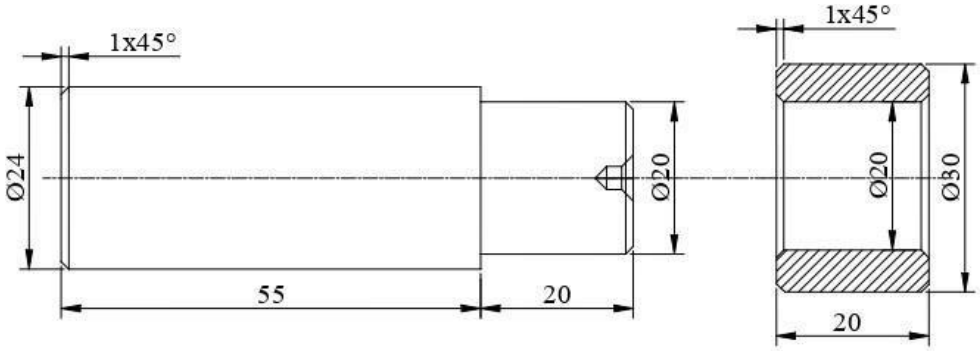
2. Prepare the specimen and make the Step turning & knurling as shown in figureusing the Lathe.



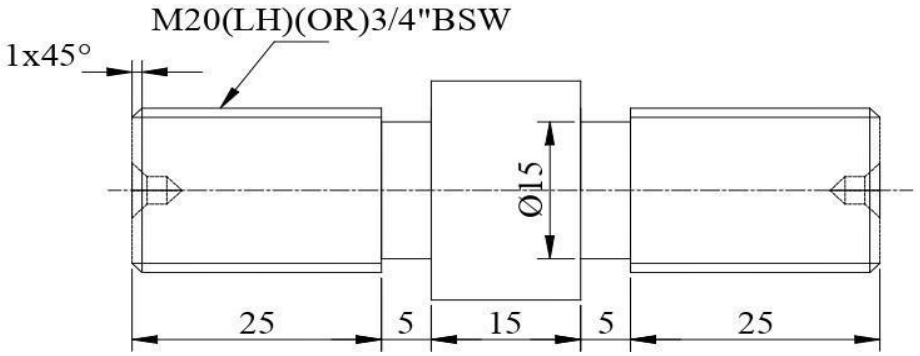
3. Prepare the specimen and make the Step turning &BSW Thread cutting as shown in figure using the Lathe.



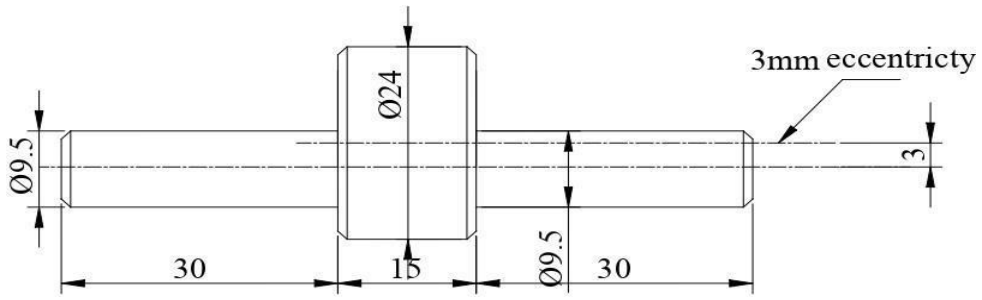
4. Prepare the specimen and make the Shaft and Bush as shown in figure using the Lathe.



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



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



PART B – Exercises

1. Prepare the green sand moulding using any one Solid Pattern in the foundry.
2. Prepare the green sand moulding using any one Split Pattern in the foundry.
3. Prepare the green sand moulding using any one Loose Piece pattern in the foundry.
4. Prepare the specimen and make the Lab joint by the Arc Welding (Both side welded). (Raw material 25mm X 6mm MS flat)
5. Prepare the specimen and make the corner joint by the Gas Welding. (Raw material 25mm X 3mm MS sheet)
6. Prepare the specimen and make the Butt joint by the Spot welding. (Raw material 25mm X 3mm GI sheet)
7. Prepare the specimen and make the Butt joint by the Arc Welding (Both side welded). (Raw material 25mmX6mm MS flat)
8. Mini Project

   The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks

Total		25 Marks

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 or Question paper issued from the Autonomous should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

LEARNING WEBSITES:

1. https://www.gopracticals.com/workshop/workshop-practical-machine-shop-lathe/
2. http://www.cittumkur.org/manuals/mech/3rd%20semester/MACHINE%20SHOP.pdf
3. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=98862
4. https://archive.hnsa.org/doc/pdf/lathe.pdf
5. https://en.wikipedia.org/wiki/Foundry
6. http://www.themetalcasting.com/foundry-step-by-step-instructions.html
7. http://www.iitg.ac.in/engfac/ganu/public_html/Metal%20casting%20processes_1.pdf
8. https://en.wikipedia.org/wiki/Welding
9. https://www.gopracticals.com/workshop/workshop-practical-welding-lap-joint/

CO – PO & PSOs MAPPING MATRIX

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D360.1	3	2	2	3	-	3	3	3	2	2
D360.2	3	2	2	3	-	3	3	3	2	2
D360.3	3	2	2	3	-	3	3	3	2	2
D360.4	3	2	2	3	-	3	3	3	2	2
D360.5	3	2	2	3	-	3	3	3	2	2
D360 Total	15	10	10	15	-	15	15	15	10	10
Correlation Level	3	2	2	3	-	3	3	3	2	2

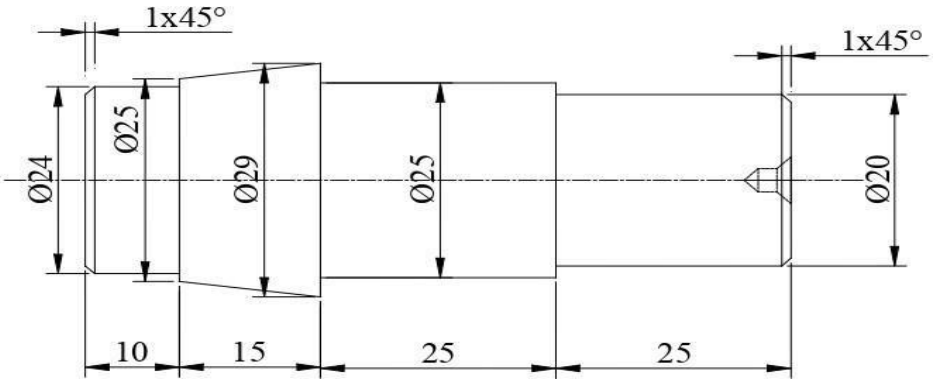
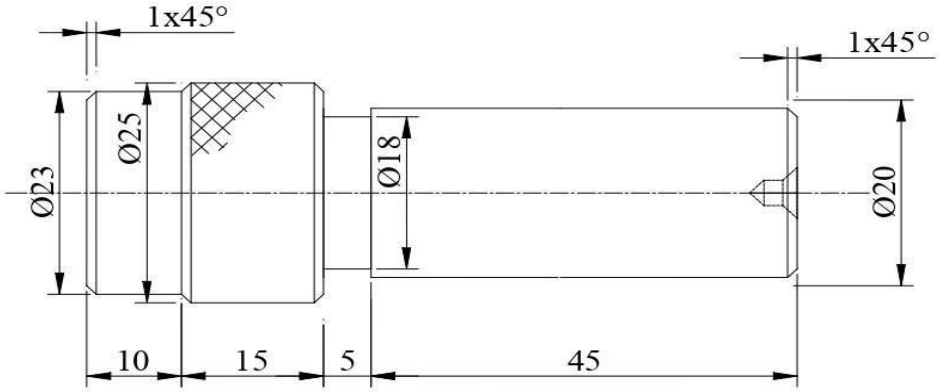
Correlation level 1 – Slight (low)

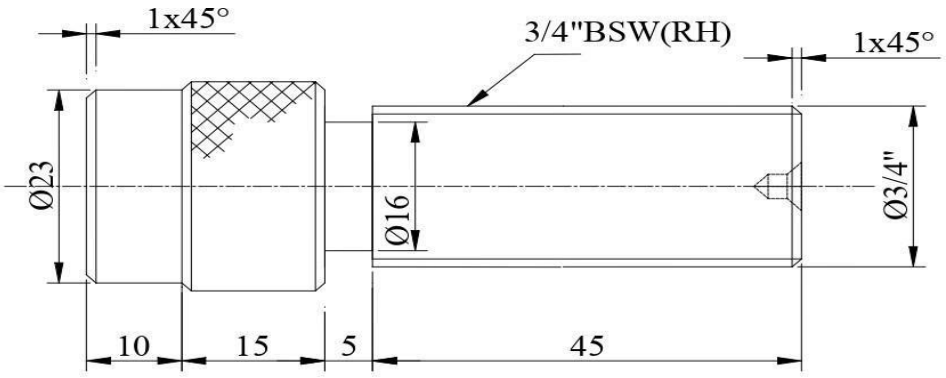
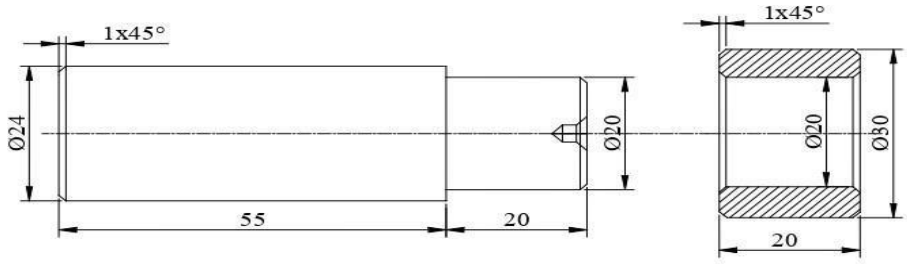
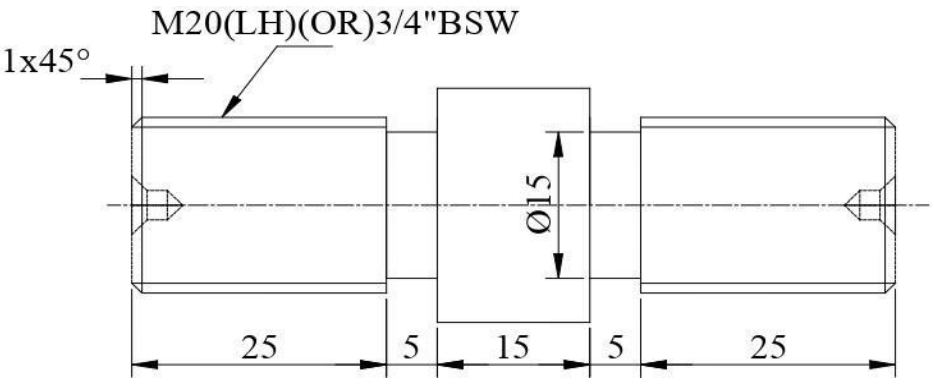
Correlation level 2 – Moderate (Medium)

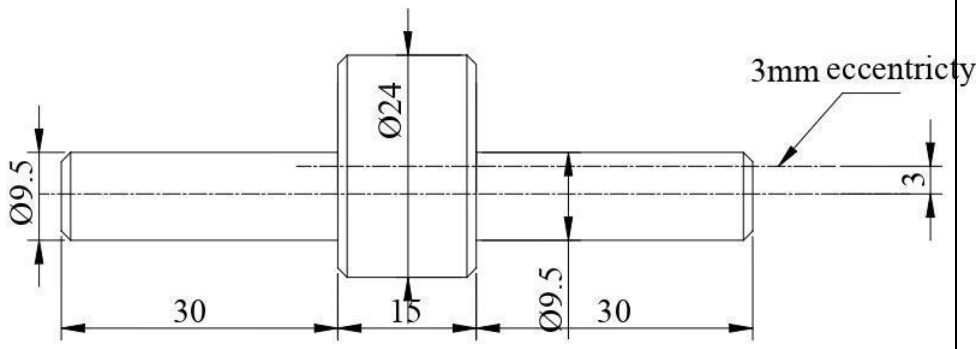
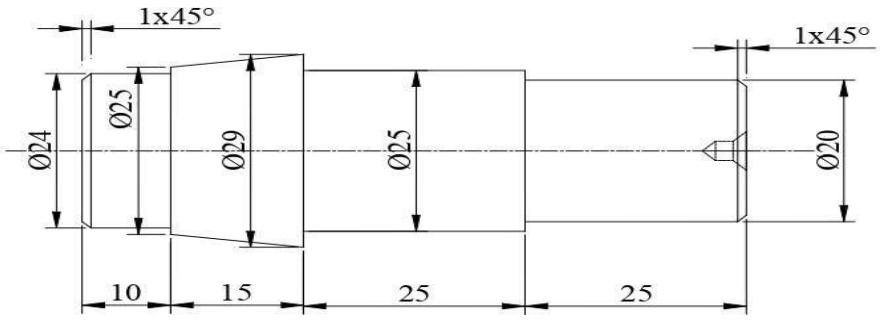
Correlation level 3 – Substantial (high)

MED360- MANUFACTURING TECHNOLOGY - I PRACTICAL

MODEL QUESTION PAPER

S. No	Experiments	CO	PO
1	1. Prepare the specimen and make the Step turning & Taper turning as shown infigure using the Lathe.  2. Prepare the green sand moulding using a one Solid Pattern in the foundry.	D360.2 D360.3	PO1,PO3,PO4,PO7
2	1. Prepare the specimen and make the Step turning & Knurling as shown in figureusing the Lathe.  2. Prepare the green sand moulding using a one Split Pattern in the foundry.	D360.2 D360.3	PO1, PO3, PO4, PO6, PO7

3	1. Prepare the specimen and make the Step turning &BSW Thread cutting as shown in figure using the Lathe.  2. Prepare the green sand moulding using any one Loose Piece pattern in the foundry.	D360.2 D360.3	PO1, PO3, PO4, PO6, PO7
4	1. Prepare the specimen and make the Shaft and Bush as shown in figure using theLathe.  2. Prepare the specimen and make the Lab joint by the Arc Welding (Both sidewelded). (Raw material 25mmX6mm MS flat)	D360.2 D360.4	PO1, PO3, PO4, PO6, PO7
5	1.Prepare the specimen and make the Step turning & BSW and Metric Thread Cutting as shown in figure using the Lathe.  2. Prepare the specimen and make the corner joint by the Gas Welding. (Raw material 25mm X 3mm MS sheet)	D360.2 D360.4	PO1, PO3, PO4, PO6, PO7

6.	1. Prepare the specimen and make the Eccentric turning as shown in figure using the Lathe.  2. Prepare the specimen and make the Butt joint by the Spot welding. (Raw material 25mm X 3mm GI sheet)	D360.2 D360.4	PO1, PO3, PO4, PO6, PO7
7.	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 Butt joint by the Arc Welding (Both side welded). (Raw material 25mmX6mm MS flat)	D360.2 D360.4	PO1, PO3, PO4, PO6, PO7
8	Mini Project	D360.1 to D360.5	PO1,PO3,PO4,PO6, PO7

MED370- 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 Examination	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 marks for result.**

DETAILED ALLOCATION OF MARKS

Part-A :	**40 marks**
Procedure / Preparation	10
Observation / Dimensions	20
Finishing	10
Part-B:	**45 marks**
Procedure / Preparation	10
Observation / Dimensions	25
Finishing	10
Viva-voce :	05
Mini Project	10
Total :	**100**

MINI PROJECT EVALUATION (10 MARKS)

Breakup Details

1	Project Description	**05**
2	Project Demo	**05**
	Total	**10**

COURSE DESCRIPTION:

This course provides knowledge on various metrological equipments available to measure the dimensions of the components and to understand the principles of Measuring Technology in Metrology Practical.

OBJECTIVES:

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

LIST OF EQUIPMENTS(For a batch of 30 students)

S.NO	Name of the Equipments	Required No's
1	Vernier Caliper	2 No's
2	Digital / Dial Vernier Caliper	2 No's
3	Outside micrometer	2 No's
4	Inside Micrometer	2 No's
5	Digital Micrometer	2 No's
6	Slip gauges	2 No's
7	Universal bevel protractor	2 No's
8	Sine bar	2 No's
9	Digital inside micrometer	2 No's
10	Surface plate	2 No's
11	Vernier height gauge	1No
12	Thread Vernier	1 No
13	Thread micrometer	1 No
14	Gear tooth Vernier	2 No's
15	Mechanical comparator	2 No's
16	Dial indicator (0-10)	2 No's
17	Abrasive grinder	1 No
18	Polishing Machine	1 No
19	Mounting machine	1 No
20	Metallurgical microscope	2 No's
21	Magnetic yoke	1 No
22	Liquid penetrant test kit	1 set
23	Consumable	Sufficient quantity

COURSE OUTCOMES

Course	MED370 MEASUREMENT AND METROLOGY PRACTICAL
After successful completion of this course, the students should be able to	
D370.1	Recognize the measuring techniques of metrology instruments.
D370.2	List the least count of measuring instruments.
D370.3	Evaluate the various dimensions using proper measuring instruments.
D370.4	Predict crack on the specimen by using visual inspection or die penetration method or by magnetic particle test.
D370.5	Prepare the record of work for all the exercises.

MED370- MEASUREMENTS AND METROLOGY PRACTICAL

EXERCISES

PART A:

1. Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper.
2. Measure the diameter of a wire using micrometer and compare the result with digital micrometer
3. Measure the thickness of ground MS plates using slip gauges
4. Measure the inside diameter of the bore of a bush cylindrical component using inside micrometer compare the result with digital micro meter.
5. Measure the height of gauge blocks or parallel bars using vernier height gauge.
6. Detect of cracks of the given two specimens using liquid penetrant test and magnetic particle test.
7. Measure the height of cylindrical bush using vernier height gauge

PART B:

8. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
9. Measure the angle of the machined surface using sine bar with slip gauges.
10. Measure the geometrical dimensions of V-Thread using thread micrometer.
11. Measure the geometrical dimensions of spur gear.
12. Find out the measurement of given component and compare with a standard component using mechanical comparator and slip gauge.
13. Prepare a specimen to examine and find the grain structure using the Metallurgical Microscope.
14. Mini Project

    The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

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 or Question paper issued from the Autonomous should be followed.

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

LEARNING WEBSITES

https://nptel.ac.in/courses/112106179/

https://nptel.ac.in/courses/113105024/

https://nptel.ac.in/courses/113106070/

CO – POS & PSOS MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D370.1	3	-	2	2	3	2	3	2	-	3
D370.2	3	-	2	2	3	2	3	2	-	3
D370.3	3	-	2	2	2	2	3	2	-	3
D370.4	3	-	2	2	3	2	3	2	-	3
D370.5	3	-	2	2	2	2	3	2	-	3
D370 Total	15	-	10	10	13	10	15	10	-	15
Correlation Level	3	-	2	2	2.6	2	3	2	-	3

Correlation level 1 – Slight (low)

Correlation level 2 – Moderate (Medium)

Correlation level 3 – Substantial (high)

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MED370- MEASUREMENTS AND METROLOGY PRACTICAL

MODEL QUESTION PAPER

S.No	Experiments	CO	PO
1	1. Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper. 2. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.	D370.1 D370.2	PO4,PO5,PO7
2	1. Measure the diameter of a wire using micrometer and compare the result with digital micrometer 2. Measure the angle of the machined surface using sine bar with slip gauges.	D370.2 D370.1	PO4,PO5,PO7
3	1. Measure the thickness of ground MS plates using slip gauges. 2. Measure the geometrical dimensions of V-Thread using thread micrometer.	D370.3 D370.3	PO2,PO4,PO5,PO7
4	1. Measure the inside diameter of the bore of a bush cylindrical component using inside micrometer compare the result with digital micro meter. 2. Measure the geometrical dimensions of spur gear.	D370.3 D370.1	PO2,PO4,PO5,PO7
5	1.Measure the height of gauge blocks or parallel bars using vernier height gauge 2. Find out the measurement of given component and compare with a standard component using mechanical comparator and slip gauge.	D370.1 D370.1	PO4,PO5,PO7
6	1. Detect of cracks of the given two specimens using liquid penetrant test and magnetic particle test. 2. Prepare a specimen to examine and find the grain structure using the Metallurgical Microscope.	D370.4 D370.4	PO2,PO4,PO5,PO7
7	1. Measure the height of cylindrical bush using vernier height gauge 2. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.	D370.1 D370.2	PO4,PO5,PO7
8.	Mini Project	D360.1 to D360.5	PO1,PO3,PO4, PO6,PO7

MED310 STRENGTH OF MATERIALS

Duration : 3 Hrs				**Max. Marks: 100**	
PART- A (10x3 = 30 Marks)					
Note: Answer all the Questions. All Questions carry equal marks.		**Unit**	**Bloom's level**	**CO**	**PO**
1	What are the uses of steels?	I	R	D310.1	PO1, PO2, PO3
2	Classify composite materials	I	U	D310.1	PO1, PO2, PO3
3	Define thermal stress.	II	R	D310.2	PO1, PO2, PO3
4	Define resilience and proof resilience.	II	R	D310.2	PO1, PO2, PO3
5	State parallel axis theorem.	III	R	D310.3	PO1, PO2, PO3
6	Distinguish between moment of inertia and polar moment of inertia.	III	AN	D310.3	PO1, PO2, PO3
7	State the advantages of hollow shafts over solid shafts.	IV	R	D310.4	PO1, PO2, PO3
8	How the springs are classified?	IV	R	D310.4	PO1, PO2, PO3
9	What are the different types of beams?	V	R	D310.5	PO1, PO2, PO3
10	State the relationship between load, force and bending moment at section.	V	R	D310.5	PO1, PO2, PO3

PART-B (5 X 14 = 70Marks)						
Note: Answer all questions choosing A or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**UNIT**	**Bloom's Level**	**CO**	**PO**
11(A)	i) Explain chemical vapour deposition method of production of Nano layers.	07	I	U	D310.1	PO1, PO2, PO3
	ii) Explain any five market forms of steels.	07	I	U	D310.1	PO1, PO2, PO3
	(OR)					
11(B)	i) Explain Vickers hardness test with neat sketch.	07	I	U	D310.1	PO1, PO2, PO3

	ii) During the tension test on mild steel specimen the following observations were made diameter of mild steel specimen 12mm, gauge length 50 mm yield load 3.4KN, ultimate load 6.1KN breaking load 8 KN. calculate yield stress, ultimate stress and breaking stress	07	1	AN	D310.1	PO1, PO2, PO3
12(A)	i) A cement concrete cube of 150 mm size crushers at a load of 330 7.5 KN determine the working stress if factor of safety is 3.	07	11	EV	D310.2	PO1, PO2, PO3
	ii) A bar of length 150 mm and 50 mm in diameter it is subjected to an axial pullof 400 KN the extension in length and contraction in diameter were found to be 0..25.mm and 0.02 mm respectively. Determine the values of elastic constants.	07	11	U	D310.2	PO1, PO2, PO3
	(OR)					
12(B)	i) Calculate the maximum stress and extension in a bar 2m long and 25 mm diameter when it is subjected to suddenly applied load of 50 KN and E= $2X10^5$ N/mm2.	07	11	U	D310.2	PO1, PO2, PO3
	ii) A weight of 250 N is dropped on to acollar the lower end of a vertical bar 2 metre long and 25 mm in diameter from a height of 100m above calculate the maximum instantaneous stress and extension produced in the section of the bar.and E= $2X10^5N/mm^2$	07	11	U	D310.2	PO1, PO2, PO3
13(A)	i) A cylindrical shell 3m long 500 mm in diameter is made up of 20 mm thick plate if the cylindrical shell is subjected to an internal pressure of 5N/mm2. Find the resulting hoop stress longitudinal stress and changes in length, diameter and volume E= $25X10^5$ N/mm2and 1/m = 0.3.	07	III	An	D310.3	PO1, PO2, PO3
	ii) An angle section of 100 mm wide and 120 mm deep overall both the flanges of the	07	III	Ap	D310.3	PO1, PO2, PO3

	angles are 10 mm thick determine the position of centre of gravity of the section and calculate I_{XX} and I_{YY}.					
	(OR)					
13(B)	i) In a boiler 3m internal diameter is subjected to a steam pressure of 5 bar find the hoop and longitudinal stresses if the thickness of the boiler plateis 14 mm.	07	III	An	D310.3	PO1, PO2, PO3
	ii) T-section of 70 mm wide and 100 mm deep with flanges are 10 mm thick calculate I_{XX} and I_{YY}.	07	III	Ap	D310.3	PO1, PO2, PO3
14(A)	i) A closed coil helical spring is made out of 10mm diameter steel rod. The coil consists of 10 complete turns with a mean diameter of 120 mm. The spring carries an axial pull of 200 N. Find the maximum shear stress induced in the section of te rod. If C = 80 GN/mm2, find the deflection in the spring, the stiffness and strain energy stored in the spring.	07	IV	An	D310.4	PO1, PO2, PO3
	ii) A shaft running at 180 RPM and to transmit 100 KW the shaft should not be stressed beyond 16N/mm2 and should not be twist more than one degree in a length of 3m select a suitable diameter of shaft take E = 0.8X105 N/mm2	07	IV	An	D310.4	PO1, PO2, PO3
	(OR)					
14(B)	i)A truck weighing 30 KN and moving at 5 km per hour has to brought to rest by buffer find how many springs each of 18 coils will be required so the energy of motion during a compression of 200mm the spring is made out of 25 mm diameter Steel rod and to a mean diameter of 240 mm, E = 0.84 X105 N/mm2	07	IV	An	D310.4	PO1, PO2, PO3
	ii) State the assumptions made in theory of pure torsion.	07	IV	R	D310.4	PO1, PO2, PO3

15(A)	i) A simply supported beam 5 metre long carries concentrated loads of 70 KN, 90 KN, 50 KN and 80 KN at a distance 1 m, 3m, 4 m. and 4.5m respectively from the left and support find the support reactions and draw SFD and BMD.	07	V	Ap	D310.5	PO1, PO2, PO3
	ii) State the assumptions made in theory of simple bending.	07	V	R	D310.5	PO1, PO2, PO3
	(OR)					
15(B)	i). A cantilever beam of length 5m loaded by an udl of 2Kn/m throughout the span with a point load of 1 Kn at the free end. Draw the SFD and BMD	07	V	An	D310.5	PO1, PO2, PO3
	ii). A simply supported beam of rectangular section carries a central load of 25 KN over a span of 6m the bending stress should not exceed 7.5 N/mm2 the depth of the section is 400 mm calculate the necessary width of the section	07	V	Ap	D310.5	PO1, PO2, PO3

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% to be included	90%	10%

MED320 – MANUFACTURING TECHNOLOGY – I

MODEL QUESTION PAPER

Duration : 3 Hrs				**Max. Marks: 100**	
PART- A (10x3 = 30 Marks)					
Note: Answer all the Questions. All Questions carry equal marks.		**Unit**	**Bloom's level**	**CO**	**PO**
1.	Why allowances are given in pattern making?	I	R	D320.1	PO1, PO2, PO3
2.	What is core and core print?	I	R	D320.1	PO1, PO2, PO3
3.	Define solid state welding. Give its types.	II	R	D320.2	PO1, PO2, PO3
4.	What is bronze welding? Give its applications.	II	R	D320.2	PO1, PO2, PO3
5.	State the advantages of cold working.	III	R	D320.3	PO1, PO2, PO3
6.	Mention the advantages of hydraulic press.	III	U	D320.3	PO1, PO2, PO3
7.	Compare between thermoplastics and thermosetting plastics.	IV	U	D320.4	PO1, PO2, PO3
8.	Give examples for thermoplastics.	IV	U	D320.4	PO1, PO2, PO3
9.	Write differences between capstan and turret lathe	V	U	D320.5	PO1, PO2, PO3
10.	List out work holding devices used in centre lathe	V	R	D320.5	PO1, PO2, PO3

PART-B (5 X 14 = 70Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**UNIT**	**Bloom's Level**	**CO**	**PO**
11(A)	i) Explain any four types of pattern	7	I	U	D320.1	PO1, PO2, PO3

	ii) Explain various properties of moulding sand	7	I	U	D320.1	PO1, PO2, PO3
	(OR)					
11(B)	i) Explain working of a sand slinger machine with a neat sketch	7	I	U	D320.1	PO1, PO2, PO3
	ii) Illustrate with a neat sketch the working of pressure die casting hot chamber process	7	1	U	D320.1	PO1, PO2, PO3
12(A)	i) Explain TIG welding process with a neat sketch	7	11	U	D320.2	PO1, PO2, PO3
	Explain magnetic particle testing of weld.	7	11	U	D320.2	PO1, PO2, PO3
	(OR)					
12(B)	i) List out safety procedures followed in welding	7	11	R	D320.2	PO1, PO2, PO3
	Sketch and explain Laser beam welding process.	7	11	U	D320.2	PO1, PO2, PO3
13(A)	i) Explain construction and operation of a hydraulic press with a neat sketch.	7	III	U	D320.3	PO1, PO2, PO3
	ii)Explain the following press working operations 1. Bending 2. Curling 3. Blanking 4. Notching	7	III	U	D320.3	PO1, PO2, PO3
	(OR)					
13(B)	i) Illustrate full annealing process with a help of diagram.	7	III	An	D320.3	PO1, PO2, PO3
	ii)Explain briefly 1. Case hardening 2. Cyaniding 3. Nitriding	7	III	U	D320.3	PO1, PO2, PO3
14(A)	i) Explain with a neat sketch the functioning of Plunger type injection mouldingprocess	7	IV	U	D320.4	PO1, PO2, PO3
	22 ii)S ii) Sketch and explain gas injection moulding process.	7	IV	U	D320.4	PO1, PO2, PO3
	(OR)					
14(B)	i) Explain with a neat sketch, the functioning of twin-screw extruder	7	IV	U	D320.4	PO1, PO2, PO3
	ii) Explain with a neat diagram the atomization process for manufacturing of metal powders.	7	IV	U	D320.4	PO1, PO2, PO3

15(A)	i) Describe apron mechanism with sketch	7	V	R	D320.5	PO1, PO2, PO3
	ii) Explain any one types of headstocks briefly	7	V	U	D320.5	PO1, PO2, PO3
	(OR)					
15(B)	i) Briefly explain the construction and working of turret lathe.	7	V	U	D320.5	PO1, PO2, PO3
	ii)Explain with a sketch the working of automatic screw cutting machine	7	V	U	D320.5	PO1, PO2, PO3

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% to be included	90%	10%

MED330 - MEASUREMENTS AND METROLOGY

MODEL QUESTION PAPER

Duration : 3 Hrs				**Max. Marks: 100**	
PART- A (10x3 = 30 Marks)					
Note: Answer all the Questions. All Questions carry equal marks.		**Unit**	**Bloom's level**	**CO**	**PO**
1	State the applications of measurement.	I	R	D330.1	PO1, PO2, PO3
2	What is meant legal metrology?	I	R	D330.1	PO1, PO2, PO3
3	List any four linear measuring instruments	II	U	D330.2	PO1, PO2, PO3
4	List any four angular measuring instrument used in metrology	II	U	D330.2	PO1, PO2, PO3
5	Name the various types of pitch errors found in screw	III	U	D330.3	PO1, PO2, PO3
6	What are the types of gears?	III	R	D330.3	PO1, PO2, PO3
7	What are the advantages of computer aided inspection?	IV	R	D330.4	PO1, PO2, PO3
8	Write short notes on performance of CMM	IV	R	D330.4	PO1, PO2, PO3
9	Name the instruments used for measurement of torque?	V	U	D330.5	PO1, PO2, PO3
10	What are the types of flow meters?	V	R	D330.5	PO1, PO2, PO3

PART-B (5 X 14 = 7Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**UNIT**	**Bloom's Level**	**CO**	**PO**
11(A)	i) Explain the need for inspection and Measurement.	7	I	U	D330.1	PO1, PO2, PO3
	ii)Explain the sources of errors. Compare the systematic error and random error.	7	I	U	D330.1	PO1, PO2, PO3
	(OR)					
11(B)	i) What are the sources of errors?	7	I	U	D330.1	PO1, PO2,

						PO3
	ii) Explain classification of errors.	7	1	U	D330.1	PO1, PO2, PO3
12(A)	i) Explain optical micrometer with neat sketch.	7	11	U	D330.2	PO1, PO2, PO3
	ii) What are the types of sine bar? Explain its uses and limitations	7	11	U	D330.2	PO1, PO2, PO3
	(OR)					
12(B)	i) With a help of a neat sketch explain angle dekkor.	7	11	R	D330.2	PO1, PO2, PO3
	ii) Compare electrical comparators with mechanical comparators	7	11	U	D330.2	PO1, PO2, PO3
13(A)	i) With neat sketches briefly explain Parkinson gear tester.	7	III	U	D330.3	PO1, PO2, PO3
	ii) Explain the function of various types of gauges. Explain floating carriage micrometer	7	III	U	D330.3	PO1, PO2, PO3
	(OR)					
13(B)	i) Discuss measurement of various elements of thread.	7	III	An	D330.3	PO1, PO2, PO3
	ii)Explain the plug screw gauges and ring screw gauges.	7	III	U	D330.3	PO1, PO2, PO3
14(A)	i) Explain Twyman green interferometer with neat sketch.	7	IV	U	D330.4	PO1, PO2, PO3
	ii) Explain the coordinate measuring machine.	**7**	IV	U	D330.4	PO1, PO2, PO3
	(OR)					
14(B)	i) Explain the futures of CMM and causes of errors.	7	IV	U	D330.4	PO1, PO2, PO3
	ii) Write short notes on computer aided inspection using robots.	7	IV	U	D330.4	PO1, PO2, PO3
15(A)	i) Explain the construction and working of laser optical torque measurement.	7	V	R	D330.5	PO1, PO2, PO3
	ii) Write short notes on load cells.	7	V	U	D330.5	PO1, PO2, PO3
	(OR)					

15(B)	i) Explain laser doppler anemometer (LDA) with neat sketch.	7	V	U	D330.5	PO1, PO2, PO3
	ii) Write short note on piezoelectric sensors.	7	V	U	D330.5	PO1, PO2, PO3

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% to be included	90%	10%

MED-340 THERMAL ENGINEERING – I

MODEL QUESTION PAPER

Duration : 3 Hrs			**Max. Marks: 100**		
PART – A (10x3 = 30Marks)					
Note: Answer All The Questions. All Questions carry equal marks.		**Unit**	**Bloom's level**	**CO**	**PO**
1	State the law of conservation of energy	I	R	D340.1	PO1,PO2,PO3
2	Define: Zeroth law of thermodynamics	I	R	D340.1	PO1,PO2,PO3
3	Define: Air standard efficiency	II	R	D340.2	PO1,PO2,PO3
4	State the modes of heat transfer	II	R	D340.2	PO1,PO2,PO3
5	State the types of refrigeration system	III	R	D340.3	PO1,PO2,PO3
6	What is dry bulb and wet bulb temperature?	III	R	D340.3	PO1,PO2,PO3
7	Draw the layout of fuel supply system in petrol engine	IV	U	D340.4	PO1,PO2,PO3
8	What is primary filter and secondary filter?	IV	R	D340.4	PO1,PO2,PO3
9	What are the requirements of good fuels?	V	U	D340.5	PO1,PO2,PO3
10	What is meant by excess air?	V	R	D340.5	PO1,PO2,PO3

	PART-B (5 X 14 = 70 Marks)					
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**Unit**	**Bloom's Level**	**CO**	**PO**
11(A)	(i)State and explain II law of Thermodynamics	7	I	U	D340.1	PO1,PO2,PO3
	(ii)A gas whose pressure, volume and temperature 5 bar,0.23 m3and 185^0C respectively has changed its state at constant pressure until its temperature	7	I	U	D340.1	PO1,PO2,PO3

	becomes70^0C.Determine a)Work done b)Change in internal energy c)The heat transfer redduring the process.TakeR=290 J/kg k and CP=0.005 KJ/Kg k.					
	(OR)					
11(B)	(i) 1kg of gas expands isentropically and its temperature is observed to fall from240^0C to 110^0C while its volume is doubled. The work done by the gas is90 KJ in the process. Determine CP, CV and R for the gas.	7	I	U	D340.1	PO1,PO2,PO3
	(ii) 0.675 kg ofgasat14 bar and 280^0C is expanded to four times the original volume according to law pv1.2=C.Determine a)the initial and final volume of gas b)Final pressure and temperature of gas c)Workdone.R=287J/Kg k.	7	1	U	D340.1	PO1,PO2,PO3
12(A)	(i)In an Otto cycle the pressure and temperature of the air at the beginning of Compression are 97KN/m2and 50respectively.The ratio of compression is5:1.The heat supplied during the cycle is970kJ/kg of the working fluid. Determine (i) maximum temperature of the cycle, (ii) the thermal efficiency of the cycle and (iii) work done during the cycle per kg of working fluid. Assume γ=1.4 and CV=0.717 KJ/kg K	7	11	U	D340.2	PO1,PO2,PO3
	(ii)Discuss about the conduction heat transfer through a plane wall and Composite walls.	7	11	U	D340.2	PO1,PO2,PO3
	(OR)					
12(B)	(i)Find the power output of a diesel engine working on a standard diesel cycle with a compression ratio of16 and airflow rate of0.25kg/s.The initial condition ofairisat1 bar pressure absolute and 27^0Ctemperature.Heat added per cycle is2500kJ/kg.Assume CP=1.0 kJ/kg K and CV=0.714kJ/kgK.	7	11	R	D340.2	PO1,PO2,PO3
	(ii)Derive the steady flow energy equation and state the assumption made in the system analysis	7	11	U	D340.2	PO1,PO2,PO3

13(A)	(i)With a Heat flow diagram explain the working of a vapour absorption refrigeration system.	7	III	U	D340.3	PO1,PO2,PO3
	(ii)A perfect reversed heat engine is used for making ice at-5^0C from water available at 200C.The temperature of brine or freezing mixture is-10^0C. Calculate the quantity of ice formed per kw-hr.Force, specific heats 2.1Kj/kg K and latent heat is 336kJ/kg.	7	III	U	D340.3	PO1,PO2,PO3
	(OR)					
13(B)	(i)Name the psychometric processes and explain anyone process indicating the chart briefly.	7	III	An	D340.3	PO1,PO2,PO3
	(ii)With the help of a line diagram, explain the working of a central Air-conditioning plant.	7	III	U	D340.3	PO1,PO2,PO3
14 (A)	(i)Explain the working of four stroke petrol engine with a neat sketch.	7	IV	U	D340.4	PO1,PO2,PO3
	(ii)What are the different types of nozzles used in diesel engines? .Explain anyone type	7	IV	U	D340.4	PO1,PO2,PO3
	(OR)					
14(B)	(i)Describe with a line diagram of coil ignition system and explain its working.	7	IV	U	D340.4	PO1,PO2,PO3
	(ii)Explain the high pressure lubrication system with a line sketch.	7	IV	U	D340.4	PO1,PO2,PO3
15(A)	(i)With a neat sketch, explain the method of determining the calorific value of Gaseous fuels using Junker's gas calorimeter	7	V	R	D340.5	PO1,PO2,PO3
	(ii) In a boiler trial, the analysis of the coal by weight indicates as follows: Carbon– 60%; Hydrogen– 4.5%; Oxygen– 7.5%; Remaining ash. The dry flue gas has the following compositionbyvolumeCO2– 9%; CO– 1%;N2– 80%;O2-10%.Determine a)weight of the air supplied/kg of coal burnt and b)Percentage of excess air	7	V	U	D340.5	PO1,PO2,PO3
	(OR)					
15(B)	(i)The following results were obtained during a test on a four cylinder four stroke oil engine: Bore– 100 mm,stroke– 115 mm,speed– 1650 rpm; fuel used 0.2kg/min;calorificvalue of fuel– 41900	7	V	U	D340.5	PO1,PO2,PO3

	kJ/kg;Net load on the brake drum– 390N;Circumference of the brake drum– 3.3m; Mechanical efficiency– 80%; Determine a)Brake thermal efficiency b)Indicated thermal efficiency and c)Indicated mean effective pressure					
	(ii)Explain the Morse test for finding out the indicated power of a Multi cylinder engine.	7	V	U	D340.5	PO1,PO2,PO3

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MED410 FLUID MECHANICS & FLUID POWER

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 16 Weeks

Course	Instructions		Examinations			
Fluid Power Mechanics & Fluid Power	**Hrs /Week**	**Hrs/ Semester**	**Marks**			**Duration**
			Internal Assessment	Autonomous Examination	Total	
	5	**80**	**25**	**100***	**100**	**3Hrs**

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

TOPICS AND ALLOCATION OF HOURS:

UNIT	TOPICS	No. of Hours
I	Properties of Fluids & Fluid Pressure	12
II	Fluid Flow, Flow Through Pipes & Impact of Jet	17
III	Hydraulic Turbines, Centrifugal Pumps & Reciprocating Pumps	15
IV	Hydraulic Systems	15
V	Pneumatic Systems	12
Tests and Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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

OBJECTIVES:

On completion of the course the students will be able to

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

COURSE OUTCOMES

Course	**MED410 FLUID MECHANICS AND FLUID POWER**
After successful completion of this course, the students should be able to	
D410.1	Express the knowledge in properties of fluids and pressure measurements
D410.2	Identify the fluid flow, through pipes and impact of jet.
D410.3	Explain the construction and working principle of centrifugal pumps & hydraulic machines
D410.4	Explode knowledge in hydraulic system application and elements
D410.5	Define the pneumatic system application and elements

MED410 FLUID MECHANICS & FLUID POWER

DETAILED SYLLABUS

UNIT -I

PROPERTIES OF FLUIDS AND FLUIDS PRESSURE **[12Hrs]**

CHAPTER 1.1: PROPERTIES OF FLUIDS

Fluid- definition-classification. Properties – density, specific gravity [1Hr]

specific weight, specific volume, dynamic viscosity, kinematic viscosity [1Hr]

surface tension, capillarity, vapour pressure and compressibility [1Hr]

Problems [1Hr]

CHAPTER 1.2:FLUID PRESSURE & ITS MEASUREMENT

Fluid Pressure – Hydrostatic law -Pressure head, Pascal's Law – proof [1Hr]

applications- Hydraulic press- Hydraulic jack. Concepts of absolute, vacuum, [1Hr]

gauge and atmospheric pressures.

Pressure measurements –Simple U tube manometers and differential manometers [2Hrs]

& their types – Problems

Bourdon tube pressure gauge. Pressure sensor technologies- classification only. [2Hrs]

Total Pressure, Centre of pressure on immersed bodies (flat vertical., flat [2Hrs]

vertical)- Problems

UNIT –II

FLOW OF FLUIDS AND FLOW THROUGH PIPES IMPACT OF JETS **[17Hrs]**

CHAPTER 2.1: FLUID FLOW

Types of Fluid flow- Laminar, turbulent, steady, unsteady, uniform, [1Hr]

non-uniform, rotational, irrotational.

Continuity equation, Bernoulli's theorem- assumptions- derivation [1Hr]

applications and limitations- Problems. [1Hr]

VENTURIMETER- Construction- working principle, coefficient of discharge- [1Hr]

derivation for discharge.

ORIFICEMETER- Construction working principle, coefficient of discharge- [1Hr]

derivation for discharge. Problems.

PITOTS TUBE – Construction and working principle only. [1Hr]

CHAPTER 2.2: FLOW THROUGH PIPES

Laws of fluid friction for Laminar and turbulent flow- Darcy's equation [1Hr]

Chezy's equation for frictional losses – Problems. Minor Losses- [2 Hrs]

description. Hydraulic gradient line and Total energy line. Hydraulic [1Hr]

Power transmission through pipes – Flow through pipes in series and parallel [2Hrs]

problems.

CHAPTER 2.3: IMPACT OF JET

Impact of jet on fixed vertical plate - Impact of jet on moving vertical flat [2Hrs]

plates in the direction of jet- Impact of jet on a series of moving plates or [2Hrs]

vanes- Problems on work done and efficiency. [1Hr]

UNIT-III

HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS **[15Hrs]**

CHAPTER 3.1: HYDRAULIC TURBINES

Classification of hydraulic turbines and their applications [1Hr]

Construction and working principle of Pelton wheel, Francis and Kaplan turbine [2Hrs]

Draft tubes – types and construction, Concept of cavitation in turbines, Surge tank and its need. [1Hr]

CHAPTER 3.2:CENTRIFUGAL PUMPS

Construction- Principle of working. Types of casings and impellers [2Hrs]

Concepts of multistage. Priming and its methods [1Hr]

Manometric head, work done, manometric, Mechanical and overall [2Hrs]

Efficiencies- problems

CHAPTER 3.3:RECIPROCATING PUMPS

Construction, working principle and applications of single and double [2Hrs]

Acting reciprocating pumps

Discharge Theoretical power required coefficient of discharge - Problems [2Hrs]

Concepts of slip – negative slip. Cavitation and separation. Use of air vessel. [2Hrs]

Indicator diagram with effect of acceleration head and friction head

UNIT-IV

HYDRAULIC SYSTEMS **[15Hrs]**

CHAPTER 4.1: INTRODUCTION TO FLUID POWER SYSTEMS

Fluid power systems- general layout- components of hydraulic & [1Hr]

Pneumatic systems.

Practical applications of Fluid power systems. [1Hr]

Comparison - Advantages and limitations. [1Hr]

CHAPTER 4.2: COMPONENTS OF HYDRAULIC SYSTEMS

Types, construction, working Principle and symbol of the following [1Hr]

Components Pump – vane, gear and piston pumps

Valves: Pressure Control valves – pressure relief valve, pressure [1Hr]

reducing valve,

Pressure unloading valve. Direction control valve – poppet valve, [2Hrs]

spool valve 3/2, 4/2 & 4/3 DC valves, sequencing valve. Flow control valve

pressure compensated – non pressure compensated. Actuators [2Hrs]

Linear actuators – single acting & double acting – rotory actuators [1Hr]

Hydraulic motors. Accessories - intensifiers & Accumulators [1Hr]

CHAPTER 4.3: HYDRAULIC CIRCUITS

Double acting cylinder with Meter in, Meter out circuits, Pump unloading cut [1Hr]

Bleed off circuit, sequencing circuit. [1Hr]

Hydraulic circuits for milling machine, shaping machine. [2Hrs]

Motion synchronization circuit.

UNIT-V

PNEUMATIC SYSTEMS [12Hrs]

CHAPTER 5.1: COMPONENTS OF PNEUMATIC SYSTEMS

Types, construction, working Principle and symbol of the following components. Compressor – Reciprocating & Rotary Compressors [2 Hrs]

Valves- Pressure Control valves – pressure relief valve, pressure regulating valves. Direction control valves – 3/2, 5/2 & 5/3 DC valves, sequencing valve. Flow control valve – throttle valves – shuttle valves- quick exhaust valves. [2 Hrs]

Actuators – Linear actuators – single acting & double acting – rotary actuator air motors [2 Hrs]

Accessories - FRL unit, intensifiers & Accumulators. [2Hrs]

CHAPTER 5.2: PNEUMATIC CIRCUITS

Double acting cylinder with Meter in, Meter out circuits, [2Hrs]

speed control circuit and sequencing circuit. [2Hrs]

Tests And Model Exam **[9Hrs]**

TEXT BOOKS

Sl.No	Text Book	Author	Publisher /Edition
1	Fluid Mechanics and Hydraulic Machines	R.S. Khurmi	S.Chand & Co/18th
2	Fluid Mechanics and Hydraulic Machines	R. K Bansal	Rajput and S.Chand

REFERENCE BOOKS

Sl.No	Text Book	Author	Publisher /Edition
1	Hydraulic Machines,	R. K Bansal	Rajput and S.Chand

	Jagadishlal		
2	Hydraulic Machines,	Jagadishlal	LaxmiPublications

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112104117/33
2. https://nptel.ac.in/courses/112105182/
3. https://nptel.ac.in/courses/112102011/2
4. https://nptel.ac.in/courses/112105171/

CONTINUOUS INTERNAL ASSESSMENT

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

i) Attendance - 5 Marks
ii) Test - 10 Marks
iii) Assignment - 5 Marks
iv) Seminar - 5 Marks

Total - 25 Marks

CO- POs & PSOs MAPPING MATRIX

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D410.1	3	2	2	2	-	2	3	2	3	2
D410.2	3	2	2	2	-	2	3	2	3	2
D410.3	3	2	2	2	-	2	3	2	3	2
D410.4	3	2	2	2	-	2	3	2	3	2
D410.5	3	2	2	2	-	2	3	2	3	2
Total	15	10	10	10	-	10	15	10	15	10
Correlation Level	3	2	2	2	-	2	3	2	3	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED420 MANUFACTURING TECHNOLOGY-II

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 16 Weeks

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

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

TOPICS AND ALLOCATION OF HOURS:

UNIT	TOPICS	No of Hours
1	Theory of Metal Cutting, Drilling Machine & Abrasive Process	15
2	Reciprocating Machines and Broaching Machine	14
3	Milling Machines and Gear Generating Processes	14
4	Unconventional Machining Processes	14
5	CNC Machine and CNC Programming	14
Tests and Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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

OBJECTIVES:

On completion of the course the students will be able to

- 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 OUTCOMES

Course	**MED420 MANUFACTURING TECHNOLOGY-II**
After successful completion of this course, the students should be able to	
D420.1	Describe metal cutting, Drilling Machines, Abrasive process
D420.2	Ability to explain the structures and operations in reciprocating machines
D420.3	Define the milling machines and gear generating process
D420.4	Understand the unconventional machining processes
D420.5	Describe CNC machines and its components

MED420 MANUFACTURING TECHNOLOGY-II

DETAILED SYLLABUS

UNIT-I

THEORY OF METAL CUTTING, DRILLING MACHINE & ABRASIVE PROCESS [15Hrs]

CHAPTER: 1.1: THEORY OF METAL CUTTING

Introduction – orthogonal cutting – oblique cutting – single point cuttingtool [2Hrs]

Nomenclature – types of chips – chip breakers – cutting tool materials – properties [1Hr]

Tool wears – factors affecting tool life – cutting fluids – functions – properties of cutting Fluid [1Hr]

CHAPTER: 1.2:DRILLING MACHINES

Drills – flat drills – twist drills – nomenclature of twist drill – types of drilling machines [1Hr]

bench type – floor type – radial type – gang drill –multi spindle type – principle of operation in drilling [1Hr]

methods of holding drill bit – drill chucks – socket and sleeve [1Hr]

Drilling operation – reaming,counter sinking, counter boring, spot facing, tapping and deep hole drilling.

CHAPTER: 1.3: ABRASIVE PROCESS

Types and classification – specifications – rough grinding – pedestal grinders – portable grinders – belt grinders [1Hr]

Precision grinding – cylindrical grinder – centerless grinders - surface grinder – tool cutter grinder – planetary grinders [2Hrs]

principles of operations – grindingwheels – abrasives – natural and artificial diamond wheels [1Hr]

types of bonds – grit, grade and structure of wheels – wheel shapes and sizes [1Hr]

standard marking systems of grinding wheels – selection of grinding wheel – mounting of grinding wheels – dressing and truing of wheels – balancing of grinding wheels- Thermal Aspects. [1Hr] [2Hrs]

UNIT-II

RECIPROCATING MACHINES **[14Hrs]**

CHAPTER: 2.1: PLANER

Introduction – description of double housing planner – specifications –principles of operation [2Hrs]

drives – quick return Mechanism – feed Mechanism – operations. [2Hrs]

CHAPTER: 2.2:SHAPER

Introduction – specifications – principles of operations – standard shaper [2Hrs]

quick return Mechanism – crank and slotted link – hydraulic shaper – feed Mechanism – operations. [2Hrs]

CHAPTER: 2.3: SLOTTER

Introduction - specifications – method of operation – whitworth quick return Mechanism [2Hrs]

feed Mechanism – types of tools. [1Hr]

CHAPTER: 2.4: BROACHING

Types of broaching machine – horizontal, vertical and continuous broaching principles of operation [2Hrs]

types of broaches – classification –broach tool nomenclature – broaching operations [1Hr]

UNIT -III

MILLING MACHINES AND GEAR GENERATING PROCESSES **[14 Hrs]**

CHAPTER: 3.1: MILLING MACHINES

Types – column and knee type, plain, vertical and universal milling machines – principles of operation [2Hrs]

specification of milling machines –work holding devices – tool holding devices – arbor – stub arbor – springcollet – adaptor. [3Hrs]

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 [3Hrs]

Milling operations – straddle milling - gang milling – vertical milling attachment. Indexing plate – differential indexing – simple indexing and compound indexing – simple problems. [2Hrs]

CHAPTER: 3.2:GENERATING PROCESSES

Gear shaper – gear hobbing – principle of operations only. [2Hrs]

Gear finishingprocesses – burnishing – shaving – grinding and lapping [2Hrs]

gear materials.

UNIT -IV

UNCONVENTIONAL MACHINING PROCESSES **[14Hrs]**

CHAPTER: 4.1: MECHANICAL ENERGY BASED PROCESS

Introduction – classification – process selection – advantages – limitations – demerits of conventional processes Mechanical energy based process [2Hrs]

Introduction – abrasive jet machining – metal removalrate process parameters – water jet machining – hydrodynamic jet machining [2Hrs]

ultrasonic machining process – advantages – disadvantages – applications – compare ultrasonic machining with traditional abrasive machining. [2Hrs]

CHAPTER: 4.2: ELECTRICAL ENERGY BASED PROCESSES

Introduction – electrical discharge machine (EDM) – flushing system in EDM – tool (electrode) materials [2Hrs]

tool wear – metal removal rate andsurface finish - factors affecting the metal removal rate [1Hr]

Advantages –disadvantages – applications – wire cut EDM features of wire cut EDM – difference between EDM and wire cut EDM. [2Hrs]

CHAPTER:4.3: THERMAL ENERGY BASED PROCESSES

Introduction – electron beam machining – laser beam machining – lasing materials – machining applications of laser – plasma arc machining [1Hr]

gases used in plasma arc machining – types of plasma arc torches – advantages – disadvantages – applications. [2Hrs]

UNIT -V

CNC MACHINE AND ITS COMPONENTS **[14Hrs]**

CHAPTER: 5.1: CNC MACHINES

Numerical control – definition – working principle of a CNC system – features of CNC machines – advantages of CNC machines – difference between NC and CNC [2Hrs]

construction and working principle of turning centre – construction and working principle of machining centre [2Hrs]

machine axes conventions turning centre and machining centre – co- ordinate measuring machine – construction and working principle. [2Hrs]

CHAPTER: 5.2: COMPONENTS OF CNC MACHINE

Slide ways – requirement – types – friction slide ways and anti-friction slide ways – linear motion bearing [2Hrs]

Recirculation ball screw – ATC – toolmagazine – feedback devices – linear and rotary transducers – encoders - in process probing – tool material – tool inserts. [1Hr]

CHAPTER: 5.3:CNC PROGRAMMING:

Introduction – Cartesian coordinate system – Polar coordinate system – Absolute and incremental positioning – Purpose of G and M codes. [2Hrs]

Basic codes – basic CNC program. CNC turning program using linear interpolation and circular interpolation. [1Hr]

Machine control panel – Homing position – Offset setting – Auto. CNC milling program using linear interpolation and circular interpolation. [1Hr]

Compensation – Machine control panel – Home position – Work offset setting procedure – Tool offset. [1Hr]

Tests And Model Exam [9Hrs]

TEXT BOOKS

Sl.No	Text Book	Author	Publisher /Edition
1	Elements of Workshop Technology	II, Hajra Choudry & Battacharya	Media Promoters and Publishers Pvt. Ltd 11^{th}
2	Production Technology	Jain & Gupta	Khanna Publishers/

REFERENCE BOOKS

Sl.No	Text Book	Author	Publisher /Edition
1	Production Technology,	-	Tata McGraw Hill Publishing Co. Ltd./18th
2	Manufacturing processes	Myro N Begman	Tata McGraw Hill Publishing Co. Ltd./18^{th}
3	Workshop Tech	WAJ Chapman	Viva Books Pvt Ltd / I,II.III
4	Production Processes	NITTR	Tata McGraw Hill Publishing Co. Ltd./^{h}

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112105126/20
2. https://nptel.ac.in/courses/112105127/pdf/LM-20.pdf
3. https://nptel.ac.in/courses/112105126/33
4. https://nptel.ac.in/courses/112106137/pdf/2_5.pdf
5. https://nptel.ac.in/courses/112105211/

CONTINUOUS INTERNAL ASSESSMENT:

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

(i)	Attendance	-	5 Marks
(i)	Test	-	10 Marks
(ii)	Assignment	-	5 Marks
(iii)	Seminar	-	5 Marks

	TOTAL	-	**25 Marks**

CO- POs & PSOs MAPPING MATRIX

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D420.1	2	-	2	3	-	2	3	3	2	2
D420.2	2	-	2	3	-	2	3	3	2	2
D420.3	2	-	2	3	-	2	3	3	2	2
D420.4	2	-	2	3	-	2	3	3	2	2
D420.5	2	-	2	3	-	2	3	3	2	2
D420 Total	10	-	10	15	-	10	15	15	10	10
Correlation Level	2	-	2	3	-	2	3	3	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

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MED430 ELECTRICAL DRIVES AND CONTROL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 16 Weeks

Course	Instructions		Examinations			
Electrical Drives and Control	Hrs /Week	Hrs/ Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
	5	80	25	100*	100	3Hrs

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

TOPICS AND ALLOCATION OF HOURS:

UNIT	TOPICS	TIME (HRS)
I	Dc Circuits and Dc Machines	15
II	Ac Circuits and Ac Machines	14
III	Special Machines & Drives	14
IV	Power Supplies, Control Elements and Electrical Safety	14
V	Display Devices, Logic Gates and PLC	14
Tests and Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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

OBJECTIVES:

On completion of the course the students will be able to

- Explore fundamental electric circuit laws.
- Explain the working principle of DC and AC Electrical machines.
- Identify the effective uses of drives of Electrical machines.
- Analyze the various power supply circuits.
- Select the field controlled elements.

COURSE OUTCOMES

Course	**MED430 ELECTRICAL DRIVES AND CONTROL**
After successful completion of this course, the students should be able to	
D430.1	Learnt about the direct current circuits, construction of DC circuits and DC machines
D430.2	Understood the fundamentals of AC circuits, transformers and AC machines
D430.3	Gaining the knowledge about special machines and drives.
D430.4	Understood the power supplies, control elements and electrical safety.
D430.5	Having the knowledge about the display device, logic gates and PLC

MED430 ELECTRICAL DRIVES AND CONTROL

DETAILED SYLLABUS

UNIT-I
DC CIRCUITS AND DC MACHINES [15Hrs]

CHAPTER:1.1

Definition- Electric current, voltage and resistance -Ohm's law [2Hrs]

Kirchhoff's law. Resistance in series, parallel and series parallel– simple problems [2Hrs]

electromagnetism (definitions only) –magnetic flux, [1Hr]

flux density magnetic field intensity, MMF, permeability, reluctance [2Hrs]

Faraday's law of induction, electromagnetic, electrical and Mechanical Units [2Hrs]

CHAPTER:1.2

DC generators – construction, principle of operation, types and Applications. [2Hrs]

DC motors: - construction, principle of operation, types and application. [2Hrs]

Necessity of starters: Three point, four point starters. [2Hrs]

UNIT-II

AC CIRCUITS AND AC MACHINES [14Hrs]

CHAPTER:2.1

Fundamentals of AC voltage, and current – peak, average, RMS [1Hr]

value of sine wave, frequency, time period, amplitude, power and [2Hrs]

power factor (definition only)- [1Hr]

Transformer: Principle of operation and construction –EMF equation [2Hrs]

(no definition)- losses in Transformer –efficiency –application

Alternator construction -– principle of operation and applications. [2Hrs]

CHAPTER:2.2

AC machine: AC motors- Principle of operation of single phase

capacitor start induction motor- universal motor - applications [2Hrs]

Three phase induction motors –Squirrel cage and slip ring Induction

motors (construction and working principle only) - application – [2Hrs]

speed control of 3Φ -Induction motor–DOL and star/delta starter [2Hrs]

UNIT-III

SPECIAL MACHINES & DRIVES [14Hrs]

CHAPTER:3.1

PMDC, Stepper motor- construction and working principle and [2Hrs]

applications - Servo motor –types: [1Hr]

permanent magnet servo motor construction and applications [2Hrs]

brushless servo motor construction and applications. [1Hr]

CHAPTER:3.2

Industrial drives- types, group drive, individual drive, multi motor drive [2Hrs]

block diagram of Variable frequency drive (VFD), [2Hrs]

stepper motor drive single stepping and half stepping Servo drives. [2Hrs]

DC Servo drive, AC Servo drive and BLDC servo drive. [2Hrs]

UNIT-IV

POWER SUPPLIES, CONTROL ELEMENTS AND ELECTRICAL SAFETY **[14Hrs]**

CHAPTER:4.1

Rectifiers – half wave and full wave bridge rectifiers – [2Hrs]

necessity of filters- Regulated power supplies: IC voltage regulators – batteries [2Hrs]

Working constructions, maintenances and trouble shooting. [2Hrs]

CHAPTER:4.2:

Fuses –selection of fuse –necessity of fuse- fuse switch units. [1Hr]

Sensors -Photo electric sensor, Inductive proximity sensors, Temperature sensors. Contactor-solenoid type contactor. [2Hrs]

CHAPTER: 4.3:

Circuit breakers – Miniature case Circuit breaker (MCB) and Earth leakage circuit breaker (ELCB) , SMPS, Energy conservation [2Hrs]

Electrical safety: - importance of earthing - electric shock: first aid, [2Hrs]

precautions - causes of accident and their preventive measures [1Hr]

UNIT-V

CONTROL ELEMENTS AND PLC **[14Hrs]**

CHAPTER:5.1:

Display devices –LED, 7 segment LED, LCD. Application [4Hrs]

CHAPTER:5.2

Logic gates: Positive and Negative Logic, Definition, Symbol and truth table. Boolean expression for OR, AND, NOT, NOR, NAND, EXOR AND [3Hrs]

EXNOR gates –Universal logic Gates: NAND, and NOR [2Hrs]

CHAPTER:5.3

Features of PLC-PLC Block diagram- PLC scan. Fixed and modular PLC ladder logic- NO,NC contacts- coils- AND logic, OR logic. [5Hrs]

Tests and model exam **[9Hrs]**

TEXT BOOKS:

Sl No.	Title	Author	Publisher with Edition
1.	Fundamentals of Electrical and Electronics Engineering	B.L. Theraja	Edn. 11, g, S.Chand & Co.
2.	Fundamentals of Electrical and Electronics Engineering	T. Thiyagarajan	Scitech Publications (India) Pvt.ltd.

REFERENCE BOOKS:

Sl No.	Title	Author	Publisher with Edition
1.	Automation, Production System and Computer Integrated Manufacturing	Mikell P. Groover	Edn. 2 published by Pearson Education (Singapore) Pte. Ltd., Indian Branch, 2842 F.I.E., Patparganj, Delhi 110 002, India.
2.	Electrical Design Estimating and Costing	KB Raina & S.K.Battachariya	Edn. 6, Tata McGraw Hill Publishing Co., 7, West Patel Nagar, New Delhi 110 008

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/108104011/
2. https://nptel.ac.in/courses/108102046/
3. https://nptel.ac.in/courses/108108077/

CONTINUOUS INTERNAL ASSESSMENT:

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

(i) Attendance - 5 Marks
(ii) Test - 10 Marks
(iii) Assignment - 5 Marks
(iv) Seminar - 5 Marks

TOTAL - 25 Marks

CO- POs & PSOs MAPPING MATRIX

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D430.1	3	-	-	2	-	2	3	2	2	2
D430.2	3	-	-	2	-	2	3	2	2	2
D430.3	2	-	2	2	-	2	3	2	2	2
D430.4	3	-	-	2	-	2	3	2	2	2
D430.5	3	-	2	2	-	2	3	2	2	2
D430 Total	14	-	4	10	-	10	15	10	10	10
Correlation Level	2.8	-	2	2	-	2	3	2	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

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MED440- PRODUCTION AND QUALITY MANAGEMENT

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours/ Semester	Internal Assessment	Autonomous Examination	Total	
Production And Quality Management	5	80	25	100*	100	3 Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	No of Hours
I	Process Planning and Selection	15
II	Basic Concepts of Total Quality Management	14
III	TQM Tools	14
IV	Statistical Fundamentals & Charts	14
V	Lean Manufacturing Concepts	14
Tests and Model Exam		09
TOTAL		**80**

COURSE DESCRIPTION

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

OBJECTIVES

On completion of the course the students will be able to

- Understand the process planning.
- Study the process selection.
- Define quality and appreciate its signature.
- Explain the concept of TQM.
- Appreciate the use of principles of TQM to meet customer satisfaction.
- Solve problem using the Quality control tools.
- Apply Brainstorming and quality circle to solve problems.
- Use PDCA cycle for continuous improvement.

COURSE OUTCOMES:

Course	**MED440- PRODUCTION AND QUALITY MANAGEMENT**
After successful completion of this course the students should be able to	
D440.1	Explain the types process planning and to explain the selection procedure
D440.2	Describe the total quality management methods
D440.3	Know the knowledge of TQM tools.
D440.4	Describe the Statistical Fundamentals & Charts methods.
D440.5	Describe the Lean Manufacturing Concepts.

MED440- PRODUCTION AND QUALITY MANAGEMENT

DETAILED SYLLABUS

UNIT I- PROCESS PLANNING AND SELECTION **[15hrs]**

CHAPTER 1.1 PRODUCTION

Types of Production – Mass production, batch production and job order production [2hrs]

CHAPTER 1.2 PROCESS PLANNING

Introduction – concept – Information required to do process planning – factors affecting process planning [1Hr]

Process planning procedure – Make (or) Buy decision using Break Even Analysis – simple problems. Manual process planning [2hrs]

Introduction of Automated process planning and generator process planning [1Hr]

Advantage of computer aided process planning – Principle of line balancing – need for line balancing [1hr]

Value Engineering –Definition – cost control vs cost reduction [1Hr]

Value analysis when to do – steps information needed – selection of product. [1Hr]

CHAPTER 1.3 PROCESS SELECTION

Process selection – technological choice – specific component choice – Process flow choice [2hrs]

Factors affecting process selection– machine capacity – analysis of machine capacity [1Hr]

Process and equipment selection procedure – Determination of man, machine and material requirements – simple problems [1hr]

selection of material – jigs – fixtures etc. – Factors influencing choice of machinery [1Hr]

Selection of machinery – simple problems –Preparation of operation planning sheet for simple components. [1hr]

UNIT II- BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT **[14hrs]**

Quality-Definitions – Dimensions of quality – Brainstorming and its objectives [2Hrs]

Introduction to TQM - Characteristics – Basic concepts – Elements [2hrs]

Pillars – Principles – Obstacles to TQM implementation - Potential benefits of TQM [2Hrs]

Quality council – duties – Responsibilities - Quality statements [2hrs]

Vision – Mission – Quality policy statements – Strategic planning [2hrs]

Seven steps to strategic planning – Deming philosophy [2Hrs]

Customer – Input / Output process model – Juran Trilogy - PDCA (Deming Wheel) cycle. [2Hrs]

UNIT III- TQM TOOLS **[14hrs]**

CHAPTER 3.1 SEVEN TOOLS OF QUALITY CONTROL (Q 7 TOOLS)

Check sheet – Types of check sheet – Histogram [2hrs]

Cause and effect diagram – Pareto diagram –Stratification Analysis [2hrs]

Scatter diagram-Graph/run charts – Control charts [2hrs]

Construction of above diagrams. Quality circle – concept of quality circle [2hrs]

Organization of Quality circle and objectives of Quality circle. Zero Defect Concepts. [2Hrs]

CHAPTER 3.2 MANAGEMENT PLANNING TOOLS (M 7 TOOLS)

Affinity diagram – Radar Diagram – Inter Relationship diagram (Inter Relationship diagram) [2Hrs]

Tree diagram – Prioritization matrix – Matrix diagram – Decision tree [1hrs]

Arrow diagram – Matrix data analysis diagram – Construction of above diagrams. [1hrs]

UNIT IV- STATISTICAL FUNDAMENTALS AND CONTROL CHARTS [14hrs]

CHAPTER 4.1 STATISTICAL FUNDAMENTALS

Types of Data – Collection of Data – Classification of Data – Tabular presentation of Data [2hrs]

Graphical representation of a frequency distribution – Comparison of Frequency distribution [2hrs]

Mean - Median – Mode – Comparison of measures of central tendency [1hr]

Introduction to measures of dispersion – Sample – sampling [1Hr]

Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems. [2hrs]

CHAPTER 4.2 CONTROL CHARTS

Control chart – Types of control charts – Control chart for variables – Construction of X bar and R charts [2hrs]

control limits Vs specification limits – N Process capability [1hr]

Method of doing process capability Analysis – Measures of process capability – Problems. [1hr]

Attributes – Control charts - P chart – np chart – c chart – u chart [1Hr]

Construction of above diagrams – Problems – Comparison between variable chart and Attribute chart. [1hr]

UNIT V – LEAN MANUFACTURING CONCEPTS [14hrs]

5S Concepts (SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE) [2hrs]

needs and objectives – effective implementation of 5S concepts in an organization [2hrs]

Housekeeping – Kaizen – Kanban System. Bench marking - Objectives of bench marking [2hrs]

Types – Benchmarking process – Benefits of Bench marking [2hrs]

Pit falls of Benchmarking-Just In Time(JIT) concepts and its objectives [1hr]

Total Productive Maintenance (TPM) – Introduction, Objectives of TPM –steps in implementing TPM. [1hr]

Overall Equipment Effectiveness(OEE)–Lean Six Sigma – Value Stream Mapping [2hrs]

DMAIC(Define, Measure, Analyse, Improve, Control) – DMADV (Define , Measure, Analyse, Design, Verify) [2Hrs]

Tests and model [9Hrs]

TEXT BOOKS

Sl.No	Title	Author	Publisher & Edition
1	A Text Book of quality management.	Panneerselvam R	PHI Learning
2	Handbook of Managing Apparel Production and Quality	B. Purushothama	Woodhead Publishing
3	Production and Operations Management	Virender S Poonia	Gen Next Publication

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Industrial Engineering & Management	O.P Khanna	-
2	Industrial Engineering & Production Management	Mart and Telsang	-
3	Total Quality Management,	Date H.Besterfiled,	Pearson Education Asia.
4	Total Quality Management	V.Jayakumar	Lakshmi Publications (reprint 2005)
5	Training manual on ISO 9001 : 2000 & TQM	Girdhar J.Gyani	Raj Publishing House, Second Edition 2001
6	Quality Management	Howard Cuitlow	Tata Mc Graw Hill, 1998
7	Production Engineering	P.C.Sharma.	-
8	Mechanical Estimating and Costing	Banga & Sharma.	-
9	Total Quality Management	Oakiand.J.S	Butterworth Heinemann Ltd. Oxford1989.
10	Total Quality Management for engineers	Zeiri	Wood Head Publishers. 1991

LEARNING WEBSITES:

1. https://nptel.ac.in/downloads/
2. https://en.wikipedia.org/wiki/Total_quality_management
3. https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
4. https://en.wikipedia.org/wiki/International_Organization_for_Standardization
5. https://en.wikiversity.org/wiki/Production_engineering
6. https://www.investopedia.com/terms/q/quality-management.asp
7. https://en.wikipedia.org/wiki/Industrial_engineering

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D440.1	2	2	-	-	2	2	2	2	3	-
D440.2	2	2	-	-	2	2	2	2	3	-
D440.3	2	2	-	-	2	2	2	2	3	-
D440.4	2	2	-	-	2	2	2	2	3	-
D440.5	2	2	-	-	2	2	2	2	3	-
D440 Total	10	10	-	-	10	10	10	10	15	-
Correlation level	2	2	-	-	2	2	2	2	3	-

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTIONS PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED450-STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks/ Semester: 16 Weeks

Subject	Instruction		Examination			
	Hrs/ Week	Hrs/ Semester	Marks			Duration
Strength of Materials and Fluid Mechanics Practical	4	64	Internal Assessment	Autonomous Examination	Total	
			25	100*	100	3Hrs

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

DETAILED ALLOCATION OF MARKS

Strength of Material lab		
Part A	**-**	**40 marks**
Procedure / Observation	-	10
Tabulation / Calculation	-	20
Result / Graph	-	10
Fluid Mechanics lab		
Part B	**-**	**45 marks**
Procedure / Observation	-	10
Tabulation / Calculation	-	25
Result / Graph	-	10
Viva-voce	**-**	**05marks**
Mini project	**-**	**10marks**
Total	**-**	**100 marks**

Mini Project Evaluation (10 marks)

Breakup Details

1	Project Description	05
2	Project Demo	05
TOTAL		10

COURSE DESCRIPTION:

Strength of Material is deals with the understanding of the structure, physical and mechanical properties and behavior of engineering materials is at very core of engineering design. A command of this knowledge is essential for all Mechanical engineers. On completion of the course, the student will be familiar with, Study of UTM, torsion testing machine, hardness testing machine. Fluid Mechanics is deals with Measuring the fluid pressure using manometers Determination of pipe friction factor and co efficient of discharges of orifice, mouthpiece, orifice meter, venturimeter. Drawing characteristics curves for centrifugal and reciprocating pumps**.**

OBJECTIVES

On completion of the course the students will be able to

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

EQUIPMENTS REQUIRED(For a batch of 30 students)

Sl.No	Name of the equipment	Required Nos.
1	UTM	01
2	Rockwell's Hardness Testing machine	01
3	Torsion Testing machine	01
4	Impact Testing machine	01
5	Spring Testing machine	01
6	Shear Testing machine	01
7	Vernier Caliper	02
8	Bernoulli's Apparatus	01
9	An Open tank fitted with an external mouth piece and a collecting tank with Piezometer	01
10	An arrangement to find friction factor of pipe	01

11	A reciprocating pump with an arrangement for collecting data to find out the efficiency and plot the characteristics curves.	01
12	A impulse turbine with an arrangement for calculating data to find out the efficiency	01
13	An arrangement Venturimeter fitted in horizontal water pipe line to find coefficient of discharge.	01

COURSE OUTCOMES

Course	**MED450 STRENGTH OF MATERIALS AND FLUID POWER PRACTICAL**
After successful completion of this course, the students should be able to	
D450.1	Acquire skills on different types of testing methods of metals.
D450.2	Conduct material testing on elasticity, hardness, shear strength
D450.3	Determine modulus of rigidity of open spring and closed coil springs.
D450.4	Calibrate flow discharge measuring device used in pipes, channels and tanks.
D450.5	Test the performance of pumps, turbines and develop the mini projects with report.

MED450-STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

List of experiments to be conducted

Ex.1	Finding Young's Modulus of Elasticity, yield points, percentage elongation and reduction in area, stress strain diagram plotting, tests on mild steel.
Ex.2	Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.
Ex.3	Torsion test on mild steel – relation between torque and angle of twist-determination of shear modulus and shear stress
Ex.4	Finding the resistance of materials to impact loads by Izod test and Charpy test.
Ex.5	Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)
Ex.6	Single or double shear test on M.S. bar to finding the resistance of material to shear load.
Ex.7	Deflection test on beams
Ex.8	Verify the Bernoulli's. Theorem
Ex.9	Determination of co-efficient of discharge of a mouth piece by variable head method.
Ex.10	Determination of co-efficient of discharge of a Venturimeter.
Ex.11	Determination of the friction factor in a pipe.
Ex.12	Performance test on reciprocating pump and to draw the characteristics curves.
Ex.13	Performance test on impulse turbine and to find out the Efficiency.
Ex.14	Mini project The mini project is activity based and it may be given to group of maximum of six students for hands on experience

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c) Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

AUTONOMOUS EXAMINATION

Note:

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

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112107146/
2. https://nptel.ac.in/courses/112107146/2
3. https://nptel.ac.in/courses/112104117/
4. https://nptel.ac.in/courses/112105182/
5. https://nptel.ac.in/courses/112104117/33

CO – PO & PSO'S MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D450.1	2	2	2	2	-	2	3	2	3	3
D450.2	2	2	2	3	-	2	3	2	3	3
D450.3	2	2	3	2	-	2	3	2	3	3
D450.4	2	2	3	3	-	2	3	2	3	3
D450.5	2	2	2	3	-	2	3	2	3	3
D450 Total	10	10	12	13	-	10	15	10	15	15
Correlation Level	2	2	2.4	2.6	-	2	3	2	3	3

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

****

MED450-STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL

MODEL QUESTION PAPER

PART – A STRENGTH OF MATERIALS			
S.No	**EXPERIMENTS**	**CO**	**PO**
1	Finding Young's Modulus of Elasticity, yield points, percentage elongation and reduction in area, stress strain diagram plotting, tests on mild steel.	D450.1	PO1,PO3 ,PO7
2	Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.	D450.1	PO1,PO3 ,PO7
3	Torsion test on mild steel – relation between torque and angle of twist-determination of shear modulus and shear stress	D450.2	PO1,PO3 ,PO7
4	Finding the resistance of materials to impact loads by Izod test and Charpy test.	D450.2	PO1,PO3 ,PO7
5	Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)	D450.2	PO1,PO3 ,PO7
6	Single or double shear test on M.S. bar to finding the resistance of material to shear load.	D450.2	PO1,PO3 ,PO7
7	Deflection test on beams	D450.3	PO1,PO3 ,PO7
8	Verify the Bernoulli's. Theorem	D450.4	PO1,PO3 ,PO7
9	Determination of co-efficient of discharge of a mouth piece by variable head method.	D450.4	PO1,PO3 ,PO7
10	Determination of co-efficient of discharge of a Venturimeter.	D450.4	PO1,PO3 ,PO7
11	Determination of the friction factor in a pipe.	D450.4	PO1,PO3 ,PO7
12	Performance test on reciprocating pump and to draw the characteristics curves	D450.5	PO1,PO3 ,PO7
13	Performance test on impulse turbine and to find out the Efficiency.	D450.5	PO1,PO3 ,PO7
14	Mini project	D450.1 to D450.5	PO1,PO3 ,PO7

MED460- MANUFACTURING TECHNOLOGY-II PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks/ Semester: 16 Weeks

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

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

DETAILED ALLOCATION OF MARKS

Description	**Marks**
Procedure	10
Preparation of the specimen	15
Setting and Machining	30
Dimensions	20
Finishing	10
Viva voce	05
Mini project	10
Total	**100**

Mini Project Evaluation (10 marks)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

COURSE DESCRIPTION:

Manufacturing technology lab - II enhances students to study and practice the various machining operations that can be performed in lathe, shaping, drilling, milling etc. and equip students with the practical knowledge required in the manufacturing/production companies. This lab helps students to study and practice the basic machining operations in the special purpose machines and acquire its applicability in the real time components 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. .

EQUIPMENTS REQUIRED(For a batch of 30 students)

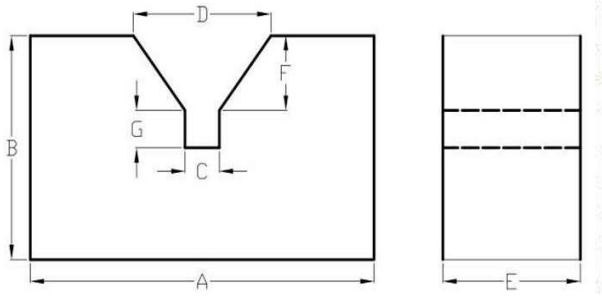
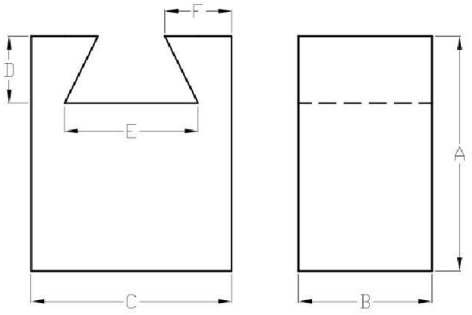
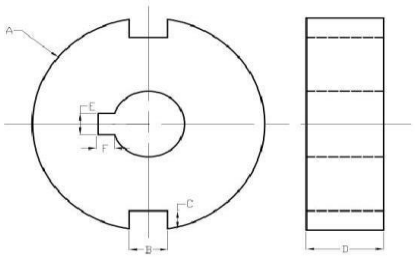
Sl.No	Name of the equipment	Required Nos.
1	Vertical milling machine /Vertical attachment	01
2	Universal Milling Machine	02
3	Surface Grinding Machine	01
4	Cylindrical Grinding Machine	01
5	Tool and Cutter Grinder	01
6	Shaping Machine	02
7	Slotting Machine	01
8	CNC Turning Centre	01
9	CNC Milling Centre	01
10	Tools and Measuring instruments	Sufficient quantity
11	Consumables	Sufficient quantity

COURSE OUTCOMES

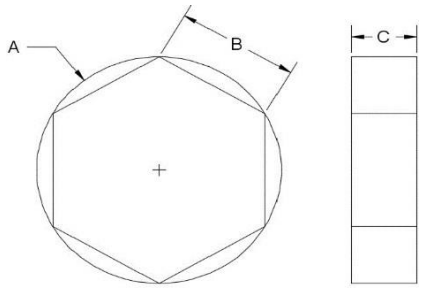
Course	**MED460 MANUFACTURING TECHNOLOGY-II PRACTICAL**
After successful completion of this course, the students should be able to	
D460.1	Recognize machines such as milling, cylindrical grinding, surface grinding, shaping, slotting machines and its parts.
D460.2	Identify the necessary tools, instruments and various work holding devices.
D460.3	Calculate the indexing for a work.
D460.4	Develop a component as per drawing using proper machine tools.
D460.5	Create program in CNC Turning and Milling machine and develop the mini projects with report.

MED 460- MANUFACTURING TECHNOLOGY-II PRACTICAL

DETAILED SYLLABUS

	Name of the exercise
1	Make 'V' Block using shaping machine  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I
2	Make dovetail using shaping machine  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I
3	Make groove cut using slotting machine  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I

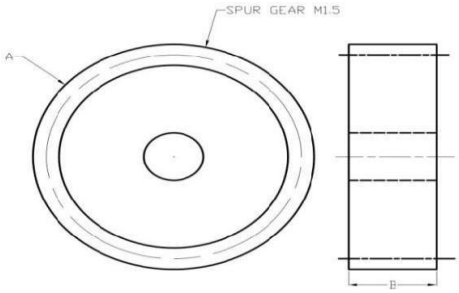
4 Make round to hexagon in milling machine.



Dimensions			
Sl.No	Part Name	Actual	Obtained

Raw Material: M.S. / C.I

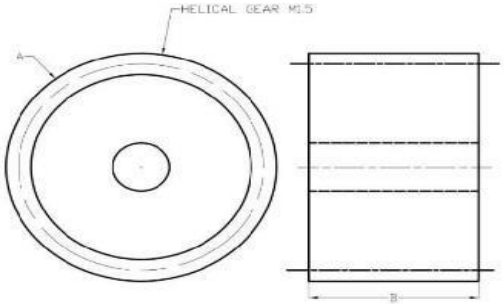
5 Make Spur Gear using milling machine by Differential Indexing.



Dimensions			
Sl.No	Part Name	Actual	Obtained

Raw Material: M.S. / C.I

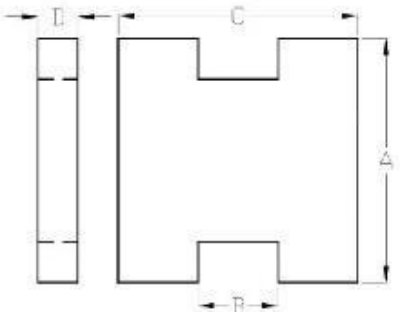
6 Make Helical Gear using milling machine



Dimensions			
Sl.No	Part Name	Actual	Obtained

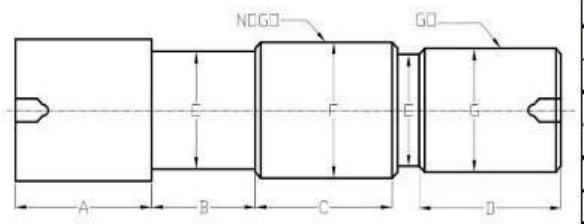
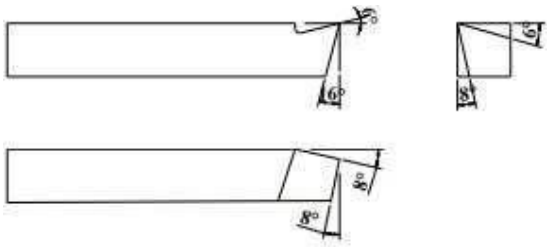
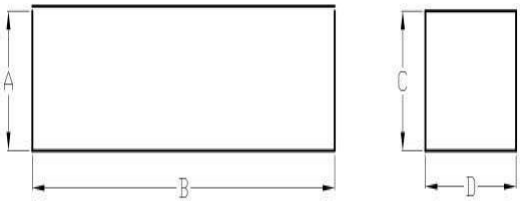
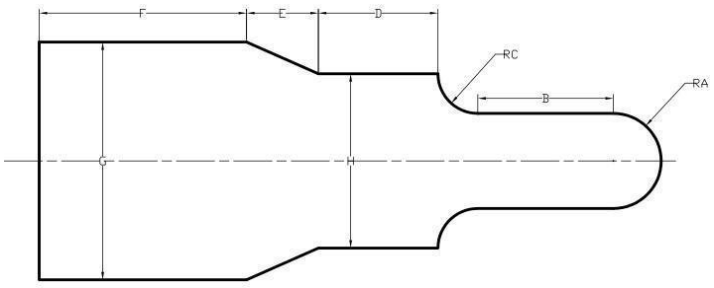
Raw Material: M.S. / C.I

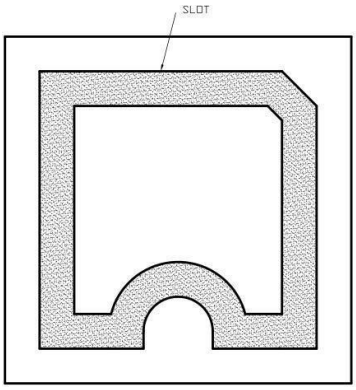
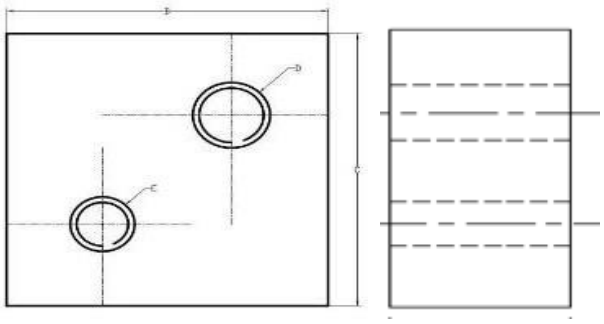
7 Make slot cut using milling machine.



Dimensions			
Sl.No	Part Name	Actual	Obtained

Raw Material: M.S. / C.I

8	Make Progressive type Plug gauge using Cylindrical Grinding machine  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I
9	Make a turning tool using Tool and Cutter Grinder  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I
10	Make plain surfaces (four surfaces) using surface Grinder  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I
11	Make the component in the CNC Turing Centre. 

12	Make the component in the CNC Milling Centre 
13	Make the component in the drilling and tapping in the drilling machine 

14. Mini project

The mini project is activity based and it may be given to group of maximum of six students for hands on experience.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

AUTONOMOUS EXAMINATION

Note:

- All the exercises should be completed. Any one exercise will be given for examination.
- All the exercises should be given in the question paper and students are allowed to select by a lot or Question paper issued from the Autonomous should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112105127/pdf/LM-20.pdf
2. https://nptel.ac.in/courses/pdf_link/112103245/lec22.pdf
3. https://nptel.ac.in/courses/112105127/pdf/LM-32.pdf
4. http://www.hnsa.org/wp-content/uploads/2014/07/milling-machine.pdf

CO – PO & PSO's Mapping Matrix

Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
D460.1	3	2	3	3	-	3	3	2	3	2
D460.2	3	2	3	3	-	3	3	2	3	2
D460.3	3	2	3	3	-	3	3	2	3	2
D460.4	3	2	3	3	-	3	3	2	3	2
D460.5	3	2	3	3	-	3	3	2	3	2
D460 Total	15	10	15	15	-	15	15	10	15	10
Correlation Level	3	2	3	3	-	3	3	2	3	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

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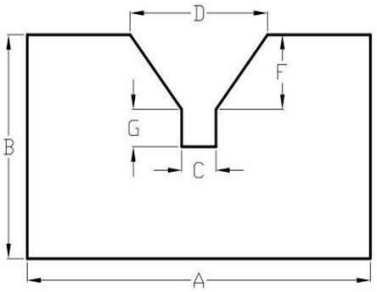
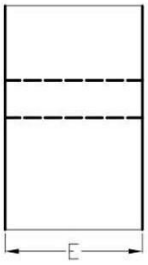
MED 460- MANUFACTURING TECHNOLOGY-II PRACTICAL

MODEL QUESTION PAPER

<table>
<tr><th>Sl.No</th><th>Name of the exercise</th><th>CO</th><th>PO</th></tr>
<tr><td>Ex.1</td><td>Make ‘V’ Block using shaping machine
 



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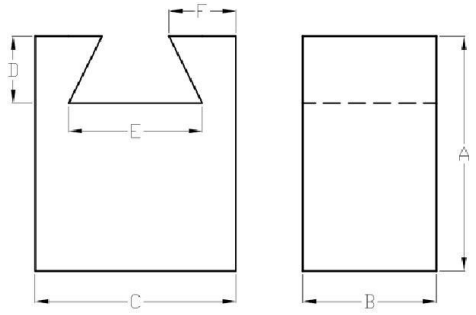
Raw Material: M.S. / C.I</td><td>D460.4</td><td>PO1,PO3, PO7</td></tr>
<tr><td>Ex.2</td><td>Make dovetail using shaping machine
 

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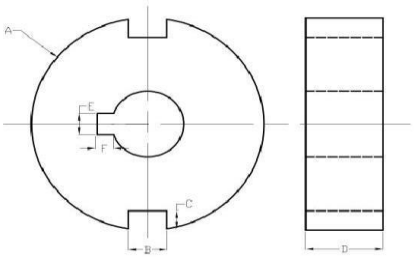
Raw Material: M.S. / C.I</td><td>D460.4</td><td>PO1,PO3, PO7</td></tr>
<tr><td>Ex.3</td><td>Make groove cut using slotting machine
 

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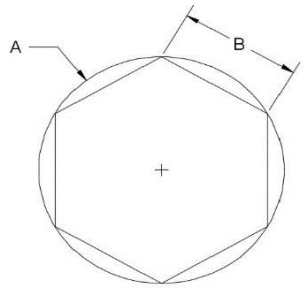
Raw Material: M.S. / C.I</td><td>D460.4</td><td>PO1,PO3, PO7</td></tr>
</table>

<table>
<tr>
<td>Ex.4</td>
<td>Make round to hexagon in milling machine.
 

Raw Material: M.S. / C.I
<table>
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<tr><th>Sl.No</th><th>Part Name</th><th>Actual</th><th>Obtained</th></tr>
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<td>D460.4</td>
<td>PO1,PO3, PO7</td>
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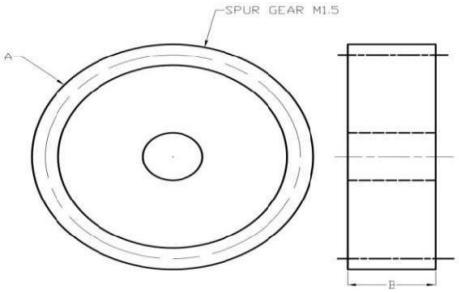
<tr>
<td>Ex.5</td>
<td>Make Spur Gear using milling machine by Differential Indexing.
 

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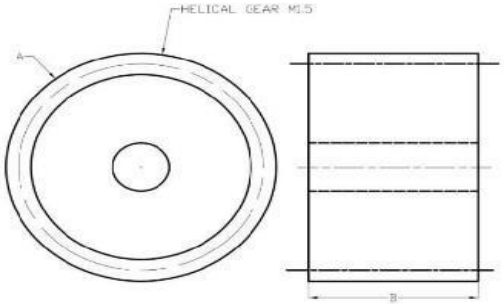
Raw Material: M.S. / C.I</td>
<td>D460.3/ D460.4</td>
<td>PO1,PO3, PO7</td>
</tr>
<tr>
<td>Ex.6</td>
<td>Make Helical Gear using milling machine
 

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Raw Material: M.S. / C.I</td>
<td>D460.3/ D460.4</td>
<td>PO1,PO3, PO7</td>
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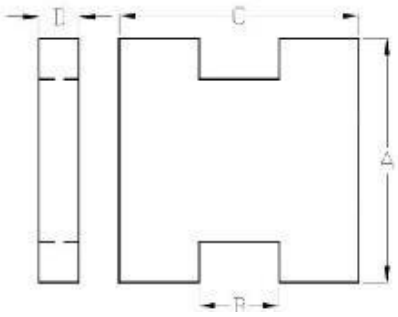
<tr>
<td>Ex.7</td>
<td>Make slot cut using milling machine.
 

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Raw Material: M.S. / C.I</td>
<td>D460.3</td>
<td>PO1,PO3, PO7</td>
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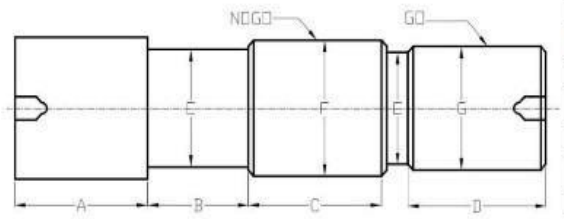
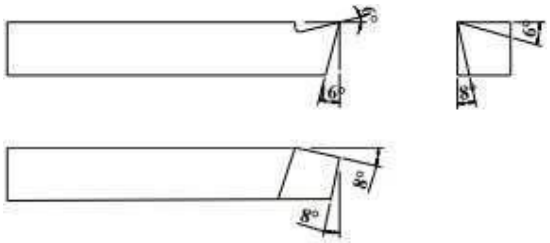
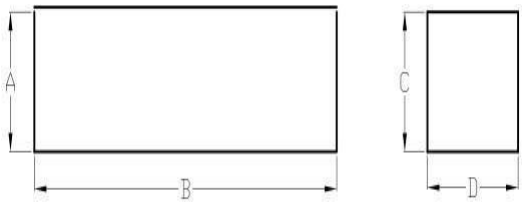
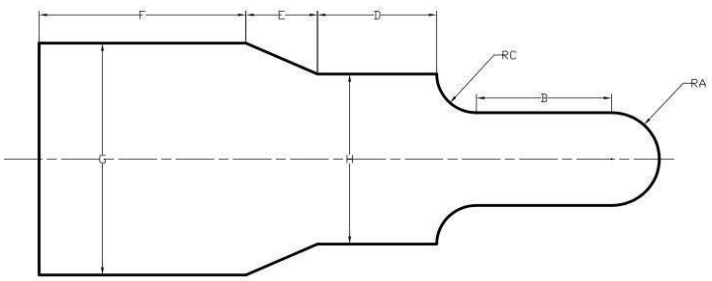
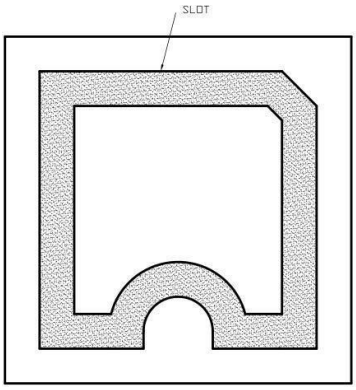
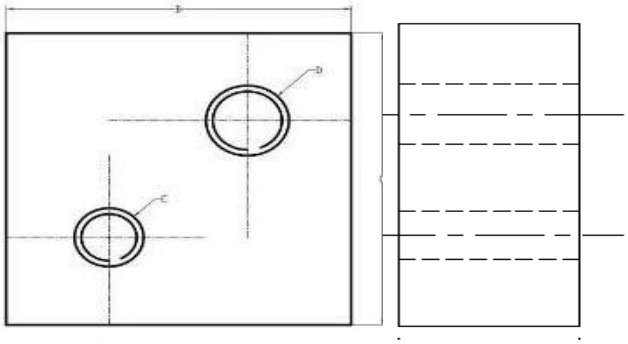
</table>

Ex.8	Make Progressive type Plug gauge using Cylindrical Grinding machine  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I	D460.3	PO1,PO3, PO7
Ex.9	Make a turning tool using Tool and Cutter Grinder  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I	D460.3	PO1,PO3, PO7
Ex.10	Make plain surfaces (four surfaces) using surface Grinder  Dimensions Sl.No | Part Name | Actual | Obtained Raw Material: M.S. / C.I	D460.3	PO1,PO3, PO7
Ex.11	Make the component in the CNC Turing Centre.  Raw Material: M.S. / C.I	D460.3	PO1,PO3, PO7

Ex.12	Make the component in the CNC Milling Centre  Raw Material: M.S. / C.I	D460.4	PO1,PO3, PO7
Ex.13	Make the component in the drilling and tapping in the drilling machine  Raw Material: M.S. / C.I	D460.3	PO1,PO3, PO7
Ex.14	Mini Project	D460.1 to D460.5	PO1,PO3, PO7

MED470- ELECTRICAL DRIVES AND CONTROL PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 16 Weeks

Course	Instructions		Examination			
	Hrs/ Week	Hrs/ Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	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 75marks for result.

DETAILED ALLOCATION OF MARKS

Part A:		**45**
	Circuit diagram	10
	Connections & Readings	20
	Calculations & Graph	15
Part B:		**40**
	Circuit diagram	10
	Connections & Readings	20
	Execution	10
	Viva Voce	**5**
	Mini project	**10**
Total		**100**

MINI PROJECT EVALUATION (10 MARKS)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

COURSE DESCRIPTION:

To Develop testing and experimental procedures applying basic knowledge in electronics, electrical circuit analysis, electrical machines, microprocessors, and programmable logic controllers.

OBJECTIVES:

On completion of the following experiments, the students must be able to

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

LIST OF EQUIPMENTS (For a batch of 30 students)
EECTRICAL LAB

Sl.No	Name of the equipment	Required Nos.
1	DC ammeter 0-5A	01 No.
2	DC ammeter 0-25A	01 No.
3	DC voltmeter 0-30V	01 No.
4	DC voltmeter 0-300V	01 No.
5	Rheostat 10.8 ,8.5A	01 No.
6	AC ammeter 0-5A	01 No.
7	AC ammeter 0-10A	02 Nos.
8	AC voltmeter 0-50V	03 Nos.
9	AC wattmeter 5A-10A (0-750W,0-600V)	03 Nos.
10	Loading rheostat 5A,230V	01 No.
11	Tachometer 0-1000rpm(Analog type)	01 No.
12	Variac 20A,250V (Auto transformer)	02 Nos.
13	Over load relay 1 to 2.5A	01 No.
14	Air break contactors 20A,220V	04 Nos.
15	Push button 2A ,220V	02 Nos.
16	Limit switch 20A,220V	01 No.

17	MCB 20A single pole	01 No.
18	MCB 20A double pole	01 No.
19	ELCB 2pole 20A,100mA	01 No.
20	ELCB 4POLE 20A,100mA	01 No.
Electronics Lab		
1	Transformer230/9-9V,1A	04 No's
2	Resistor 1K□/½W	03 no's
3	Capacitor 1000 µF/2 V	04 No's
4	IC 7805	01 No.
5	Logic gates IC 7400, 7408, 7432, 7404, 7402,7486	1 each
6	Stepper motor drive kit	01 No.
7	Servo motor drive kit	01 No.
8	Digital multimeter	01 No.
9	LED, 7 segment LED, Laser Diode	1 each

COURSE OUTCOMES

Course	**MED470 ELECTRICAL DRIVES AND CONTROL PRACTICAL**
After successful completion of this course, the students should be able to	
D470.1	Identify the starters for different motors.
D470.2	Test the characteristics of DC and AC machines.
D470.3	Design regulated power supplies.
D470.4	Identify display devices – LED, 7 segment LED, LCD
D470.5	Test the speed control circuit of the special motors and develop the mini projects with report

MED470- ELECTRICAL DRIVES AND CONTROL PRACTICAL

DETAILED SYLLABUS

List of experiments to be conducted

Sl.No	Name of the Exercise
1	Verification of Ohm's Law
2	Load test on DC shunt motor
3	Load test on single phase induction motor
4	Load test on three phase squirrel cage motor
5	Testing of relays, contactors, push buttons and limit switch
6	Connection and Testing of MCB, ELCB
7	Load test on three phase induction motor
8	Construction and testing of Half wave and Full wave rectifier.
9	Construction and testing of IC voltage regulator using IC 7805.
10	Verification of truth tables for logic gates.
11	Verification of universal gates.
12	Identification and testing of display devices- LED, 7 segment LED, Laser diode.
13	Testing of Stepper motor drive.
14	Testing of Servo motor drive.
15	Mini project The mini project is activity based and it may be given to group of maximum of six students for hands on experience.

Continuous Internal Assessment

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

AUTONOMOUS EXAMINATION

Note:

- All the experiments in both sections have to be completed. Two experiments will be given for examination by selecting one from PART A and one from PART B.
- All the experiments should be given in the question paper and students are allowed to select by a lot or Question paper issued from the Autonomous should be followed.
- All the students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

LEARNING WEBSITES:

1. http://mgcl.iitr.ac.in/NPTEL-1308-video-courses.pdf
2. http://videos.gitam.edu/nptel/electrical.html
3. https://nptel.ac.in/courses/108108076/35

CO – POs & PSOs Mapping Matrix

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D470.1	**2**	-	**2**	**2**	-	**2**	**3**	**2**	**2**	**2**
D470.2	**2**	-	**2**	**2**	-	**2**	**3**	**2**	**2**	**2**
D470.3	**2**	-	**2**	**2**	-	**2**	**3**	**2**	**2**	**2**
D470.4	**2**	-	**2**	**2**	-	**2**	**3**	**2**	**2**	**2**
D470.5	**2**	-	**2**	**2**	-	**2**	**3**	**2**	**2**	**2**
D470 Total	**10**	-	**10**	**10**	-	**10**	**15**	**10**	**10**	**10**
Correlation Level	**2**	-	**2**	**2**	-	**2**	**3**	**2**	**2**	**2**

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

****

MED470- ELECTRICAL DRIVES AND CONTROL PRACTICAL

MODEL QUESTION PAPER

Sl.No	Name of the Exercise	CO	PO
1	Verification of Ohm's Law	D470.2	PO1,PO3,PO4,PO7
2	Load test on DC shunt motor	D470.2	PO1,PO3,PO4,PO7
3	Load test on single phase induction motor	D470.2	PO1,PO3,PO4,PO7
4	Load test on three phase squirrel cage motor	D470.2	PO1,PO3,PO4,PO7
5	Testing of relays, contactors, push buttons and limit switch	D470.3	PO1,PO3,PO4,PO7
6	Connection and Testing of MCB, ELCB	D470.3	PO1,PO3,PO4,PO7
7	Load test on three phase induction motor	D470.2	PO1,PO3,PO4,PO7
8	Construction and testing of Half wave and Full wave rectifier.	D470.4	PO1,PO3,PO4,PO7
9	Construction and testing of IC voltage regulator using IC 7805.	D470.4	PO1,PO3,PO4,PO7
10	Verification of truth tables for logic gates.	D470.4	PO1,PO3,PO4,PO7
11	Verification of universal gates.	D470.4	PO1,PO3,PO4,PO7
12	Identification and testing of display devices- LED, 7 segment LED, Laser diode.	D470.5	PO1,PO3,PO4,PO7
13	Testing of Stepper motor drive.	D470.5	PO1,PO3,PO4,PO7
14	Testing of Servo motor drive.	D470.5	PO1,PO3,PO4,PO7
15	Mini Project	D470.1 to D470.5	PO1,PO3,PO4,PO7

MED410 FLUID MECHANICS AND FLUID POWER

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

PART-A (10 X 3 = 30Marks)					
Note: Answer All The questions. All questions carry equal marks					
S.No	**Questions**	**UNIT**	**Bloom's Level**	**CO**	**PO**
1	State the relation between absolute viscosity and kinematic viscosity.	I	R	D410.1	PO1, PO2, PO3
2	State Pascal's law.	I	R	D410.1	PO1, PO2, PO3
3	Write any two assumptions of Bernoulli's theorem.	II	An	D410.2	PO1, PO2, PO3
4	Write the condition for maximum power transmission.	II	R	D410.2	PO1, PO2, PO3
5	What is dynamic brake in pelton wheel? State its uses.	III	An	D410.3	PO1, PO2, PO3
6	Describe the multistage pump with impellers in parallel.	III	R	D410.3	PO1, PO2, PO3
7	Draw the BIS symbol for 2/3DCV.	IV	R	D410.4	PO1, PO2, PO3
8	What is the function of a directional control valve?	IV	U	D410.4	PO1, PO2, PO3
9	Describe with a line sketch the FRL unit.	V	U	D410.5	PO1, PO2, PO3
10	Explain with sketches, the working of air filter.	V	R	D410.5	PO1, PO2, PO3

PART-B (5 X 14 = 70Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**UNIT**	**Bloom's Level**	**CO**	**PO**
11(A)	(i) Explain with neat sketch on Bourdons pressure gauge and Diaphragm gauge.	07	I	U	D410.1	PO1,PO2, PO3
	(ii) The left limb of a U tube manometer containing mercury is open to the atmosphere and the right limb is connected to the pipe line carrying water under pressure. The centre of pipe is at the face surface of mercury. Find the difference in level of mercury in limbs if the absolute pressure of water in the pipe is 12.5 m of water.	07	I	U	D410.1	PO1,PO2, PO3

	(OR)					
11(B)	(i) Explain the working of Hydraulic Jack with neat sketch.	07	I	U	D410.1	PO1,PO2, PO3
	(ii) An inverted U tube Differential manometer connected to two pipes A & B both are containing same liquid of specific gravity 1.4. Its two ends are at same horizontal line. The relative density of manometric liquid is 0.8 . Find the difference in pressures between the two pipes. The manometer reading is 370 mm. .	07	1	U	D410.1	PO1,PO2, PO3
12(A)	(A) (i) Water is supplied to a factory a hydro power station by means of a pipe of 200 mm diameter and 12 km long. The pressure at the power station 45000kN/m^2 . Find the maximum power that can be transmitted to the factory. Assume F = 0.028.	07	II	Ap	D410.2	PO1,PO2, PO3
	(ii) A jet of water 0.25 m diameter is moving with a velocity of 30 m/s. Find the force Exerted by the jet if, i)the plate is fixed. ii)the plate is moving with a velocity of 12 m/s in the direction of flow.	07	II	U	D410.2	PO1,PO2, PO3
	(OR)					
12(B)	(i) Derive an expression for force exerted by the Jet on a Stationary plate normal to the Jet.	07	II	U	D410.2	PO1,PO2, PO3
	(ii) An oil of specific gravity of 0.9 is flowing through a venturimeter having inlet diameter 20 cm and hroat diameter 10 cm. The mercury manometer shows a reading 20 cm. Calculate the discharge of oil through the horizontal venturimeter. Take Cd = 0.98	07	II	U	D410.2	PO1,PO2, PO3
13(A)	(A).(i) Explain the working of multistage centrifugal pump state the reason for multi staging.	07	III	An	D410.3	PO1,PO2, PO3
	(ii) With a neat sketch, explain the working of a double acting reciprocating pump.	07	III	Ap	D410.3	PO1,PO2, PO3
	(OR)					

13(B)	(i) Explain the construction and working of a Francis turbine with a neat sketch.	07	III	U	D410.3	PO1,PO2, PO3
	(ii) A Double acting reciprocating pump has a piston diameter of 150 mm and a stroke length of 300 mm. It raises the water to a height of 20 m at a speed of 60 rpm. The discharge is 10 lps. Calculate i)Theoretical discharge. ii)% of slip iii) Cd iv)Efficiency of pump.	07	III	U	D410.3	PO1,PO2, PO3
14(A)	(A) (i) Draw the hydraulic circuit with BIS symbols for the table movement of a surface grinding machine.	07	IV	U	D410.4	PO1,PO2, PO3
	(ii) Explain the working of internal gear pump with neat sketch.	07	IV	U	D410.4	PO1,PO2, PO3
14(B)		**(OR)**				
	(i) Explain the hydraulic circuit with ISO symbol for quick return motion of a Shaper.	07	IV	U	D410.4	PO1,PO2, PO3
	(ii) Explain the importance service properties of a hydraulic fluid.	07	IV	U	D410.4	PO1,PO2, PO3
15(A)	(i) Explain the working principle of pressure reducing valve with a neat sketch.	07	V	U	D410.5	PO1,PO2, PO3
	(ii) ii. Draw a circuit diagram for the operation of a double acting cylinder with metering out control.	07	V	U	D410.5	PO1,PO2, PO3
15(B)		**(OR)**				
	(i) Explain the working of 4/2 and 5/2 DC valve with neat sketch.	07	V	U	D410.5	PO1,PO2, PO3
	(ii) Draw a circuit diagram for the operation of a double acting cylinder with metering in control.	07	V	U	D410.5	PO1,PO2, PO3

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED420 MANUFACTURING TECHNOLOGY-II

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

PART-A (10 X 3 = 30Marks)					
Note: Answer all questions. All questions carry equal marks					
S.No	**Questions**	**Unit**	**Bloom's Level**	**CO**	**PO**
1	State the properties of cutting fluid.	I	R	D420.1	PO1,PO2, PO3
2	Write short notes on Reaming	I	U	D420.1	PO1,PO2, PO3
3	Specify a planer.	II	U	D420.2	PO1,PO2, PO3
4	Explain any one type of tool used in shaper.	II	U	D420.2	PO1,PO2, PO3
5	State the functions of a universal vice.	III	U	D420.3	PO1,PO2, PO3
6	Compare up milling and down milling operations.	III	U	D420.3	PO1,PO2, PO3
7	Classify unconventional machining processes.	IV	U	D420.4	PO1,PO2, PO3
8	List out the applications of electro chemical machining.	IV	U	D420.4	PO1,PO2, PO3
9	What is a NC system? What are its components?	V	U	D420.5	PO1,PO2, PO3
10	List out the various Mechanical structure of CMM.	V	U	D420.5	PO1,PO2, PO3

PART-B (5 X 14 = 70Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
Sl.No	**Questions**	**Marks**	**UNIT**	**Bloom's Level**	**CO**	**PO**
11(A)	(i)Explain surface grinder with neat sketch	7	I	U	D420.1	PO1,PO2, PO3
	(ii) What are the factors affecting tool life?.	7	I	U	D420.1	PO1,PO2, PO3
	(OR)					
11(B)	(i) Explain multi spindle drilling machine with neat sketch	7	I	U	D420.1	PO1,PO2, PO3
	(ii) Explain about the mounting of grinding wheels	7	I	U	D420.1	PO1,PO2, PO3
	(i) Explain the hydraulic drive employed	7	II	R	D420.2	PO1,PO2,

12(A)	for a planer with the help of a neat sketch.					PO3
	(ii) Explain the quick return Mechanism of a planer	7	II	R	D420.2	PO1,PO2, PO3
	(OR)					
12(B)	(i) With a help of a neat sketch explain a pull broach with its nomenclature	7	II	R	D420.2	PO1,PO2, PO3
	(ii) Explain the various work holding devices used in a shaper	7	II	U	D420.2	PO1,PO2, PO3
13(A)	(i) With neat sketches briefly explain any three milling operations..	7	III	U	D420.3	PO1,PO2, PO3
	(ii) Explain the gear burnishing process with neat sketch	7	III	R	D420.3	PO1,PO2, PO3
	(OR)					
13(B)	(i) Explain the gear grinding process with neat sketch.		III	U	D420.3	PO1,PO2, PO3
	(ii) Explain about the indexing in milling machine.	7	III	U	D420.3	PO1,PO2, PO3
14(A)	(i) Explain with a neat sketch the operation of ultrasonic machining process.	7	IV	U	D420.4	PO1,PO2, PO3
	(ii) Explain the principle of wire cut EDM	7	IV	R	D420.4	PO1,PO2, PO3
	(OR)					
14(B)	(i) Explain the working principle of plasma arc machining process with neat sketch.	7	IV	U	D420.4	PO1,PO2, PO3
	(ii) Write short notes on design consideration for plastic components.	7	IV	R	D420.4	PO1,PO2, PO3
15(A)	(i) Explain the construction and working of CNC machining centres	7	V	U	D420.5	PO1,PO2, PO3
	(ii) Explain about the linear interpolation and circular interpolation.	7	V	U	D420.5	PO1,PO2, PO3
	(OR)					
15(B)	(i) Explain the different types of tool magazines used in a CNC machines	7	V	U	D420.5	PO1,PO2, PO3
	(ii) Explain the home setting and tool setting procedure in CNC machine.	7	V	R	D420.5	PO1,PO2, PO3

Note: The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as prescribed below:

Bloom's Taxonomy Level	Lower Order Thinking Skills (LOTS)	Higher Order Thinking Skills (HOTS)
	R – Remember, U – Understand, Ap - Apply	An – Analysis, E – Evaluate, C - Create
% to be included	90%	10%

MED430 ELECTRICAL DRIVES AND CONTROL

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

PART-A (10 X 3 = 30Marks)					
Note: Answer all the questions. All questions carry equal marks					
Sl.No	**Questions**	**UNIT**	**Bloom's Level**	**CO**	**PO**
1	State and explain Ohm's law	I	R	D430.1	PO1,PO2, PO3
2	State the Faradays law of Electromagnetic Induction	I	U	D430.1	PO1,PO2, PO3
3	Define RMS value	II	U	D430.2	PO1,PO2, PO3
4	Write the losses in transformer	II	U	D430.2	PO1,PO2, PO3
5	What is meant by Industrial drive? Mention the types of industrial drive	III	U	D430.3	PO1,PO2, PO3
6	Write short notes on VFD	III	U	D430.3	PO1,PO2, PO3
7	Define sensor. Mention the types of sensor	IV	U	D430.4	PO1,PO2, PO3
8	What is meant by ELCB?	IV	U	D430.4	PO1,PO2, PO3
9	Mention the features of PLC	V	U	D430.5	PO1,PO2, PO3
10	Define universal gate. How NAND gate is converted into AND gate	V	U	D430.5	PO1,PO2, PO3

PART-B (5 X 14 = 70Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
Sl.No	**Questions**	**Unit**	**Blooms Level**	**Max Marks**	**CO**	**PO**
11(A)	(i) A resistance of 'R' ohms is connected in series with a parallel circuit comprising of two resistances 12 ohms, 8 ohms respectively. The total power dissipated in the circuit is 70 watts. When the applied voltage is 20 volt. Calculate the value of 'R'	I	U	7	D430.1	PO1,PO2, PO3
	(ii) Explain with neat diagram construction details of DC generator.	I	U	7	D430.1	PO1,PO2, PO3
	(OR)					
11(B)	(i) Explain with neat diagram working principle of three point starter	I	U	7	D430.1	PO1,PO2, PO3
	(ii) Explain with neat diagram working principle of DC motor.	I	U	7	D430.1	PO1,PO2, PO3

12(A)	(i) Explain the working principle of single phase induction motor	II	R	7	D430.2	PO1,PO2, PO3
	(ii) Explain with neat diagram construction details of Transformer.	II	R	7	D430.2	PO1,PO2, PO3
	(OR)					
12(B)	(i) Explain the working principle of single phase alternator	II	R	7	D430.2	PO1,PO2, PO3
	(ii) Explain with neat diagram working principle three phase Induction motor.	II	U	7	D430.2	PO1,PO2, PO3
13(A)	(i) Explain with neat diagram working principle of DC servo motor.	III	U	7	D430.3	PO1,PO2, PO3
	(ii) Explain with neat diagram construction and working principle of stepper motor.	III	R	7	D430.3	PO1,PO2, PO3
	(OR)					
13(B)	(i) Explain with neat diagram working principle of AC servo motor.	III	U	7	D430.3	PO1,PO2, PO3
	(ii) Explain with neat diagram types if industrial drives.	III	U	7	D430.3	PO1,PO2, PO3
14(A)	(i) Why need for regulator? Explain IC 7805 voltage regulator.	IV	U	7	D430.4	PO1,PO2, PO3
	(ii) Explain with neat diagram construction and working principle of Full wave rectifier.	IV	R	7	D430.4	PO1,PO2, PO3
	(OR)					
14(B)	(i) List the care and maintenance of lead acid batteries	IV	U	7	D430.4	PO1,PO2, PO3
	(ii) Explain with neat diagram construction details of lead acid batteries.	IV	R	7	D430.4	PO1,PO2, PO3
15(A)	(i) Explain with neat diagram working principle of LCD	V	U	7	D430.5	PO1,PO2, PO3
	(ii) Draw a symbol, Boolean equation, truth table for the following gates AND, OR, NOT, NAND, NOR.	V	U	7	D430.5	PO1,PO2, PO3
	(OR)					
15(B)	(i) Explain with neat block diagram of PLC scan	V	U	7	D430.5	PO1,PO2, PO3
	(ii) Explain with neat block diagram of PLC and explain each block in detail.	V	R	7	D430.5	PO1,PO2, PO3

Note: The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as prescribed below:

Bloom's Taxonomy Level	Lower Order Thinking Skills (LOTS)	Higher Order Thinking Skills (HOTS)
	R – Remember, U – Understand, Ap - Apply	An – Analysis, E – Evaluate, C - Create
% to be included	90%	10%

MED440 PRODUCTION AND QUALITY MANAGEMENT

MODEL QUESTION PAPER					
Duration : 3 Hrs			**Max. Marks: 100**		
PART – A (10x3 = 30 Marks)					
Note: Answer all the Questions. All Questions carry equal marks.		**Unit**	**Bloom's level**	**CO**	**PO**
1	List the types of Production System.	I	R	D440.1	PO1,PO2, PO3
2	What is the need for line balancing?	I	R	D440.1	PO1,PO2, PO3
3	What is meant by TQM?	II	R	D440.2	PO1,PO2, PO3
4	Write about the Quality Statement of an organization.	II	R	D440.2	PO1,PO2, PO3
5	Write the types of check sheet generally used.	III	R	D440.3	PO1,PO2, PO3
6	Explain Zero Defect Concepts.	III	U	D440.3	PO1,PO2, PO3
7	What is meant by frequency distribution?	IV	R	D440.4	PO1,PO2, PO3
8	Differentiate control limits and specification limit.	IV	AN	D440.4	PO1,PO2, PO3
9	Discuss about Kaizen Process.	V	R	D440.5	PO1,PO2, PO3
10	Give examples of 5S in shop floor.	V	R	D440.5	PO1,PO2, PO3

PART B (5x14 = 70Marks)						
Note: Answer all the questions by choosing either (A) or (B)		**Marks**	**Unit**	**Bloom's level**	**CO**	**PO**
11 A)	i) Describe the steps or procedure involved in process planning.	7	I	R	D440.1	PO1,PO2, PO3
	ii) Write short notes about Make (or) Buy decision using Break Even Analysis.	7	I	U	D440.1	PO1,PO2, PO3
	(OR)					
11B)	i) Enumerate the different types of production system generally used.	7	I	R	D440.1	PO1,PO2, PO3
	ii) Write short notes about selection of machinery.	7	I	U	D440.1	PO1,PO2, PO3

12 A)	i) Explain strategic planning and seven steps to strategic planning.	7	II	U	D440.2	PO1,PO2, PO3
	ii) Explain about the brainstorming and its objectives.	7	II	U	D440.2	PO1,PO2, PO3
	(OR)					
12 B)	i) Describe the Deming's Philosophy of quality management technique.	7	II	R	D440.2	PO1,PO2, PO3
	ii) Explain the Quality council duties and responsibilities.	7	II	U	D440.2	PO1,PO2, PO3
13 A)	i) Illustrate the pareto diagram and its construction procedure with an example.	7	III	U	D440.3	PO1,PO2, PO3
	ii) Explain briefly about the Inter-relationship diagram.	7	III	U	D440.3	PO1,PO2, PO3
	(OR)					
13 B)	i) Explain briefly about the Matrix diagram.	7	III	U	D440.3	PO1,PO2, PO3
	ii) Explain about the cause and effect diagram.	7	III	U	D440.3	PO1,PO2, PO3
14 A)	i) Describe briefly the concept of six sigma and state the principles.	7	IV	R	D440.4	PO1,PO2, PO3
	ii) Compare between variable chart and Attribute chart.	7	IV	An	D440.4	PO1,PO2, PO3
	(OR)					
14 B)	i) Compare X bar chart with R chart.	7	IV	An	D440.4	PO1,PO2, PO3
	ii) Write short notes about Mean, Median and Mode.	7	IV	R	D440.4	PO1,PO2, PO3
15 A)	i) Explain the concept of 5S in continuous process improvement.	7	V	U	D440.5	PO1,PO2, PO3

	ii) Explain the objectives of TPM.	7	V	U	D440.5	PO1,PO2, PO3
	(OR)					
15 B)	i) Write the step by step procedure of implementing a benchmarking process in an organization.	7	V	U	D440.5	PO1,PO2, PO3
	ii) Write short notes on Overall Equipment Effectiveness.	7	V	U	D440.5	PO1,PO2, PO3

Note: The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as prescribed below:

Bloom's Taxonomy Level	Lower Order Thinking Skills (LOTS)	Higher Order Thinking Skills (HOTS)
	R – Remember, U – Understand, Ap - Apply	An – Analysis, E – Evaluate, C - Create
% to be included	90%	10%

MED510-DESIGN OF MACHINE ELEMENTS

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	
Design of Machine Elements	6	96	25	100*	100	3 Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	No of Hours
I	Engineering Materials and Joints	17
II	Design of Shafts, Keys and Couplings	18
III	Design of Flat Belts and V-Belts	17
IV	Design of Bearings & Spur Gears	18
V	Computer Aided Design (CAD) and Geometrical Modelling	17
Tests and Model Exam		9
TOTAL		**96**

COURSE DESCRIPTION:

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

OBJECTIVES:

On completion of the course the students will be able to

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

COURSE OUTCOMES:

Course	MED510-DESIGN OF MACHINE ELEMENTS
After successful completion of this course the students should be able to	
D510.1	Explain general considerations in machine design and explain the principles of joints and fasteners.
D510.2	Design the shafts, coupling and keys.
D510.3	Develop a strong knowledge to differentiate between various belt drives like flat belt and V belt.
D510.4	Identify and apply the factors to be considered while designing a bearing and spur gear
D510.5	Understanding the CAD and Geometric Modelling

MED510-DESIGN OF MACHINE ELEMENTS

DETAILED SYLLABUS

UNIT-I ENGINEERING MATERIALS AND JOINTS **[17Hrs]**

CHAPTER: 1.1:

General Considerations in Machine Design. Engineering materials - [1Hr]

Factors affecting selection of material – [1Hr]

BIS designation of Ferrous materials – [1Hr]

Preferred number - Factor of safety and allowable stress – [1Hr]

Stresses: Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion -problem. [1Hr]

Creep strain and Creep Curve- Fatigue, S-N curve, [1Hr]

Endurance Limit - Stress Concentration – Causes & Remedies. [1Hr]

Theories of Elastic Failures – Principal normal stress theory, [1Hr]

Maximum shear stress theory & maximum distortion energy theory. [1Hr]

CHAPTER: 1.2:

Joints: Design of sleeve and cotter joint,. **[** 4 Hrs]

knuckle joint and welded joint **[** 4 Hrs]

UNIT- II DESIGN OF SHAFTS, KEYS AND COUPLINGS **[18Hrs]**

CHAPTER: 2.1:

Shafts: Design of shafts subjected to – twisting moment – [2Hrs]

bending moment – [2Hrs]

combined twisting and bending moments – [2Hrs]

fluctuating loads – [2Hrs]

design of shafts based on rigidity. [1Hr]

CHAPTER: 2.2:

Keys: Types of keys - design of sunk keys only - Effect of keyways on shaft - splines [2Hrs]

problems. [1Hr]

Couplings: Requirements of good couplings – types - [1Hr]

design of - rigid protected type flange couplings - [2Hrs]

marine couplings – [2Hrs]

pin type flexible coupling (Description only). [1 Hr]

UNIT-III DESIGN OF FLAT BELTS AND V-BELTS: **[17Hrs]**

CHAPTER: 3.1:

Flat Belts: Types of belts - materials for belt -– [1Hr]

types of belt drives – Speed ratio – effect of slip - [1Hr]

length of flat belts –Tension Ratio T1/T2=$e^{\mu\Theta}$ centrifugal tension - power transmitted – [2Hrs]

condition for maximum power - transmission – Initial Tension - [1Hr]

problems - [1Hr]

Design procedure of flat belts -design of flat belt based on manufacturer's data only - problems. [3Hrs]

CHAPTER: 3.2:

V-belt drive - comparison with flat belt drive - [1Hr]

designation of V-belts – [1Hr]

length of belt - power transmitted – [1Hr]

Design of V-belt using manufacturer's data only - [2Hrs]

Problem. [3Hrs]

UNIT IV -DESIGN OF BEARINGS & SPUR GEARS [18Hrs]

CHAPTER: 4.1:

Bearings: Classifications of bearings – sliding contact and rolling contact bearings - [1 Hr]

radial and thrust bearings - roller bearing – types - [1 Hr]

Designation of ball bearings - materials used for bearings - [2 Hrs]

journal bearings - heat generated - heat dissipated - cooling oil requirement – problems - [3 Hrs]

design of journal bearings – Problems. (Design based on approved data books only.). [3 Hrs]

CHAPTER: 4.2:

Spur Gears: Gear drives - Types of gears - applications - [2 Hrs]

materials - spur gear terminology - [2 Hrs]

design of spur gear based on Lewis and Buckingham equation (design procedure only) - [2 Hrs]

speed reducer – types. [2 Hrs]

UNIT-V COMPUTER AIDED DESIGN (CAD) AND GEOMETRIC MODELLING: [17Hrs]

CHAPTER: 5.1:

CAD – Roles of CAD in design – Development and uses - Applications – Advantages – [2 Hrs]

Product cycle – [1 Hr]

Design process: Shigley Model - [2 Hrs]

Pahl and Beitz Model – [1 Hr]

Sequential Engineering – [1 Hr]

Concurrent Engineering – [1 Hr]

2D and 3D Transformation. [1 Hr]

CHAPTER: 5.2:

Geometric Modelling: Solid modelling – entities – advantages and disadvantages – [2 Hrs]

Boolean operations - Boundary representation – [2 Hrs]

Constructive Solid Geometry – Comparison – [2 Hrs]

Finite Element analysis – Steps. [2 Hrs]

Tests and Model Exam [09 Hrs]

TEXT BOOKS:

S.no	Title	Author	Publisher with edition
1	Machine Design	Pandya& Shah	Charotar Publishing House. Edn. 1995,
2	Machine Design	T. V. Sundararajamoorthy& N. Shanmugam	Anuradha Publications Revised Edition June-2003
3	Design Data Book	by PSG College of Technology, DPV Printers	by PSG College of Technology, DPV Printers

REFERENCES BOOKS:

Sl.No	Title	Author	Publisher with Edition
1	A text book of Machine Design	R.S. Khurmi&J.K.Gupta	Eurosia Publishing House Pvt. Limited, Edn. 18.
2	Machine Design	Bandari	
3	Theory and Problems of Machine Design	Holowenko, Laughlin	Schaum's outline series
4	"CAD/CAM/CIM"	R.Radhakrishnan, and S.Subramanian	New Age International Pvt Limited

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112/105/112105124/
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=125510
3. https://en.wikipedia.org/wiki/Machine_Design
4. https://www.engineersgallery.com/sleeve-and-cotter-joint-and-its-design/
5. https://www.accessengineeringlibrary.com/content/book/9780071367073/toc chapter/chapter14/section/section3

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	**-**	**25 Marks**

CO-POs & PSOs Mapping matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C510.1	3	3	3	-	-	3	3	3	3	2
C510.2	3	3	3	-	-	3	3	3	3	2
C510.3	3	3	3	-	-	3	3	3	3	2
C510.4	3	3	3	-	-	3	3	3	3	2
C510.5	3	3	3	-	-	3	3	3	3	2
C510 Total	15	15	15	-	-	15	15	15	15	10
Correlation Level	3	3	3	-	-	3	3	3	3	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTIONS PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED520-THERMAL ENGINEERING - II

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	
Thermal Engineering - II	5	80	25	100*	100	3Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	No of Hours
I	Formation And Properties of Steam & Thermodynamic Processes of Vapour	14
II	Steam Boilers and Performance of Boiler	14
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
Tests And Model Exam		09
TOTAL		**80**

COURSE DESCRIPTION:

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

OBJECTIVES

On completion of the course the students will be able to

- 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.

COURSE OUTCOMES:

Course	**MED520-THERMAL ENGINEERING - II**
After successful completion of this course the students should be able to	
D520.1	Understand the Properties of Steam and thermodynamic processes of vapour
D520.2	Explain the steam boilers and Performance of Boilers
D520.3	Describe various circuits used in the thermal power plant.
D520.4	Compare conventional energy sources with Non-Conventional Sources of energy and Explain working of nuclear power plant.
D520.5	Explain the functions of Air Compressors and Gas Turbines

MED520-THERMAL ENGINEERING - II

DETAILED SYLLABUS

UNIT I
FORMATION AND PROPERTIES OF STEAM & THERMODYNAMIC PROCESSES OF VAPOUR **[14Hrs]**

Steam - Properties – formation of steam– saturation temperature – [1 Hr]

enthalpy of water – enthalpy of evaporation – [1 Hr]

conditions of steam – wet, dry and superheated steam - [1 Hr]

dryness fraction – enthalpy of wet, dry and superheated steam - [1 Hr]

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 – [1 Hr]

critical conditions of water – specific volume of water and steam – density of steam – [1 Hr]

external work done during evaporation – internal latent heat – [1 Hr]

internal energy of steam – entropy of water and steam – [1 Hr]

steam tables - Mollier chart– Description only. [1 Hr]

Determination of dryness fraction of steam – bucket calorimeter - combined separating and throttling calorimeters -problems. [2 Hrs]

Expansion processes of steam - constant volume, constant pressure, constant temperature, hyperbolic, polytrophic, isentropic and throttling processes – [1 Hr]

problems. [2 Hrs]

UNIT II STEAM BOILERS AND PERFORMANCE OF BOILERS **[14Hrs]**

Introduction -Classification of boilers – comparison of fire tube and [1 Hr]

water tube boilers– high pressure boilers – advantages of high pressure boilers - [1 Hr]

BHEL high pressure boilers – [1 Hr]

boiler mountings and function- [1 Hr]

construction and working – boiler accessories and function - [1 Hr]

construction and working – comparison of mountings and accessories – [1 Hr]

feed water treatment – internal and external [1 Hr]

treatments - starting boiler from cold condition – [1 Hr]

safety precautions in boiler operation – clauses of Indian boiler act. [1 Hr]

Evaporation rate - actual, equivalent and factor of evaporation – [1 Hr]

boiler efficiency – factors influencing boiler efficiency - [1 Hr]

boiler power - problems – boiler plant - [1 Hr]

efficiency of economizer and super heater - problems – [1 Hr]

boiler trial – heat losses in a boiler heat balance sheet – problems. [1 Hr]

UNIT III THERMAL POWER PLANT AND STEAM TURBINES AND CONDENSERS **[15Hrs]**

Selection of site for thermal power plant -Layout of thermal power plant – [1 Hr]

fuel and ash circuit – water and steam circuit – air and flue gas circuit – [1 Hr]

cooling water circuit – merits and demerits of thermal power plant — air pollution by thermal power plants – [2 Hrs]

pollutants, effects and control – cyclone separator – wet scrubber – electrostatic precipitator – [1 Hr]

control of No2 and SO2.fiudised bed combustion- thermal and noise pollution. [1 Hr]

Basic steam power cycles – Carnot, Rankine and modified Rankine cycles. [1 Hr]

Classification of steam turbine-Impulse and reaction turbines- [1 Hr]

Difference - necessity of compounding – [1 Hr]

Methods of compounding – special turbines [1 Hr]

Steam condensers – elements of condensing plant – classification of condensers – jet condenser – surface condensers – [1 Hr]

Comparison of jet and surface condensers – sources of air in condenser – [1 Hr]

condenser vacuum – vacuum efficiency – [1 Hr]

condenser efficiency - mass of cooling water required – mass of air present – [1 Hr]

number of tubes – simple problems. [1 Hr]

UNIT IV CONVENTIONAL SOURCES OF ENERGY AND NUCLEAR POWER PLANT **[13Hrs]**

Conventional sources of energy – [1 Hr]

layout of hydel and diesel power plants – merits and demerits. [2 Hrs]

Nuclear fuels –fissile and fertile fuels – Nuclear fission and fusion – [1 Hr]

chain reaction – radio activity – layout of nuclear power plant – [1 Hr]

merits and demerits – Nuclear reactors -Components–Reactor Core -moderators – [1 Hr]

control rods – coolant – reflectors – biological shield- [1 Hr]

Reactor Vessels-Classification of Reactor- pressurized water reactor – [1 Hr]

boiling water reactor – Candu type reactor – fast breeder reactor — [1 Hr]

effect of nuclear radiation – Fuel Cycle –Site selection – [1 Hr]

Safety-Floating Nuclear Power Plants-Uranium Enrichment – [1 Hr]

Methods-disposal of nuclear wastes- [1 Hr]

comparison of nuclear power plants with thermal power plants- Nuclear Power Plant in India. [1 Hr]

UNIT V AIR COMPRESSORS AND GAS TURBINES **[15Hrs]**

Air Compressors-uses of compressed air – classifications of Air compressor – [1 Hr]

reciprocating compressor - single stage reciprocating compressor – [1 Hr]

compression processes – power required to drive the compressor (Neglecting clearance Volume) [1 Hr]

– clearance volume and its effects – volumetric efficiency – power required to drive the compressor with clearance volume – [1 Hr]

problems – multi stage compression – merits and demerits - work input – ratio of cylinder diameters for minimum work input. [1 Hr]

Rotary compressors – Roots blower - vane blowers – centrifugal and axial flow air compressors. [1 Hr]

Gas turbines – uses - classifications – merits and demerits of gas turbines - [1 Hr]

constant pressure combustion gas turbine – [1 Hr]

gas turbine with – intercooler –reheater - [1 Hr]

regenerator -effects – [1 Hr]

closed cycle gas turbines - merits and demerits of open and closed cycle gas turbines [1 Hr]

Jet propulsion -turbojet engines– merits and demerits – [1 Hr]

turbo propeller engines – merits and demerits – Turbo fan engine [1 Hr]

ramjet – merits and demerits – [1 Hr]

Rocket engines – solid propellant rocket -applications of rockets. [1 Hr]

Tests and Model Exam **[09 Hrs]**

TEXT BOOKS:

S.no	Title	Author	Publisher with edition
1	Thermal Engg,	R.K . Rajput	Laxmi publications PvtLtd , New Delhi. 8th Edition
2	Applied Thermodynamics	P.K. Nag	TATA Mcgraw – Hill Publishing Company, New Delhi .2nd Edition

REFERENCE BOOKS

Sl.No	Title	Author	Publisher with Edition
1	Thermal Engineering	R.S. Khurmi and J.K. Gupta	S.Chand& Co,NewDelhi,18th Edition
2	Thermal Engineering	P.L Ballaney	KhannaPublishers,New Delhi. 24th Edition
3	Thermal Engineering	B.K. Sarkar	DhanpatRai& Sons New Delhi. 3rd Edition
4	Applied Thermodynamics	Domkundwar and C.PKothandaraman	Khanna publishers, New Delhi.2ndEdition

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POS & PSOS MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D520.1	3	2	2	2	-	3	3	2	3	2
D520.2	3	2	2	2	-	3	3	2	3	2
D520.3	3	2	2	2	-	3	3	2	3	2
D520.4	3	2	2	2	-	3	3	2	3	2
D520.5	3	2	2	2	-	3	3	2	3	2
Total	15	10	10	10	-	15	15	10	15	10
Correlation Level	3	2	2	2	-	3	3	2	3	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED531-COMPUTER INTEGRATED MANUFACTURING

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

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

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	No of Hours
I	Computer Aided Design	14
II	Computer Aided Manufacturing	14
III	CNC Programming	15
IV	FMS, AGV, AS/RS, Robotics	14
V	Advanced Concepts of CIM	14
Tests and Model Exam		09
TOTAL		**80**

COURSE DESCRIPTION:

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:

On completion of the course the students will be able to

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

COURSE OUTCOMES:

Course	**MED531-COMPUTER INTEGRATED MANUFACTURING**
After successful completion of this course the students should be able to	
D531.1	Discuss and explain the various factors in CAD.
D531.2	Explain the functions of Computer Aided Manufacturing (CAM).
D531.3	Describe the G codes, M codes, tool offset, work offset, CNC machining processes
D531.4	Explain the concepts of FMS, AGV, AS/RS and robotics
D531.5	Explain the advanced concepts of CIM

MED531-COMPUTER INTEGRATED MANUFACTURING

DETAILED SYLLABUS

UNIT-I COMPUTER AIDED DESIGN **[14Hrs]**

Computer Aided Design: Introduction – definition – Shigley's design process –	[1 Hr]
CAD activities – benefits of CAD -	[1 Hr]
CAD software packages –	[1 Hr]
point plotting, drawing of lines, Bresenham's circle algorithm,	[1 Hr]
Transformations: 2D & 3D transformations –	[1 Hr]
translation, scaling, rotation and concatenation.	[1 Hr]
Geometric modelling: Techniques - Wire frame modelling – applications – advantages and disadvantages.	[1 Hr]
Surface modelling – types of surfaces – applications – advantages and disadvantages –	[1 Hr]
Solid modelling – entities – advantages and disadvantages –	[1 Hr]
Boolean operations - Boundary representation –	[1 Hr]
Constructive Solid Geometry – Comparison.	[1 Hr]
Graphics standard: Definition – Need - GKS –	[1 Hr]
IGES – DXF.	[1 Hr]
Finite Element Analysis: Introduction – Development - Basic steps – Advantages.	[1 Hr]

UNIT-II COMPUTER AIDED MANUFACTURING **[14Hrs]**

CAM – Definition - functions of CAM – benefits of CAM.	[1 Hr]
Introduction of CIM – concept of CIM -	[1 Hr]
evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM.	[1 Hr]
Group technology: Part families - Parts classification and coding -	[1 Hr]
coding structure – Opitz system,	[1 Hr]
MICLASS system and CODE System.	[1 Hr]
Process Planning: Introduction –	[1 Hr]
Computer Assisted Process Planning (CAPP) –	[1 Hr]
Types of CAPP - Variant type, Generative type – advantages of CAPP.	[1 Hr]
Production Planning and Control (PPC): Definition – objectives - Computer	[1 Hr]
Integrated Production management system – Master Production Schedule	[1 Hr]
(MPS) – Capacity Planning – Materials Requirement Planning (MRP) –	[1 Hr]

Manufacturing Resources Planning (MRP-II) – Shop Floor Control system (SFC) - [1 Hr]

Just In Time manufacturing philosophy (JIT) - Introduction to Enterprise Resources Planning (ERP). Additive Manufacturing [1 Hr]

UNIT III CNC PROGRAMMING **[15Hrs]**

NC in CAM, tooling for CNC – ISO designation for tooling – CNC operating system. [1 Hr]

Programming for CNC machining – [1 Hr]

part program - [1 Hr]

Manual part programming - [1 Hr]

coordinate system – [1 Hr]

Datum points: machine zero, work zero, tool zero - [1 Hr]

reference points - NC dimensioning – [1 Hr]

G codes and M codes – [1 Hr]

linear interpolation and circular interpolation - [1 Hr]

CNC program procedure - [1 Hr]

sub-program – canned cycles - [1 Hr]

stock removal – thread cutting – [1 Hr]

mirroring – drilling cycle – pocketing. [1 Hr]

Rapid prototyping: Classification – subtractive – [1 Hr]

additive – advantages and applications – materials – Virtual machining. [1 Hr]

UNIT IV FMS, AGV, AS/RS, ROBOTICS **[14Hrs]**

FMS: Introduction – FMS components – FMS layouts – [1 Hr]

Types of FMS: Flexible Manufacturing Cell (FMC) – [1 Hr]

Flexible Turning Cell (FTC) – Flexible Transfer Line (FTL) – [1 Hr]

Flexible Machining System (FMS) – benefits of FMS - [1 Hr]

- introduction to intelligent manufacturing system. [1 Hr]

Material handling in CIM environment: Types – AGV: Introduction – [1 Hr]

AGV - working principle – types – benefits. [1 Hr]

AS/RS – working principle –types – benefits. [1 Hr]

Robotics: Definition – robot configurations – basic robot motion – [1 Hr]

robot programming method – robotic sensors – [1 Hr]

end effectors – mechanical grippers – vacuum grippers – [1 Hr]

robot programming concepts - [1 Hr]

Industrial applications of Robot: Characteristics - material transfer and loading – welding - [1 Hr]

spray coating - assembly and inspection. [1 Hr]

UNIT V ADVANCED CONCEPTS OF CIM **[14Hrs]**

Concurrent Engineering: Definition – [1 Hr]

Sequential Vs Concurrent engineering– [1 Hr]

need of CE – benefits of CE. [1 Hr]

Quality Function Deployment (QFD): Definition – [1 Hr]

House of Quality (HOQ) – [1 Hr]

advantages – disadvantages. [1 Hr]

Steps in Failure Modes and Effects Analysis (FMEA) – [1 Hr]

Value Engineering (VE) – types of values – [1 Hr]

identification of poor value areas – [1 Hr]

techniques – benefits. [1 Hr]

Guide lines of Design for Manufacture and Assembly (DFMA). [1 Hr]

Product Development Cycle: Product Life Cycle - [1 Hr]

New product development processes. [1 Hr]

Augmented Reality (AR) – Introduction - concept – Applications. [1 Hr]

Tests and Model Exam **[09 Hrs]**

TEXT BOOKS:

S.No	Title	Author	Publisher with Edition
1	CAD/CAM/CIM	R.Radhakrishnan, and S.Subramanian	New Age International Pvt. Ltd.
2	CAD/CAM	MikellP.Groover, and Emory Zimmers	Jr.Prentice Hall of India Pvt., Ltd.

REFERENCES BOOKS:

Sl.No	Title	Author	Publisher with Edition
1	CAD/CAM/ CIM	Dr.P.N.Rao	Tata McGraw Hill Publishing Company Ltd.
2	Mastering CAD/CAM	Ibrahim Zeid	Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3	Automation, Production	Mikell P. Groover	Pearson Education Asia

	Systems, and Computer-Integrated Manufacturing		
4	Computer control of manufacturing systems	YoramKoren	McGraw Hill Book.
5	CAD/CAM – Principle Practice and Manufacturing Management	Chris Mcmahon and Jimmie Browne	Addision Wesley England, Second Edition,2000.
6	Computer Aided Design and Manufacturing	Dr.Sadhu Singh	Khanna Publishers, NewDelhi, Second Edition,2000.
7	Principles of Computer Integrated Manufacturing	S.Kant Vajpayee	Prentice Hall of India, 1999.
8	Computer Integrated Design and Manufacturing	David Bed worth	TMH,1998.

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112102103/16
2. https://nptel.ac.in/courses/112104228/31
3. https://www.youtube.com/watch?v=tiarT1YS-lM
4. https://nptel.ac.in/courses/112101099/

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D531.1	2	-	2	-	-	3	3	3	2	2
D531.2	2	-	2	-	-	3	3	3	2	2
D531.3	2	-	2	-	-	3	3	3	2	2
D531.4	2	-	2	-	-	3	3	3	2	2
D531.5	2	-	2	-	-	3	3	3	2	2
D531 Total	10	-	10	-	-	15	15	15	10	10
Correlation Level	2	-	2	-	-	3	3	3	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED532 -GREEN ENERGY AND ENERGY CONSERVATION

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

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

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	No of Hours
I	Fundamentals of Energy, Geothermal Energy, Wind Energy	14
II	Bio Mass Energy, Solar Energy	14
III	Photovoltaic (PV)	15
IV	PV Technologies, Applications	14
V	Energy Conservation	14
Tests and Model Exam		09
TOTAL		**80**

COURSE DESCRIPTION:

There is an ever-increasing demand for energy in spite of the rising prices of oil &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 sources viz., 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:

On completion of the course the students will be able to

- Study about the fundamentals of Energy.
- Study of construction and principle of Wind energy, Solar energy, Geo thermal and 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 OUTCOMES

Course	**MED532 -GREEN ENERGY AND ENERGY CONSERVATION**
After successful completion of this course the students should be able to	
D532.1	Discuss the fundamentals of energy, geothermal energy, wind energy
D532.2	Explain the bio mass energy and solar energy
D532.3	Explain the functions of photovoltaic (PV)
D532.4	Understand the PV technologies and application.
D532.5	Understand the energy conservation process.

MED532 -GREEN ENERGY AND ENERGY CONSERVATION

DETAILED SYLLABUS

UNIT-I FUNDAMENTALS OF ENERGY, GEOTHERMAL ENERGY, WIND ENERGY **[14Hrs]**

ENERGY: Introduction – Energy need and trends - [1Hr]

Forms of Energy– First Law of Thermodynamics - Second Law of Thermodynamics [1Hr]

– energy requirement and supply – Fossil fuels and climate changes – [1Hr]

need of renewable energy sources – Current renewable energy uses – [1Hr]

Renewable energy policies in India. [1Hr]

Geothermal energy: Introduction – Essential characteristic – [1Hr]

Sources – Power Plants – [1Hr]

Single flash power plant – double flash power plant – [1Hr]

Flow diagram and principle only. [1Hr]

Wind energy: Introduction – energy conversion [1Hr]

site selection considerations – [1Hr]

Components of wind energy conversion system – Classification. [1Hr]

Wind mill: Horizontal axis machines - Vertical axis machines [1Hr]

– working principle, advantages and disadvantages. Schemes for electric generation. [1Hr]

UNIT-II BIO MASS ENERGY, SOLAR ENERGY **[14Hrs]**

Bio mass energy: Introduction – conversion technologies: [1Hr]

Wet processes -dry processes. [1Hr]

Bio gas generation – factors affecting the bio gas generation – [1Hr]

classification of bio gas plants – Bio gas plant – construction - advantages and disadvantages. [1Hr]

Materials used for bio gas generation – [1Hr]

factors to be considered for the selection of site. [1Hr]

Solar Energy: Introduction – Sun’s energy: advantages – [1Hr]

conversion challenges– [1Hr]

The Sun-Earth movement - [1Hr]

Solar radiation [1Hr]

- Different angles - optimal angle for fixed collector, in summer and winter. [1Hr]

Sun tracking - [1Hr]

measuring instruments of solar radiation – [1Hr]

methods to estimate solar radiation. [1Hr]

UNIT III PHOTOVOTAIC (PV) [15Hrs]

Photovoltaic (PV): Semiconductors as solar cell – types of unit cells - [1Hr]

electronic arrangement of silicon atom – intrinsic semiconductor – [1Hr]

extrinsic semiconductor – Description only. P-N junction diode - [1Hr]

forward bias - reverse bias. Solar cell - characteristics - [1Hr]

description of short circuit current, open circuit voltage, [1Hr]

fill factor and efficiency - losses in solar cells. [1Hr]

Growth of solar PV and silicon (Si) requirement – [1Hr]

production of metallurgical grade (MGS) – [1Hr]

production of electronic grade (EGS) – Production of Si wafers: ingot making - [1Hr]

Mono crystalline – multi crystalline – wafer dicing. [1Hr]

Si sheets. Solar grade silicon (SoG) – refining processes – [1Hr]

Si usage in Solar PV. Process flow of commercial Si cell technology – [1Hr]

Description of saw damage removal and surface texturing, diffusion process, [1Hr]

thin-film layers for anti reflection coating and surface passivation, metal contacts and their deposition. [2Hrs]

UNIT IV PV TECHNOLOGIES, APPLICATIONS [14Hrs]

PV Technologies: Thin film Technologies – materials for thin film technologies – [1Hr]

Thin film deposition techniques: Physical vapour deposition – Evaporation – Sputtering. [1Hr]

Chemical vapour deposition – Low pressure – plasma enhanced. Advantages of thin film Si solar cell technologies. [1Hr]

Solar cell structures – substrate arrangement – superstrate arrangement. [1Hr]

Solar PV module: series and parallel connections of cells – [1Hr]

mismatch in cell / module- Design and structure of PV module. [1Hr]

Batteries for PV systems – factors affecting battery performance – [1Hr]

DC to DC converters – Charge controllers – [1Hr]

DC to AC converter (inverter) (Description only). [1Hr]

Applications: Flat plate collector - [1Hr]

concentrating solar collectors – [1Hr]

solar pond – solar water heating – [1Hr]

space heating and cooling – solar pumping – [1Hr]

solar cooking – solar green house. principle and applications only. [1Hr]

UNIT V ENERGY CONSERVATION **[14 Hrs]**

Energy conservation act 2001 - [1Hr]

Power of state government to facilitate and enforce efficient use of energy and its conservation - [1Hr]

Finance, Accounts and Audit of bureau - [1Hr]

Penalties and Adjudication - [1Hr]

Appellate tribunal for energy conservation – [1Hr]

Energy Conservation Guidelines for Industries by BEE, Govt of India - [1Hr]

Guide lines – heating, cooling and heat transfer – [1Hr]

waste recovery and usage – [1Hr]

conversion of heat to electricity – [1Hr]

Prevention of energy loss due to heat radiation and electric resistance – [1Hr]

Industry energy management system. [1Hr]

Net-metering policies – [1Hr]

Tamil Nadu Energy Development Agencies – [1Hr]

Projects in Tami Nadu: Solar energy, Bio energy and Wind energy – Tamil Nadu Solar policy 2019. [1Hr]

Tests and Model Exam [09Hrs]

TEXT BOOKS:

S.no	Title	Author	Publisher with edition
1	Non Conventional Energy Sources	G.D.Rai	Khanna Publishers
2	Non Conventional Energy Sources and Utilisation	R.K.Rajput	S.Chand& Company Ltd.

REFERENCES BOOKS:

Sl.No	Title	Author	Publisher with Edition
1	Renewable Energy	Stephen Peake	Oxford press
2	Non Conventional Energy Resources	B.H.Khan	Tata McGraw Hill.
3	Industrial energyconservation	D. A. Ray	Pergaman Press
4	Energy resource management	Kirpal Singh Jogi	Sarup and sons.
5	Solar Photovltaics	Chetan Singh Solanki	PHI Learning Pvt. Ltd.

6	Renewable Energy Engineering and Technology	V V N Kishore	TERI
7	Principles of Solar Engineering	D.Yogi Goswami, Frank Kreith, Jan F.Kreider,Taylor& Francis.	-
8	Energy conservation act 2001	-	Government of India.
9	Energy Conservation Guidelines for Industries	-	Bureau of energy Efficiency, Ministry of Power, Government of India.
10	Tamil Nadu Solar policy 2019	-	-

LEARNING WEBSITES:

1. https://teda.in/achievements/solar-energy-4/
2. https://teda.in/achievements/bio-energy-2/
3. https://teda.in/achievements/wind-energy-2/

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
D532.1	3	-	2	2	2	2	3	2	3	2
D532.2	3	-	2	2	2	2	3	2	3	2
D532.3	3	-	2	2	2	2	3	2	3	2
D532.4	3	-	2	2	2	2	3	2	3	2
D532.5	3	-	2	2	2	2	3	2	3	2
D532 Total	15	-	10	10	10	10	15	10	15	10
Correlation Level	3	-	2	2	2	2	3	2	3	2

Correlation level 1 – Slight (low)

Correlation level 2 – Moderate (Medium)

Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	**Lower Order Thinking Skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED533 -MECHATRONICS

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	
Mechatronics	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 & ALLOCATION OF HOURS

UNIT	TOPICS	No of Hours
I	Introduction, Sensors & Transducers	14
II	Actuation Systems	13
III	Basic System Models, Input / Output Systems	14
IV	Programmable Logic Controller	14
V	Design Examples & Advanced Applications in Mechatronics	16
Tests and Model Exam		09
TOTAL		**80**

COURSE DESCRIPTION:

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

OBJECTIVES

On completion of the course the students will be able to

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

COURSE OUTCOMES

Course	**MED533 -MECHATRONICS**
After successful completion of this course the students should be able to	
D533.1	Explain the working of sensors and transducers
D533.2	Understand about actuation systems
D533.3	Explain the system models and I/O systems
D533.4	Write program and operate PLCs
D533.5	Understand the advanced applications In Mechatronics

MED533 -MECHATRONICS

DETAILED SYLLABUS

UNIT-I INTRODUCTION, SENSORS & TRANSDUCERS **[14Hrs]**

Introduction – Systems – [2Hrs]

Measurement Systems – Control Systems – [2Hrs]

Microprocessor Based Controllers. [1Hr]

Examples – Mechatronics approach. [1Hr]

Measurement System terminology – [1Hr]

Displacement, Position & Proximity Sensors – [1Hr]

Velocity and Motion Sensors – Force Sensors – [1Hr]

Fluid Pressure Sensors – Flow Sensors – Liquid Level Sensors – [2Hrs]

Temperature Sensors – Light Sensors – Selection of Sensors – [2Hrs]

Calibration of sensors. [1Hr]

UNIT-II ACTUATION SYSTEMS **[13Hrs]**

Mechanical Actuation Systems – [1Hr]

Types of motion – Freedom and constraints – [1Hr]

Loading – Gear Trains – [1Hr]

Pawl & Ratchet – [1Hr]

Belt & Chain drive – [1Hr]

Bearing – Selection – Ball & Roller bearings – [1Hr]

Mechanical aspects of motor selection. [1Hr]

Electrical Actuation Systems – Switches & Relays – [1Hr]

Solenoids – D.C Motors – A.C. Motors – Stepper Motors – [1Hr]

Specification and control of stepper motors – [1Hr]

Servomotors: D.C Servomotor and A.C Servomotor. [1Hr]

Pneumatic & Hydraulic Systems – [1Hr]

Power supplies – DCV – PCV – Cylinders – Rotary actuators. [1Hr]

UNIT III BASIC SYSTEM MODELS, INPUT/OUTPUT SYSTEMS **[14Hrs]**

Mathematical Model – Introduction to mathematical model – [1Hr]

Mechanical System building blocks – [1Hr]

Electrical System building blocks –	[1Hr]
Fluid System building blocks –	[1Hr]
Thermal System building blocks.	[1Hr]
System Model –	[1Hr]
Engineering Systems –	[1Hr]
Rotational – Translational Systems –	[1Hr]
Electro-Mechanical System –	[1Hr]
Hydro- Mechanical System.	[1Hr]
Interfacing – Input/Output ports –	[1Hr]
Interface requirements: Buffers, Handshaking, Polling and interrupts, Serial interfacing –	[1Hr]
Introduction to PIA – Serial communications interface –	[1Hr]
Example of interfacing of a seven-segment display with a decoder.	[1Hr]
UNIT IV PROGRAMMABLE LOGIC CONTROLLER	**[14Hrs]**
Definition – Basic block diagram and structure of PLC –	[2 Hrs]
Input/Output processing –	[2 Hrs]
PLC Programming: Ladder diagram, logic functions,latching and sequencing –	[4Hrs]
PLC mnemonics – Timers, internal relays and counters –	[2 Hrs]
Shift registers – Master and jump controls – Data handling –	[2 Hrs]
Analog input/output – Selection of PLC – sample ladder programs.	[2 Hrs]
UNIT V DESIGN EXAMPLES & ADVANCED APPLICATIONS IN MECHATRONICS	**[16Hrs]**
Design process stages – Traditional Vs Mechatronics designs –	[2 Hrs]
Possible design solutions: Timed switch, Wind- screen wiper motion,Bath room scale –	[2 Hrs]
Case studies of Mechatronics systems: A pick-and - place robot, Car park barrier,	[2Hrs]
Car engine management system, Automatic Camera and Automatic Washing Machine.	[3 Hrs]
Sensors for condition monitoring systems of production systems –	[2Hrs]
Examples of monitoring methods: Vibration monitoring, Temperature monitoring,	[1Hr]
Wear behavior monitoring – Mechatronics control in automated manufacturing: Monitoring of manufacturing processes,	[2 Hrs]
On-line quality monitoring, Model-based systems, Hardware-in-the-loop simulation,	[1 Hr]
Supervisory control in manufacturing inspection, Integration of heterogeneous systems.	[1 Hr]
Tests and Model Exam	[9Hrs]

TEXT BOOKS:

S.no	Title	Author	Publisher with edition
1	Mechatronics	W.Bolton	Pearson Education, New Delhi. 2nd Edition 2001.
2	A Text Book of Mechatronics	R.K.Rajput	S.Chand & Co. Ltd., New Delhi.1st Edition 2007

REFERENCES

Sl.No	Title	Author	Publisher with Edition
1	Mechatronics	HMT	Tata McGraw Hill, New Delhi.1st Edition 1998
2	Mechatronics System Design	DevdasShetty&Kolk	PWS Publishing Co., Boston.1st Reprint, 2001
3	Electromechanics	James H.Harter	Prentice-Hall of India, New Delhi. 1st Edition 2003
4	Mechatronics	M.D.Singh & J.G.Joshi	Prentice-Hall of India, New Delhi.1st Edition 2006

LEARNING WEBSITES

1. https://nptel.ac.in/courses/112/103/112103174/
2. https://onlinecourses.nptel.ac.in/noc21_me27/preview
3. https://www.cet.edu.in/noticefiles/259_Lecturer%20Note%20on%20Mechatronics-ilovepdf-compressed.pdf
4. https://engineering.purdue.edu/ME588/lecture_notes.html

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POS & PSOS MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D533.1	**3**	-	**2**	**2**	-	**3**	**3**	**2**	-	**2**
D533.2	3	-	**2**	**2**	-	3	3	**2**	-	**2**
D533.3	3	-	**2**	**2**	-	3	3	**2**	-	**2**
D533.4	3	-	**2**	**2**	-	3	3	**2**	-	**2**
D533.5	3	-	**2**	**2**	-	3	3	**2**	-	**2**
D533 Total	15	-	10	10	-	15	15	10	-	10
Correlation Level	3	-	2	2	-	3	3	2	-	2

Correlation level 1 – Slight (low)

Correlation level 2 – Moderate (Medium)

Correlation level 3 – Substantial (high)

QUESTIONS PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	**Lower Order Thinking Skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED540 -PROCESS AUTOMATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	Duration
Process Automation Practical	4	64	25	100*	100	3 Hrs

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

DETAILED ALLOCATION OF MARKS

Part A:		**45**
Procedure / Circuit diagram	10	
Identification of Components	15	
Connection and execution	20	
Part B:		**40**
Procedure / Circuit diagram	10	
Ladder diagram / Programming	20	
Execution	10	
Viva Voce		**5**
Mini Project		**10**
Total 100		**100**

Mini Project Evaluation (10 marks)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

COURSE DESCRIPTION:

In this laboratory, every student will learn to design, construct and test pneumatics (compressed air) and hydraulics (pressurized oil) systems through hands-on learning. Using electronic control of hydraulic and pneumatic valves in the design and assembly of fluid power systems, students design, construct and test electronically controlled fluid power systems using programmable logic controllers (PLCs). Hydraulic and Pneumatic Automation Technology technician positions for Diploma Engineering students including woman students exist with companies all over the world. More jobs than engineering graduates are available for Diploma Students in the fluid power industry like manufacturing, mining, fishing, wood products, food processing industries, etc. All exercises in this lab are focused towards (i) training on industrial hydraulics, (ii) training on industrial pneumatics and (iii) training program on industrial control using Programmable Logic Controllers (PLCs).

EQUIPMENTS REQUIRED (For a batch of 30 students)

S.NO	Name of the Equipments	Required Nos.
1	Pneumatic Trainer Kit (All Cylinders, Control Valves, Limit switches and other accessories)	2Nos
2	Hydraulics Trainer Kit (All Cylinders, Control Valves, Limit switches and other accessories)	2Nos
3	PLC kit	2Nos
4	Computer with software	10Nos

OBJECTIVES:

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

COURSE OUTCOMES:

Course	**MED540 -PROCESS AUTOMATION PRACTICAL**
After successful completion of this course the students should be able to	
D540.1	Develop and operate pneumatic and fluid power circuits.
D540.2	Apply PLC system and its elements for process control.
D540.3	Memorize the working of function blocks in PLC.
D540.4	Demonstrate the automatic operation of pneumatic cylinder using PLC.
D540.5	Record work to be prepared and develop the mini projects with report.

MED540 -PROCESS AUTOMATION PRACTICAL

DETAILED SYLLABUS

PART A

PNEUMATICS LAB.

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

HYDRAULICS LAB.

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

PART B

PLC Lab.

9. Direct operation of a motor using latching circuit.
10. Operation of a motor using 'AND' logic control.
11. Operation of a motor using 'OR' 'control.
12. On-Delay control of a motor and Off –Delay control of a motor.
13. Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.
14. Automatic operation of Double acting cylinder-Multi cycle.
15. Sequential operation of double acting cylinder and a motor.
16. Mini Project

    The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

LEARNING WEBSITES

1. https://www.etf.ues.rs.ba/~slubura/Procesni%20racunari/PLCLab_1-7_v2.pdf
2. http://www.engppt.com/2010/10/programmable-logic-controllers-lectures.html
3. https://plc-coep.vlabs.ac.in/

CO-POS & PSOS MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D540.1	3	2	2	2	-	3	3	3	2	2
D540.2	3	2	2	2	-	3	3	3	2	2
D540.3	3	2	2	2	-	3	3	3	2	2
D540.4	3	2	2	2	-	3	3	3	2	2
D540.5	3	2	2	2	-	3	3	3	2	2
Total	15	10	10	10	-	15	15	15	10	10
Correlation level	3	2	2	2	-	3	3	3	2	2

Correlation level 1 – Slight (low)

Correlation level 2 – Moderate (Medium)

Correlation level 3 – Substantial (high)

MODEL QUESTION PAPER

MED540 -PROCESS AUTOMATION PRACTICAL

Duration: 3 Hours **Maximum marks:100**

S.No	Experiments	CO	PO
	PART A		
1	Direct operation of single and double acting cylinder.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
2	Operation of double acting cylinder with quick exhaust valve.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
3	Speed control of double acting cylinder using metering-in and metering-out circuits.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
4	Automatic operation of double acting cylinder in single cycle - using limit switch.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
5	Direct operation of single acting cylinder.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
6	Direct operation of double acting cylinder.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
7	Direct operation of hydraulic motor.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
8	Speed control of double acting cylinder metering-in and metering-out control.	D540.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
	PART B		
9	Direct operation of a motor using latching circuit.	**D540.2**	PO1,PO2,PO3 PO4,PO5,PO6,PO7
10	Operation of a motor using ‘AND’ logic control.	**D540.3**	PO1,PO2,PO3 PO4,PO5,PO6,PO7
11	Operation of a motor using ‘OR’ ‘control.	**D540.3**	PO1,PO2,PO3 PO4,PO5,PO6,PO7
12	On-Delay control of a motor and Off –Delay control of a motor.	**D540.3**	PO1,PO2,PO3 PO4,PO5,PO6,PO7
13	Automatic operation of a Double acting cylinder-single cycle.	**D540.4**	PO1,PO2,PO3 PO4,PO5,PO6,PO7
14	Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.	**D540.4**	PO1,PO2,PO3 PO4,PO5,PO6,PO7
15	Sequential operation of double acting cylinder and a motor.	**D540.5**	PO1,PO2,PO3 PO4,PO5,PO6,PO7
16	Mini Project	**D540.1 to D540.5**	PO1,PO2,PO3 PO4,PO5,PO6,PO7

MED550 -THERMAL ENGINEERING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

COURSE	Instructions		Examination			
			Marks			
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	Duration
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 for result.**

DETAILED ALLOCATION OF MARKS

PART A		**35**
Observation and Tabular Column	05	
Calculations	20	
Result / Graph	10	
PART B		**50**
Observation and Tabular Column	05	
Formulae, Calculations	30	
Result / Graph	15	
Viva Voce		**05**
Mini Project		**10**
Total		**100**

Mini Project Evaluation (10 marks)

Breakup Details

1.	Project Description	05
2.	Project Demo	05
Total		**10**

COURSE DESCRIPTION:

To Identify the various fuel characterizations through experimental testing. Analyze the performance characteristics of an internal combustion engines. Evaluate the performance parameters of refrigeration systems. Analyze the air compressor characteristics.

EQUIPMENTS REQUIRED(For a batch of 30 students)

S.NO	NAME OF THE EQUIPMENTS	REQUIRED NOS.
1	Open cup apparatus	2 Nos
2	Close cup apparatus	2 Nos
3	Redwood viscometer	2 Nos
4	Say bolt viscometer	2 Nos
5	Four stroke petrol engine Model	2 Nos
6	Four stroke diesel engine Model	2 Nos
7	Two stroke petrol engine Model	2 Nos
8	Four stroke Petrol Engine Test rig	1 No
9	Four stroke Diesel engine Test rig	1 No
10	Multi -cylinder petrol engine test rig	1 No
11	Air compressor test rig	1 No
12	Refrigeration Test rig	1 No
13	Measuring instruments	Required quantity
14	Consumables	Required quantity

OBJECTIVES:

On completion of the course the students will be able to

- Determine the flash and fire point and viscosity of oil.
- Draw the valve timing diagram of petrol and diesel engines.
- Draw the port timing diagram of petrol and diesel engines.
- Conduct performance test on petrol and diesel engines.
- Prepare heat balance sheet for an IC engine.
- Conduct of C.O.P of Refrigerators.
- Determine the volumetric efficiency of the Air Compressor.

COURSE OUTCOMES:

Course	**MED550 -THERMAL ENGINEERING PRACTICAL**
After successful completion of this course the students should be able to	
D550.1	Analyze the flash, fire point and viscosity of oil
D550.2	Sketch the valve timing and port timing diagram of petrol or diesel engine.
D550.3	Express the effect of various operating variables on engine performance.
D550.4	Prepare heat balance sheet for an ic engine
D550.5	Determine the volumetric efficiency of the air compressor and develop the mini projects with report

MED550 -THERMAL ENGINEERING PRACTICAL

List of experiments to be conducted

PART-A

1. Determine flash and fire point of the given oil using open cup and closed cup apparatus.
2. Determine the absolute viscosity of the given lubricating oil using Redwood viscometer.
3. Determine the absolute viscosity of the given lubricating oil using Say bolt viscometer.
4. Port timing diagram of two stroke petrol Engine
5. Valve time diagram for four stroke petrol Engine.
6. Valve time diagram for four stroke diesel engines.

PART-B

7. Load test (Performance test) on Four Stroke Petrol Engine.
8. Load test (Performance test) on Four Stroke diesel Engine.
9. Morse test on Multi-cylinder petrol engine.
10. Heat balance test on Four Stroke Diesel / Petrol Engine.
11. Volumetric efficiency of Air Compressor.
12. Determination of COP of Refrigeration System.
13. To determine R.E.Capacity and COP of Refrigerator by using Thermostatic Expansion valve
14. Mini Project

The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

LEARNING WEBSITE

1. https://www.iare.ac.in/sites/default/files/lab2/TE%2Blab.pdf
2. https://www.bitswgl.ac.in/lab-manuals-mech/11.TE_LAB.PDF
3. https://www.lbrce.ac.in/TE%20LAB.pdf

CO-POS & PSOS MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D550.1	3	2	2	2	1	3	3	2	3	-
D550.2	3	2	2	2	1	3	3	2	3	-
D550.3	3	2	2	2	1	3	3	2	3	-
D550.4	3	2	2	2	1	3	3	2	3	-
D550.5	3	2	2	2	1	3	3	2	3	-
Total	15	10	10	10	5	15	15	10	15	-
Correlation level	3	2	2	2	1	3	3	2	3	-

Correlation level 1 – Slight (low)

Correlation level 2 – Moderate (Medium)

Correlation level 3 – Substantial (high)

MODEL QUESTION PAPER

MED550 -THERMAL ENGINEERING PRACTICAL

Duration: 3 Hours **Maximum marks:100**

S.No	Experiments	CO	PO
	PART A		
1	Determine flash and fire point of the given oil using open cup and closed cup apparatus.	D550.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
2	Determine the absolute viscosity of the given lubricating oil using Redwood viscometer.	D550.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
3	Determine the absolute viscosity of the given lubricating oil using Say bolt viscometer.	D550.1	PO1,PO2,PO3 PO4,PO5,PO6,PO7
4	Port timing diagram of two stroke petrol Engine	D550.2	PO1,PO2,PO3 PO4,PO5,PO6,PO7
5	Valve time diagram for four stroke petrol Engine.	D550.2	PO1,PO2,PO3 PO4,PO5,PO6,PO7
6	Valve time diagram for four stroke diesel engines.	D550.2	PO1,PO2,PO3 PO4,PO5,PO6,PO7
	PART B		
7	Load test (Performance test) on Four Stroke Petrol Engine.	D550.3	PO1,PO2,PO3 PO4,PO5,PO6,PO7
8	Load test (Performance test) on Four Stroke diesel Engine.	D550.3	PO1,PO2,PO3 PO4,PO5,PO6,PO7
9	Morse test on Multi-cylinder petrol engine.	D550.3	PO1,PO2,PO3 PO4,PO5,PO6,PO7
10	Heat balance test on Four Stroke Diesel / Petrol Engine.	D550.4	PO1,PO2,PO3 PO4,PO5,PO6,PO7
11	Volumetric efficiency of Air Compressor.	D550.5	PO1,PO2,PO3 PO4,PO5,PO6,PO7
12	Determination of COP of Refrigeration System.	D550.5	PO1,PO2,PO3 PO4,PO5,PO6,PO7
13	To determine R.E.Capacity and COP of Refrigerator by using Thermostatic Expansion valve	D550.5	PO1,PO2,PO3 PO4,PO5,PO6,PO7
14	Mini Project	D550.1 to D550.5	PO1,PO2,PO3 PO4,PO5,PO6,PO7

MED561 -COMPUTER INTEGRATED MANUFACTURING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

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

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

DETAILED ALLOCATION OF MARKS

Part A: Solid Modeling		**45**
Creation of sketch	15	
Modelling	25	
Accuracy	5	
Part B:CNC Programming		**40**
Program writing	10	
Editing and Machining	25	
Finish	05	
Viva Voce		**5**
Mini Project		**10**
Total		**100**

Mini Project Evaluation (10 marks)

Breakup Details

1.	Project Description	05
2.	Project Demo	05
Total		**10**

COURSE DESCRIPTION:

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

EQUIPMENTS REQUIRED(For a batch of 30 students)

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

OBJECTIVES:

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

COURSE OUTCOMES:

Course	**MED561 Computer Integrated Manufacturing Practical**
After successful completion of this course the students should be able to	
D561.1	Summarize 3D commands of Auto CAD
D561.2	Relate the part model and assembly of parts using Auto CAD.
D561.3	Define the working principles of CNC machines.
D561.4	Determine to prepare, edit and execute part program in CNC machines.
D561.5	Develop components as per drawings using CNC machines and develop the mini projects with report

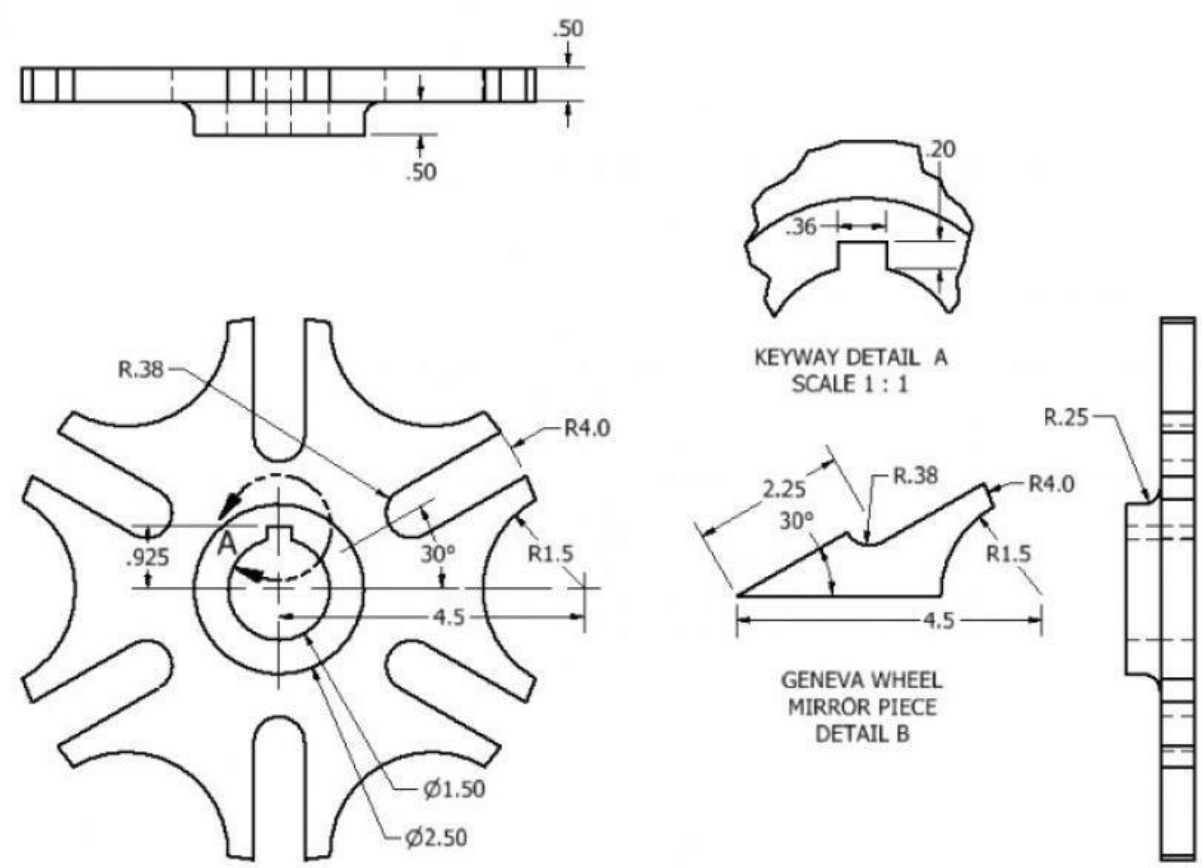
MED561 -COMPUTER INTEGRATED MANUFACTURING PRACTICAL

DETAILED SYLLABUS

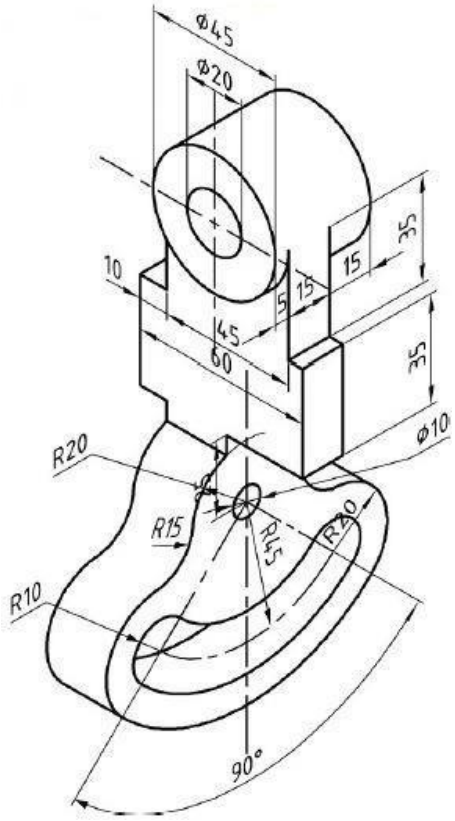
PART A: SOLID MODELLING

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

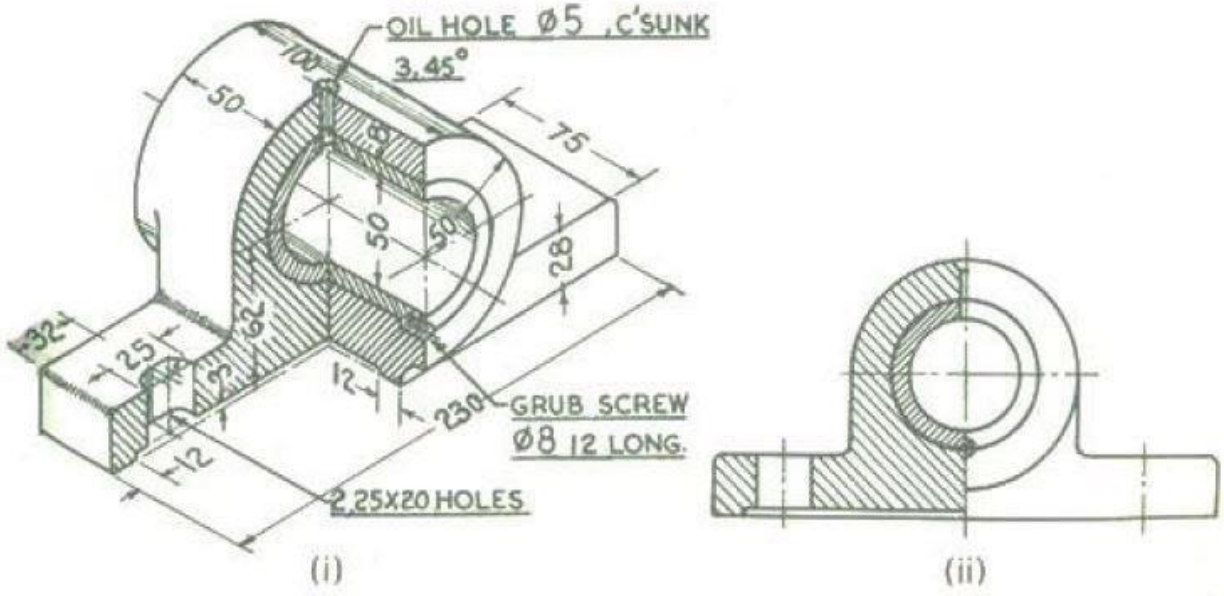
Exercise No. 1. Geneva Wheel



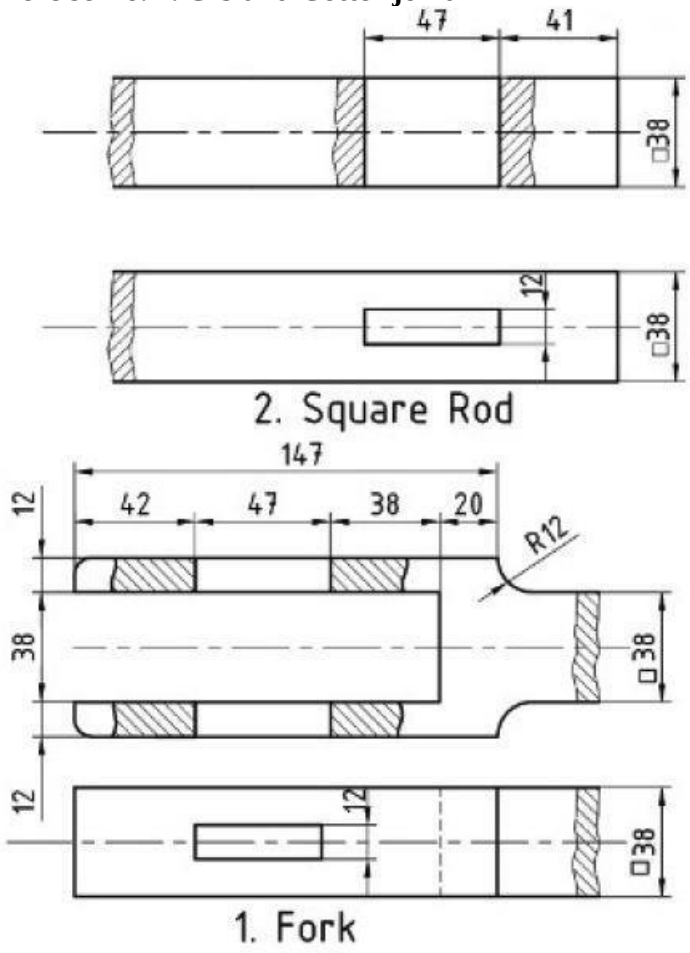
Exercise No. 2. Bearing Block

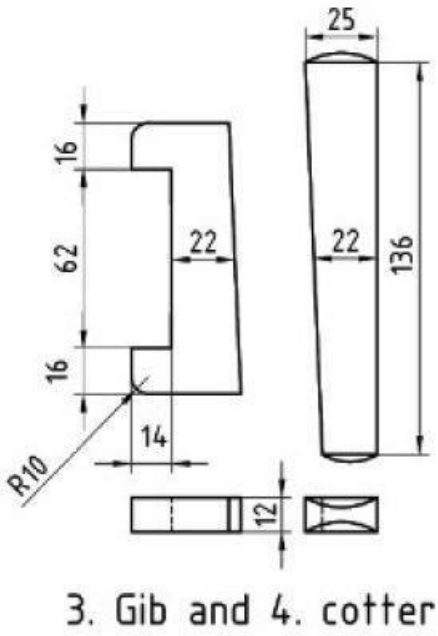


Exercise No. 3. Bushed bearing

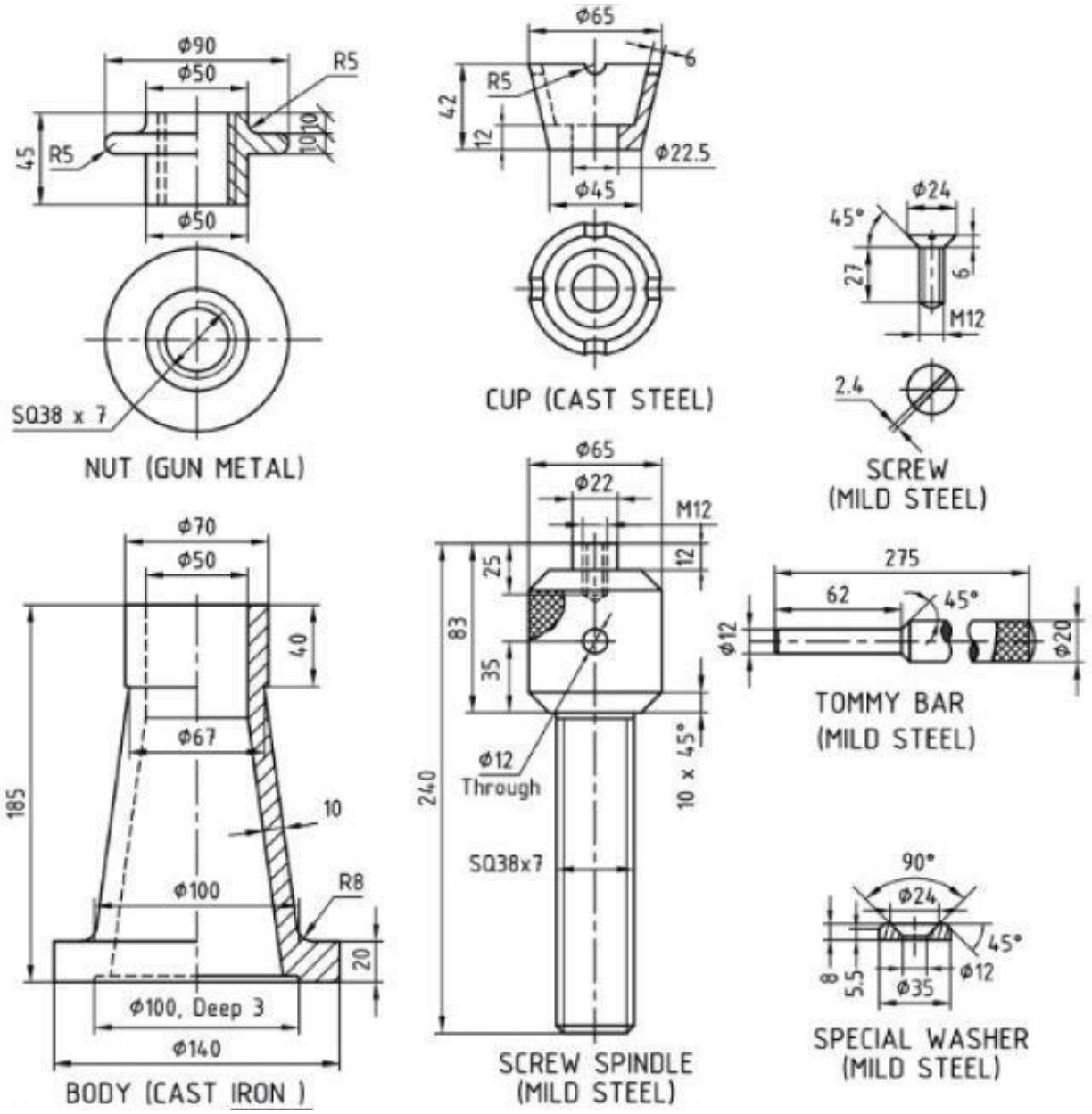


Exercise No. 4. Gib and Cotter joint

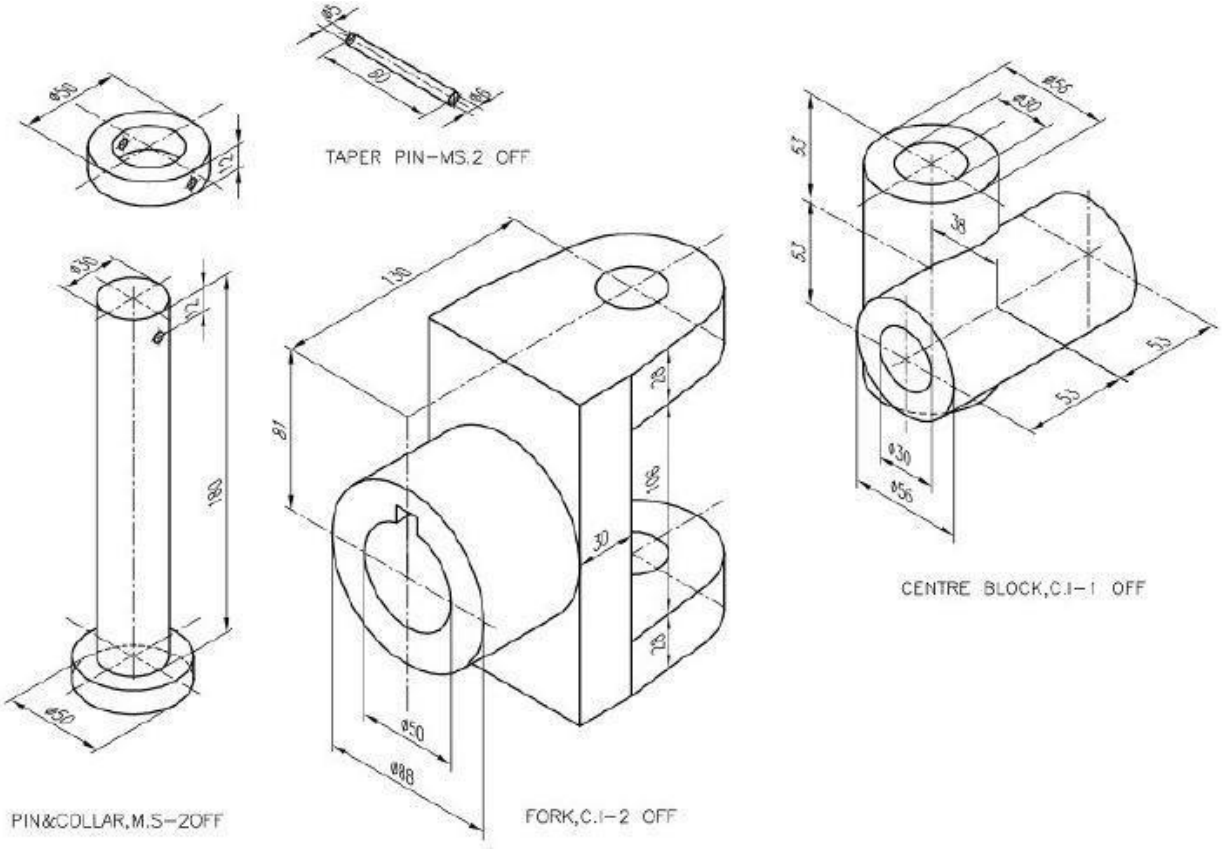




Exercise No. 5. Screw Jack



Exercise No. 6. Universal Coupling



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

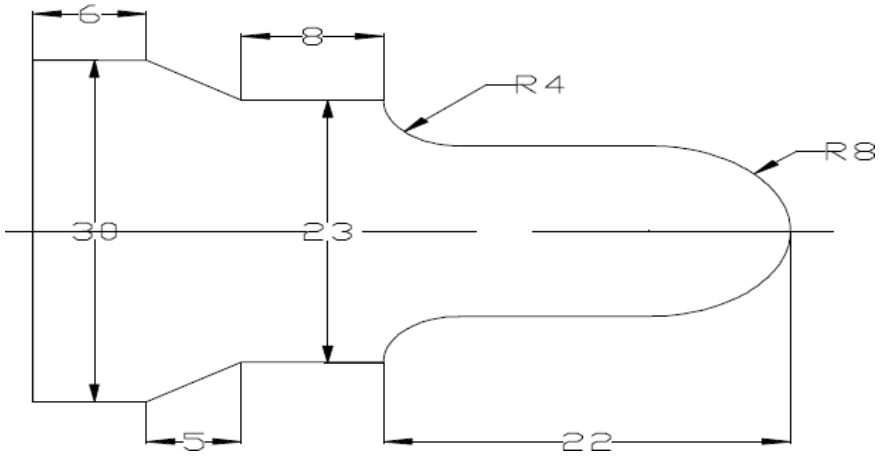
PART B: CNC Programming and Machining

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

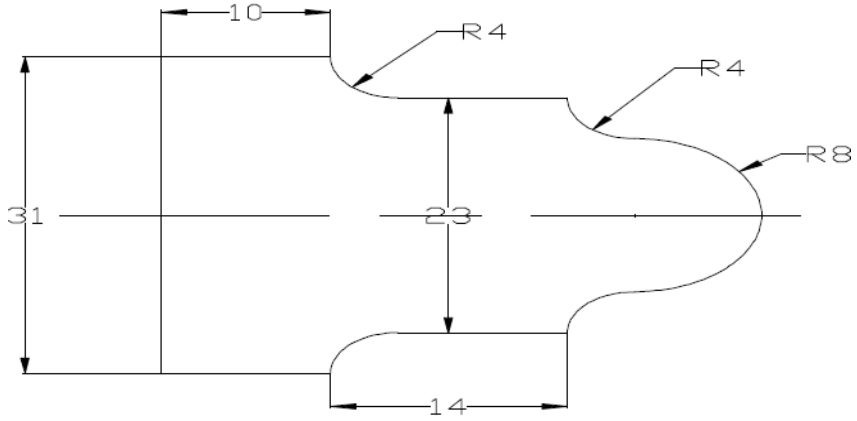
Note: Create and edit the part program in the simulation software for verification of the part program. Enter / transfer the program to make the component in the CNC machine.

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

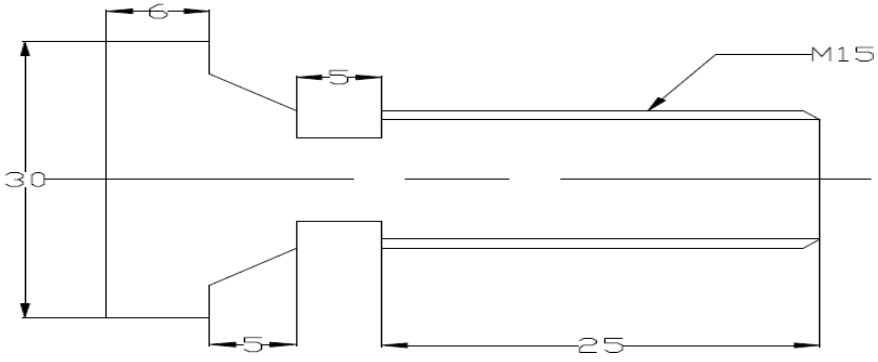
7. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.



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

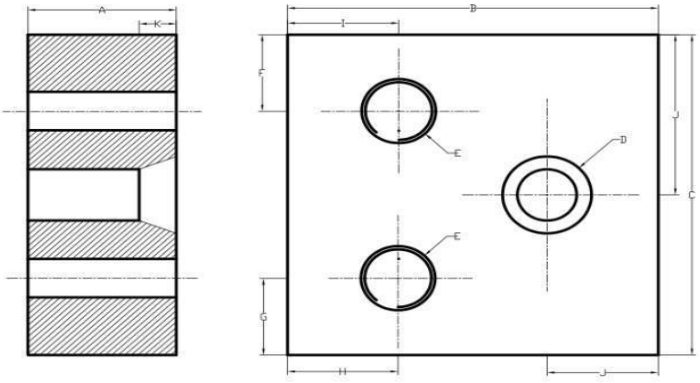


9. Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.

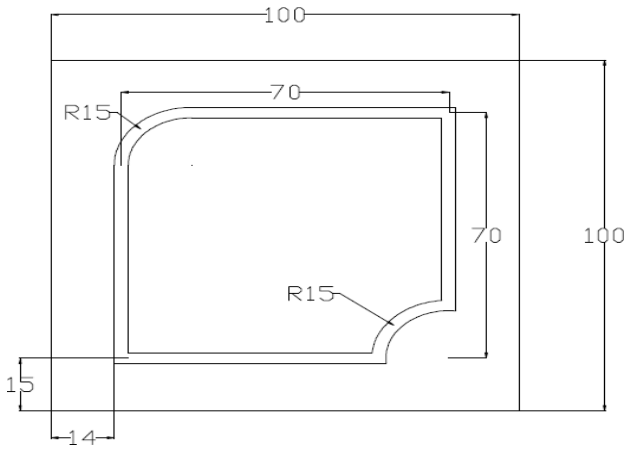


CNC Milling Machine Material: M.S / Aluminum / acrylic fibre / plastic

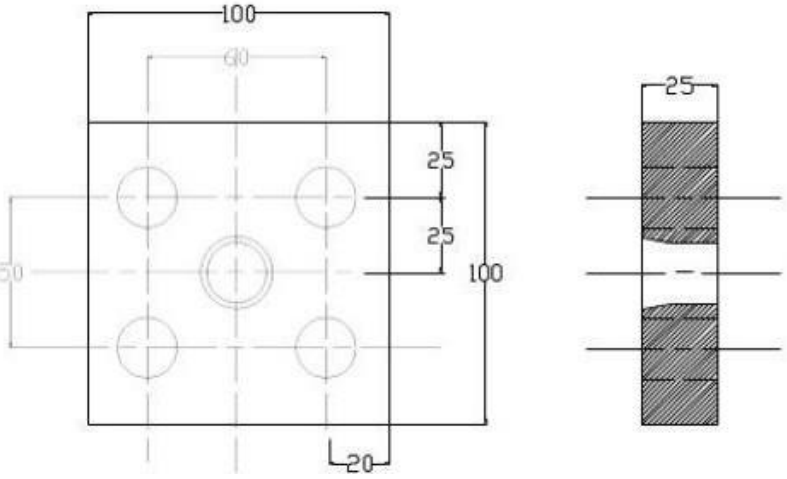
10. Create part program for internal drills, boring and simulate in the software



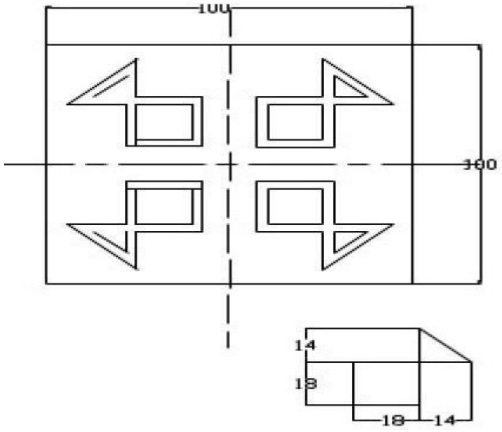
11. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.



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



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



14. Mini project

The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

LEARNING WEBSITES

1. http://vlabs.iitkgp.ac.in/cim/
2. https://www.bietdvg.edu/media/department/ME/data/learningmaterials/CIM_LAB_MANUAL17MEL77.pdf
3. https://nptel.ac.in/courses/112105211/
4. https://www.digimat.in/nptel/courses/video/112105211/L01.html
5. http://www.nptelvideos.in/2012/12/computer-aided-design.html

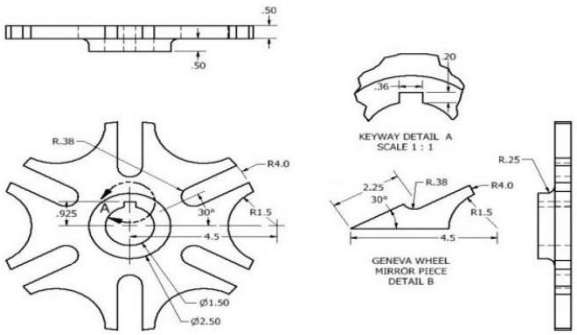
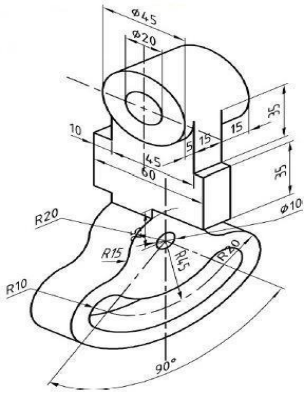
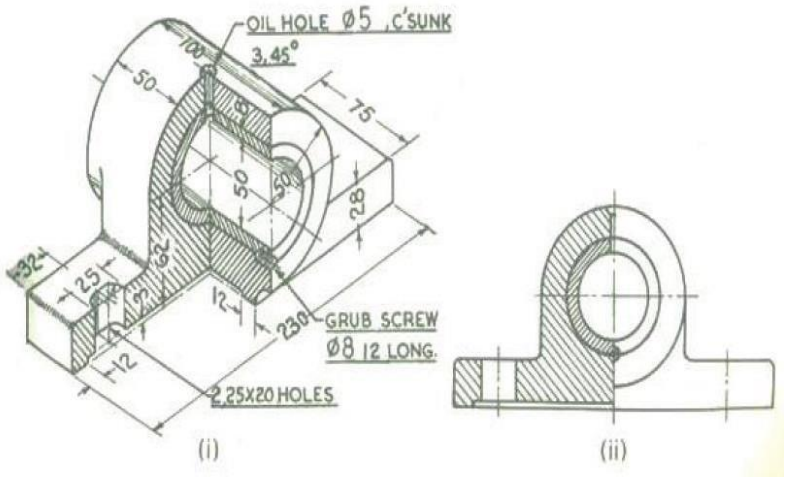
CO – PO & PSO'S MAPPING MATRIX

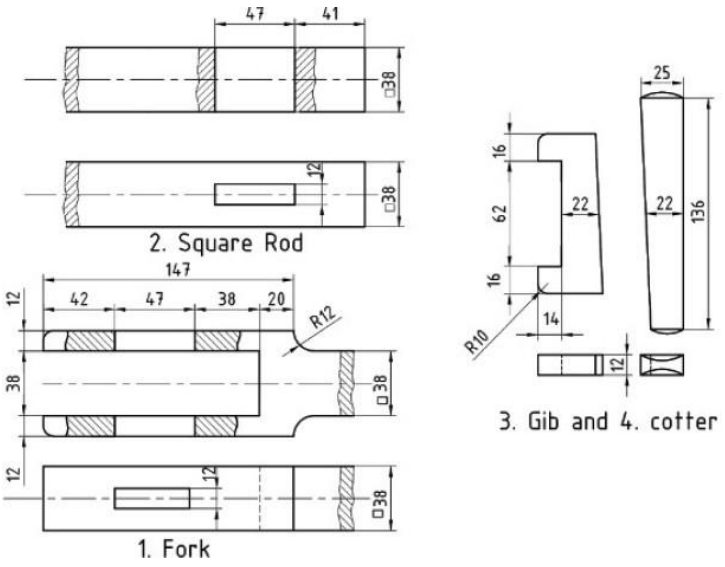
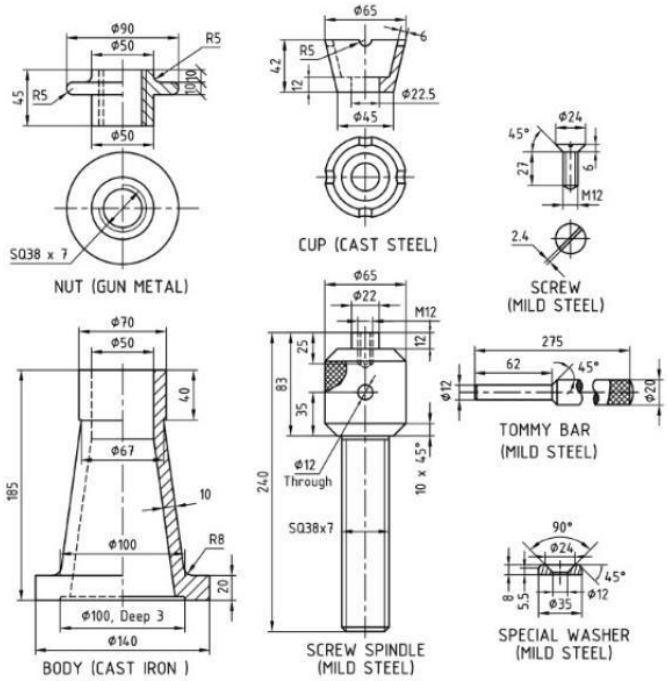
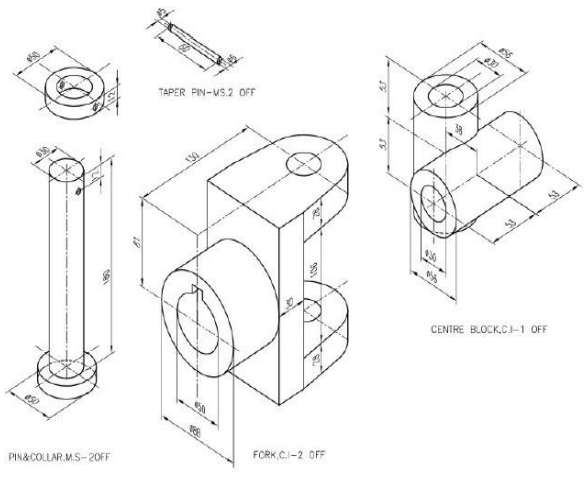
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D561.1	**3**	-	2	**3**	-	**3**	**3**	**3**	2	2
D561.2	**3**	-	2	**3**	-	**3**	**3**	**3**	2	2
D561.3	3	-	2	3	-	3	3	3	2	2
D561.4	3	-	2	3	-	3	3	3	2	2
D561.5	3	-	2	3	-	3	3	3	2	2
Total	15	-	10	15	-	15	15	15	10	10
Correlation Level	3	-	2	3	-	3	3	3	2	2

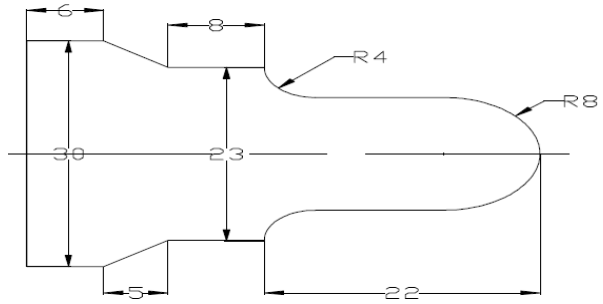
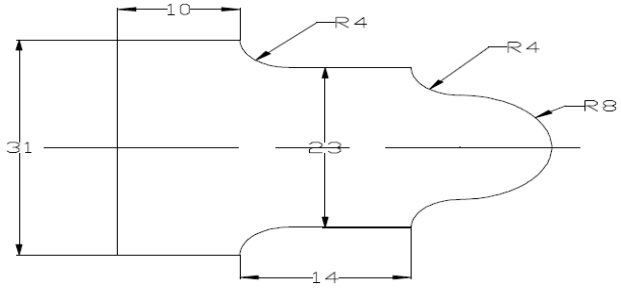
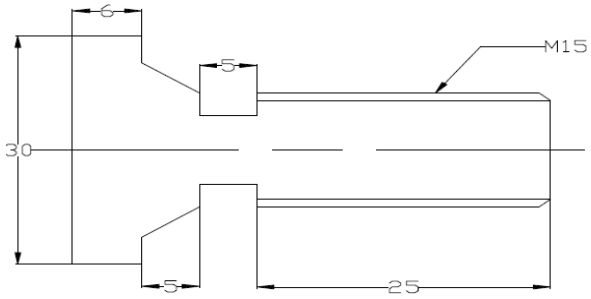
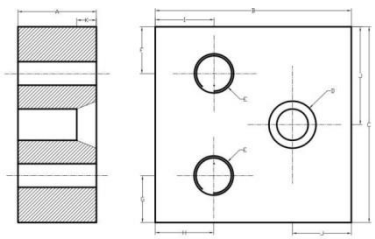
MED561 -COMPUTER INTEGRATED MANUFACTURING PRACTICAL

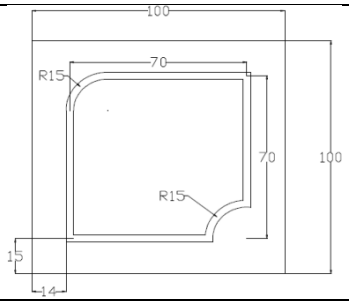
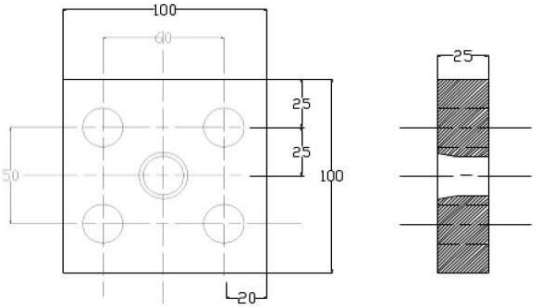
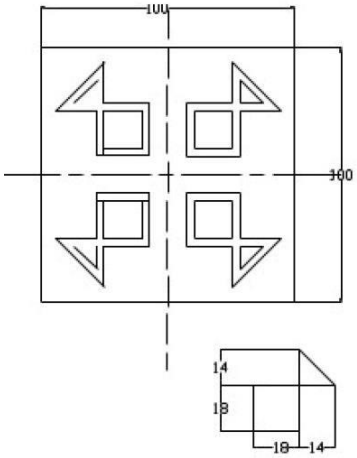
MODEL QUESTION PAPER

Duration: 3 Hours **Maximum marks:100**

S.No.	Experiments	CO	PO
1	**Geneva Wheel** 	**D561.2**	PO3,PO4,PO7
2	**Bearing Block** 	**D561.2**	PO3,PO4,PO7
3	**Bushed bearing** 	**D561.2**	PO3,PO4,PO7

4	**Gib and Cotter joint**  	**D561.2**	PO3,PO4,PO7
5	**Screw Jack**  	**D561.2**	PO3,PO4,PO7
6	**Universal Coupling**  	**D561.2**	PO3,PO4,PO7

	PART B		
1.	Using Linear and Circular interpolation - Create a part program and produce component in the Machine. 	**D561.5**	PO3,PO4,PO7
2.	Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine. 	**D561.5**	PO3,PO4,PO7
3.	Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine. 	**D561.5**	PO3,PO4,PO7
4.	Create part program for internal drills, boring and simulate in the software 	**D561.5**	PO3,PO4,PO7
5.	Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.		

		**D561.5**	PO3,PO4,PO7
6.	Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine. 	**D561.5**	PO3,PO4,PO7
7.	Using subprogram - Create a part program and produce component in the Machine. 	**D561.5**	PO3,PO4,PO7
	Mini Project	**D561.1 to D561.5**	PO1,PO2, PO3,PO4,PO7

MED562 -GREEN ENERGY AND ENERGY CONSERVATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

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

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

DETAILED ALLOCATION OF MARKS

Part A:		**30**
Study explanation	30	
Part B:		**55**
Procedure	15	
Observation / Reading / calculation	30	
Result	10	
Viva Voce		**5**
Mini Project		**10**
Total		**100**

Mini Project Evaluation (10 marks)

Breakup Details

1.	Project Description	05
2.	Project Demo	05
Total		**10**

COURSE DESCRIPTION:

The field of Green Energy Technology (GET) encompasses a continuously evolving group of methods, materials and processes from environmentally benign techniques for generating energy to its minimal utilization for maximal production of end materials and utilization of waste products when generated.

EQUIPMENTS REQUIRED(For a batch of 30 students)

S.NO	NAME OF THE EQUIPMENTS	REQUIRED NOS.
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 Charge Controller	1 No.
5	Solar Structure	1 No.
6	Wall mountable 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

OBJECTIVES:

On completion of the course the students will be able to

- 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 load DC load with battery.
- To understand how to use various electrical measuring equipments.
- To study the different electrical parameters of a mono crystalline and
- polycrystalline 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 OUTCOMES:

Course	**MED562 -GREEN ENERGY AND ENERGY CONSERVATION PRACTICAL**
After successful completion of this course the students should be able to	
D562.1	Demonstrate the i-v and p-v characteristics of pv module .
D562.2	Understand how a solar pv standalone system works
D562.3	Learn about the wind power generation status and biogas generation status in Tamil nadu.
D562.4	Workout power flow calculations of standalone pv system ac load dc load with battery.
D562.5	Study the different electrical parameters of a mono crystalline, polycrystalline silicon solar panel and develop the mini projects with report

MED562 -GREEN ENERGY AND ENERGY CONSERVATION PRACTICAL

List of experiments to be conducted

EXPERIMENTS

PART A

1. Study and demonstrate the I-V and P-V Characteristics of PV module with varying radiation and temperature level.
2. Study and demonstrate the I-V and P-V characteristics of series and 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

7. Conduct experiment to show the effect of variation in tilt angle on PV module power.
8. Conduct the experiment to demonstrate the working of diode as Bypass diode and blocking diode.
9. Conduct the experiment to draw the charging and discharging characteristics of battery.
10. Conduct the experiment for the power flow calculations of standalone PV system of AC load with battery.
11. Conduct the experiment for the power flow calculations of standalone PV system of DC load with battery.
12. Conduct the experiment to determine the different electrical parameters of a monocrystalline and polycrystalline silicon solar panel.
13. Mini project

    The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/121/106/121106014/
2. https://www.vnmkv.ac.in/student-corner/ENGG-243.pdf
3. https://www.stmarysmd.com/docs/Energ%20ManagementConservation.pdf

CO – POs & PSOs MAPPING MATRIX

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D561.1	2	2	2	3	3	3	3	2	3	2
D561.2	2	2	2	3	3	3	3	2	3	2
D561.3	2	2	2	3	3	3	3	2	3	2
D561.4	2	2	2	3	3	3	3	2	3	2
D561.5	2	2	2	3	3	3	3	2	3	2
Total	10	10	10	15	15	15	15	10	15	10
Correlation Level	2	2	2	3	3	3	3	2	3	2

MODEL QUESTION PAPER

MED562 -GREEN ENERGY AND ENERGY CONSERVATION PRACTICAL

Duration: 3 Hours **Maximum marks:100**

S.No	Experiments	CO	PO
	PART A		
1.	Study and demonstrate the I-V and P-V Characteristics of PV module with varying radiation and temperature level.	D562.1	PO1,PO2,PO3, PO4,PO5,PO6,PO7
2.	Study and demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.	D562.1	PO1,PO2,PO3, PO4,PO5,PO6,PO7
3.	Study and demonstrate the effect of shading on module output power.	D562.2	PO1,PO2,PO3, PO4,PO5,PO6,PO7
4.	Do a shading analysis on the site where solar PV system needs to be setup.	D562.2	PO1,PO2,PO3, PO4,PO5,PO6,PO7
5.	Study the wind power generation status in Tamilnadu.	D562.3	PO1,PO2,PO3, PO4,PO5,PO6,PO7
6.	Study the biogas generation status in Tamilnadu.	D562.3	PO1,PO2,PO3, PO4,PO5,PO6,PO7
	PART B		
7.	Conduct experiment to show the effect of variation in tilt angle on PV module power.	D562.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
8.	Conduct the experiment to demonstrate the working of diode as Bypass diode and blocking diode.	D562.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
9.	Conduct the experiment to draw the charging and discharging characteristics of battery.	D562.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
10.	Conduct the experiment for the power flow calculations of standalone PV system of AC load with battery.	D562.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
11.	Conduct the experiment for the power flow calculations of standalone PV system of DC load with battery.	D562.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
12.	Conduct the experiment to determine the different electrical parameters of a mono crystalline and polycrystalline silicon solar panel.	D562.5	PO1,PO2,PO3, PO4,PO5,PO6,PO7
13	Mini project	D562.1 to D562.5	PO1,PO2,PO3, PO4,PO5,PO6,PO7

ELECTIVE PRACTICAL-I
MED563 – MECHATRONICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			
	Hours / Week	Hours / Semester	Internal Assessment	Board Examination	Total	Duration
Mechatronics Practical	4	64	25	100*	100	3 Hrs

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

DETAILED ALLOCATION OF MARKS		
Part A: Electro Pneumatic circuit / Electro Hydraulic circuit (by lot):		**45**
Circuit diagram :	15	
Components connections & execution :	20	
Output :	10	
Part B:Process Control Instrumentation		**40**
Circuit diagram : 15	10	
Execution & Programming : 20	20	
Output : 10	10	
Viva Voce		**5**
Mini Project		**10**
Total		**100**

Mini Project Evaluation (10 marks)

Breakup Details

1.	Project Description	05
2.	Project Demo	05
Total		**10**

COURSE DESCRIPTION:

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

EQUIPMENTS REQUIRED(For a batch of 30 students)

S.NO	Name of the Equipments	Required Nos.
	Electro Pneumatics:	
1	Basic Pneumatic Trainer Kit with FRL Unit, Compressor and Accessories –	2 Nos
2	3/2 NC Single Solenoid Valve	- 2Nos
3	3/2 NO Single Solenoid Valve	- 2Nos
4	5/2 Single Solenoid Valve	- 2Nos
5	5/2 Double Solenoid Valve	- 2Nos
6	Limit Switch	– 6 Nos
7	Proximity Sensor (Inductive, Capacitive & Optical)	– Each 2 Nos
8	Single Acting Pneumatic Cylinder	– 4 Nos
9	Double Acting Pneumatic Cylinder	– 2 Nos
10	Power Supply Unit, Connecting Leads and Hoses	– As per Requirements
	Electro Hydraulics:	
1	Basic Hydraulics Trainer Kit with Hydraulic Pump, Regulator and Hoses Accessories	– 2 Nos
2	Double Acting Cylinder	– 2 Nos
3	Single Acting Cylinder	– 2 No
4	Manual Actuator Switch	– 4 Nos
5	Conveyor Assembly set up	– 1 No
6	Lifting Station Assembly Set up	– 1 No
7	Limit Switch	- 4 Nos
	Process Control Instrumentation:	
1	Programmable Logic Controller (PLC) with Software	– 3 Nos
2	Human Machine Interface (HMI) with Software	- 3 Nos
3	SCADA Software	– 1 No or Integrated Software for PLC, HMI and SCADA)
4	Personnel Computer	– 3 Nos
5	Water Tank Assembly set up with Level Sensor and Flow Controller (Actuator) to interface with PLC and HMI	– 1 No

OBJECTIVES:

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

COURSE OUTCOMES:

Course	**MED563 – MECHATRONICS PRACTICAL**
After successful completion of this course the students should be able to	
D563.1	Understand the applications of Electro Pneumatics
D563.2	Explain Limit switch and proximity switch application circuits
D563.3	Understand the Working of hydraulic cylinder
D563.4	Design of HMI screen for two chemicals mixing process
D563.5	Configuring Alarms in SCADA for the same application and develop the mini projects with report

ELECTIVE PRACTICAL-I
MED563 – MECHATRONICS PRACTICAL

DETAILED SYLLABUS

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

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

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

SCADA - Fundamental principles of modern SCADA systems - SCADA hardware - SCADA software - Landlines for SCADA - SCADA and local area networks – Modem used in SCADA systems - Remote terminal units. Human Machine Interface – components of HMI.Distributed Control System - Parts of DCS – Layered structure of DCS –Communication options in DCS. Variable Frequency Drives - Construction, Working,Operation, Applications and Specifications

List of experiments to be conducted

PART A

(ELECTRO PNEUMATICS)

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

(ELECTRO HYDRAULICS)

5. Sorting device using double acting cylinder, directly actuated, manually
6. Component selection on conveyor belt using double acting cylinder and directly actuated, manually
7. Lifting station using single acting cylinder and directly actuated, manually
8. Door control using double acting cylinder and interlocking.

PART B

PROCESS CONTROL INSTRUMENTATION

9. Wiring practice of HMI
10. Design of HMI screen
11. HMI Configuration and Interfacing with PLC and PC
12. Configuring Alarms in SCADA
13. Real time project development and interfacing with PLC
14. Monitoring & Control of Pneumatic System using HMI

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks

Total		25 Marks

LEARNING WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc21_me129/preview
2. http://btech.mit.asia/files/btech/departments/mech/Labmanual/13.pdf
3. https://cet.edu.in/noticefiles/259_Lecturer%20Note%20on%20Mechatronics-ilovepdf-compressed.pdf

CO,PO'S & PSO'S MAPPING MATRIX

COURSE OUTCOME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D563.1	3	2	2	2	-	3	3	2	2	2
D563.2	3	2	2	2	-	3	3	2	2	2
D563.3	3	2	2	2	-	3	3	2	2	2
D563.4	3	2	2	2	-	3	3	2	2	2
D563.5	3	2	2	2	-	3	3	2	2	2
Total	15	10	10	10	-	15	15	10	10	10
Correlation level	3	2	2	2	-	3	3	2	2	2

MODEL QUESTION PAPER

MED563 – MECHATRONICS PRACTICAL

Duration: 3 Hours **Maximum marks:100**

S.No	Experiments	CO	PO
	PART A		
1	Direct control of a 3/2 NC Single solenoid valve and a 3/2 NO Single solenoid valve	D563.1	PO1,PO2,PO3, PO4,PO5,PO6,PO7
2	Direct control of a 5/2 single solenoid valve and a 5/2 double solenoid valve	D563.1	PO1,PO2,PO3, PO4,PO5,PO6,PO7
3	Simple circuit using OR Logic and AND Logic	D563.2	PO1,PO2,PO3, PO4,PO5,PO6,PO7
4	Limit switch and proximity switch application circuits	D563.2	PO1,PO2,PO3, PO4,PO5,PO6,PO7
5	Reed switch and Pressure switch application circuit	D563.3	PO1,PO2,PO3, PO4,PO5,PO6,PO7
6	Sorting device using double acting cylinder, directly actuated, manually	D563.3	PO1,PO2,PO3, PO4,PO5,PO6,PO7
7	Component selection on conveyor belt using double acting cylinder and directly actuated, manually	D563.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
8	Lifting station using single acting cylinder and directly actuated, manually	D563.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
9	Door control using double acting cylinder and interlocking	D563.5	PO1,PO2,PO3, PO4,PO5,PO6,PO7
10	Feed for drilling machine using rapid traverse feed circuit, and controlling the speeds by limit switch	D563.5	PO1,PO2,PO3, PO4,PO5,PO6,PO7
	PART B		
11.	Wiring practice of HMI	D563.1	PO1,PO2,PO3, PO4,PO5,PO6,PO7
12.	Design of HMI screen for two chemicals mixing process	D563.1	PO1,PO2,PO3, PO4,PO5,PO6,PO7
13.	HMI Configuration and Interfacing with PLC and PC	D563.2	PO1,PO2,PO3, PO4,PO5,PO6,PO7
14.	Configuring Alarms in SCADA for the same application	D563.3	PO1,PO2,PO3, PO4,PO5,PO6,PO7
15.	Two chemicals mixing process at different proportions using PLC	D563.4	PO1,PO2,PO3, PO4,PO5,PO6,PO7
16.	Water Tank over flow Monitoring & Control System using HMI	D562.5	PO1,PO2,PO3, PO4,PO5,PO6,PO7
17.	Mini Project	D562.1 to D562.5	PO1,PO2,PO3, PO4,PO5,PO6,PO7

MED570–ENTREPRENEURSHIP & STARTUPS

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

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

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO.OF. 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 And Preparation of Case Study Report		14
TOTAL		**64**

COURSE DESCRIPTION

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

OBJECTIVES:

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

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

COURSE OUTCOMES:

Course	**MEC570- Entrepreneurship & Startups**
After successful completion of this course the students should be able to	
D570.1	Understand the concept and process of Entrepreneurship.
D570.2	Familiarize about business idea and banking.
D570.3	Understand the formation of E-Cell, start-ups and success stories.
D570.4	Aware about pricing and cost analysis
D570.5	Learn about the business plan preparation

MED570–ENTREPRENEURSHIP & STARTUPS

DETAILED SYLLABUS

UNIT	NAME OF THE TOPICS	HOUR
I	**Entrepreneurship – Introduction and Process** • Concept, Functions and Importance • Myths about Entrepreneurship • Pros and Cons of Entrepreneurship • Process of Entrepreneurship • Benefits of Entrepreneur • Competencies and characteristics • Ethical Entrepreneurship • Entrepreneurial Values and Attitudes • Motivation • Creativity • Innovation • Entrepreneurs - as problem solvers • Mindset of an employee and an entrepreneur • Business Failure – causes and remedies • Role of Networking in entrepreneurship	**10**
II	**Business Idea and Banking** • Types of Business: Manufacturing, Trading and Services. • Stakeholders: sellers, vendors and consumers and Competitors • E- commerce Business Models • Types of Resources - Human, Capital and Entrepreneurial tools and resources • Selection and utilization of human resources and professionals, etc. • Goals of Business; Goal Setting • Patent, copyright and Intellectual property rights • Negotiations - Importance and methods • Customer Relations and Vendor Management • Size and capital based classification of business enterprises • 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	**10**
III	**Start ups, E-cell and Success Stories** • Concept of Incubation centre's • Visit and report of DIC , financial institutions and other relevance 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	**10**

	• Role of E-Cell • E-Cell to Entrepreneurship	
IV	**Pricing and Cost Analysis** • Unit of Sale, Unit Price and Unit Cost - for single product or service • Types of Costs - Start up, Variable and Fixed • 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 Income Statement • Prepare a Cash Flow Projection • Projections • Pricing and Factors affecting pricing. • Launch Strategies after pricing and proof of concept	**10**
V	**Business Plan Preparation** • Generation of Ideas. • Business Ideas vs. Business Opportunities • Opportunity Assessment – Factors, Micro and Macro • Market Environment • Selecting the Right Opportunity • Product selection • New product development and analysis • Feasibility Study Report – Technical analysis, financial analysis and commercial analysis • Market Research - Concept, Importance and Process • 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 risks • Execution of Business Plan	**10**

TEXT BOOK AND REFERENCE BOOK :

Sl.No	Title	Author	Publisher with Edition
1	Fundamentals of Entrepreneurship,	Dr. G.K. Varshney,	SahityaBhawan Publications, Agra - 282002
2	Business Regulatory Framework ,	Dr. G.K. Varshney,	SahityaBhawan Publications, Agra - 282002
3	Entrepreneurship ,	Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd,	McGraw Hill (India) Private Limited, Noida - 201301
4	Essentials of Entrepreneurship and small business management	M.Scarborough, R.Cornwell,	Pearson Education India, Noida - 201301
5	Entrepreneurship Development and Small Business Enterprises,	CharantimathPoornima M.	Pearson Education, Noida - 201301
6	Innovation Management and New Product Development,	Trott,	Pearson Education, Noida - 201301
7	A Textbook of Cost and Management Accounting,	M N Arora,	Vikas Publishing House Pvt. Ltd., New Delhi-110044
8	Financial Management,	Prasanna Chandra,	Tata McGraw Hill education private limited, New Delhi
9	Indian Banking System,	I. V. Trivedi, Renu Jatana,	RBSA Publishers, Rajasthan
10	HOW TO START A BUSINESS IN INDIA,	Simon Daniel,	BUUKS Chennai - 600018
11	The Business Plan Write-Up Simplified - A practitioners guide to writing the Business Plan,	Ramani Sarada,	Notion Press Media Pvt. Ltd., Chennai 600095.

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	**-**	**25 Marks**

Note:

*** Two assignments should be submitted. The same must be evaluated and converted to 05 marks.**

Guidelines for assignment:

First assignment	Unit I
Second assignment	Unit II
Guidelines for Seminar Presentation	Unit III

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

AUTONOMOUS EXAMINATION

Note

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

2. The students should maintain theory assignment and seminar presentation. The assignment and seminar presentation should be submitted during the Autonomous Practical Examinations.

3. The question paper consists of theory and practical portions. All students should write the answers for theory questions (40 Marks) and practical portions (60 Marks) should be completed for board examinations.

4. All exercises should be given in the question paper and students are allowed to select by lot. If required the dimensions of the exercises may be varied for every batch. No fixed time allotted for each portion and students have liberty to do the examination for 3Hrs.

5. For Written Examination: theory question and answer: 45 Marks Ten questions will be asked for 3 marks each. Five questions from each unit 1 & 2. (10 X 3 = 30). Three questions will be asked for 5 marks each. One question from each unit 1, 2 &3. (3 X 5 = 15)

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

ALLOCATION OF MARKS

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

CO-POS & PSOS MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D570.1	3	-	2	-	-	2	3	2	2	2
D570.2	3	-	2	-	-	2	3	2	2	2
D570.3	3	-	2	-	-	2	3	2	2	2
D570.4	3	-	2	-	-	2	3	2	2	2
D570.5	3	-	2	-	-	2	3	2	2	2
Total	15	-	10	-	-	10	15	10	10	10
Correlation level	3	-	2	-	-	2	3	2	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as Presented below:

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

****

MODEL QUESTION PAPER

TIME: 3 Hrs **MARKS: 100**

PART-I (10 X 3= 30 Marks)					
Note: Answer all questions. All questions carry equal marks					
S.No	**Questions**	**Unit**	**Bloom's Level**	**CO**	**PO**
1	Define entrepreneurship.	I	R	D570.1	POI,PO2,PO3
2	State the process of entrepreneurship.	I	R	D570.1	POI,PO2,PO3
3	What are the benefits of being an entrepreneur?	I	R	D570.1	POI,PO2,PO3
4	How do entrepreneurs act as problem solvers?	I	U	D570.1	POI,PO2,PO3
5	Outline the role of networking in entrepreneurship.	I	U	D570.1	POI,PO2,PO3
6	List the various types of business.	II	R	D570.2	POI,PO2,PO3
7	Outline the business model.	II	U	D570.2	POI,PO2,PO3
8	Suggest the various goals of business.	II	U	D570.2	POI,PO2,PO3
9	How selection of human resources is carried out?	II	U	D570.2	POI,PO2,PO3
10	Specify the role of government policy on entrepreneurship.	II	U	D570.2	POI,PO2,PO3

PART-II (3 X 5 = 15 Marks)					
Note: Answer all questions. All questions carry equal marks					
S.No	**Questions**	**Unit**	**Bloom's Level**	**CO**	**PO**
11	Describe the importance of innovation on entrepreneurship.	I	An	D570.1	POI,PO2,PO3
12	Enumerate the various incentive schemes for the central government.	II	U	D570.2	POI,PO2,PO3
13	How technology will play a major role in E-commerce?	III	An	D570.3	POI,PO2,PO3
	Part B **40 Marks** Practical Examination – Submission on BusinessPlan/Feasibility Report or Report on Unit 4 & 5				
	Part C Viva voce **15 Marks**				

QUESTION PAPER SETTING

The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as Presented below:

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

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MED510-DESIGN OF MACHINE ELEMENTS

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

	PART- A (5 x 5 = 25 Marks)				
	Note: Answer all questions. All questions carry equal marks				
S.No	**Questions**	**UNIT**	**BLOOM'S LEVEL**	**CO**	**PO**
1.	Name the type of steel with its composition designated as X10 Cr18 Ni9.	I	R	D510.1	PO 1, PO2,PO3
2.	What is the effect of key way cut on a shaft?	II	R	D510.2	PO 1, PO2,PO3
3.	What is slip and what are its effects? How it can be reduced?	III	R	D510.3	PO 1, PO2,PO3
4.	Define Mechanical advantage, leverage and displacement ratio.	IV	R	D510.4	PO 1, PO2,PO3
5.	Explain about 2D and 3D transformations.	V	U	D510.5	PO 1, PO2,PO3

	PART – B (5x15 = 75 Marks)					
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**Unit**	**Bloom's level**	**CO**	**PO**
6 A)	A mild steel rod supports a tensile load of 50kN and the stress in the rod is limited to 100N/mm^2. Determine the size of the rod when the section is (a) circular (ii) square and (iii) rectangle with width = 3 x thickness.	15	I	E	D510.1	PO 1, PO2,PO3
	(OR)					
6 B)	Design a knuckle joint to take a load of 60kN, assuming that all the parts are made of the same material. The permissible stresses are 60MPa in tension, 75MPa in compression and 40MPa in shear respectively.	15	I	Ap	D510.1	PO 1, PO2,PO3
7A)	A shaft is supported on bearings A and B, 800mm between centres. A 20^o straight tooth spur gear with 600mm pitch diameter is located 200mm to the right of the left hand bearing A and a 700mm diameter pulley is mounted 250mm towards the left of bearing B. The gear is driven by a pinion with a downward					

	tangential force while the pulley drives a horizontal belt having 180^o angle of wrap. The pulley also serves as a flywheel and weighs 2000N. The maximum belt tension is 3000N and the tension ratio is 3:1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 N/mm^2	15	II	Ap	D510.2	PO 1, PO2,PO3
	(OR)					
7 B)	Design a protective type of cast iron flange coupling for a steel shaft transmitting 15KW at 200 rpm. The allowable shear stress is 40N/mm^2. The working stress in the bolts should not exceed 30 N/mm^2.Assume that the same material is used for shaft and key and that the crushing stress is twice the value of shear stress. The maximum torque is 20% greater than the full load torque. The shear stress for cast iron is 14N/mm2. Check your design for hub, key, flange and bolts.	15	II	Ap	D510.2	PO 1, PO2,PO3
8 A)	Select a flat belt from manufacturer's catalogue to transmit power of15KW at 1200 rpm. The speed of the driven pulley is 450 rpm. The maximum centre distance between the shafts is 2m. Assume steady load	15	III	R	D510.3	PO 1, PO2,PO3
	(OR)					
8 B)	Design a V-belt drive using manufacturer's data to the following specifications. Power to be transmitted =7.5kW Speed of driving pulley=1000 rpm Speed of driven pulley= 300 rpm Diameter of driving pulley= 150 mm Diameter of driven pulley= 500 mm Centre distance between pulleys = 925mm Service = 16 hrs / day	15	III	Ap	D510.3	PO 1, PO2,PO3
9 A)	Design a journal bearing for a centrifugal pump from the following data. Load on the journal: 20 kN Speed: 900 rpm Types of oil used: SAE 10 Absolute viscosity at 55C: 17 centipoise Ambient temperature of oil: 15.5 °C Maximum bearing pressure : 1.5 N/mm^2 Heat dissipation co-efficient : 1232 $J/s/m^2$ /°C Calculate also mass of lubricating oil required for artificial cooling, if rise of temperature of oil is limited to 10°C	15	IV	Ap	D510.4	PO 1, PO2,PO3
	(OR)					
9 B)	A foot lever is 1.5m from the centre of the shaft	15	IV	Ap	D510.4	PO 1,

	to the point of application of 900N load. The allowable tensile stress 75N/mm^2 and allowable shear stress is 70N/mm^2. Determine (a) Diameter of shaft (b) Dimensions of boss (c) Diameter of shaft at the centre of the bearing (d) Dimensions of the key and (e) Dimensions of rectangular arm of the foot lever at 60 mm from the centre of the shaft, assuming the width of the arm its 3 times the thickness.					PO2,PO3
	(OR)					
10 A)	(i) Explain the Shigley's design	10	V	U	D510.5	PO 1, PO2,PO3
	(ii) Explain the steps involved in finite element analysis of a component?	5				
	(OR)					
10 B)	Briefly explain the CSG and B-REP technique of solid modelling.	15	V	U	D510.5	PO 1, PO2,PO3

MED520-THERMAL ENGINEERING - II

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

PART – A (10x3 = 30 Marks)					
Note: Answer all the questions. All questions carry equal marks					
S.No	**Questions**	**Unit**	**Bloom's level**	**CO**	**PO**
1	Define: Dryness fraction.	I	R	D520.1	PO1, PO2,PO3
2	State the advantages of super heated steam.	I	R	D520.1	PO1, PO2,PO3
3	What is the function of boiler mountings?	II	R	D520.2	PO1, PO2,PO3
4	State the advantages of high pressure boiler.	II	R	D520.2	PO1, PO2,PO3
5	What are the methods of compounding?	III	R	D520.3	PO1, PO2,PO3
6	What are the elements of a condensing plant?	III	R	D520.3	PO1, PO2,PO3
7	What is dry bulb and wet bulb temperature?	IV	R	D520.4	PO1, PO2,PO3
8	What are the functions of moderator?	IV	R	D520.4	PO1, PO2,PO3
9	What are the uses of compressed air?	V	R	D520.5	PO1, PO2,PO3
10	State the compression process to be followed in air compressor.	V	R	D520.5	PO1, PO2,PO3

PART B (5x14 = 70Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**Unit**	**Bloom'S Level**	**CO**	**PO**
11 A)	(i) Explain the process of steam generation with graph connecting temperature and heat added to convert one kg of water to super heated steam?	7	I	U	D520.1	PO1, PO2,PO3
	(ii) How do you determine the dryness fraction of a steam by using barrel calorimeter?	7	I	R	D520.1	PO1, PO2,PO3
	(OR)					
11 B)	(i) Calculate the internal energy of 1kg of steam at a pressure of 10 bar when the condition of steam is a) wet and dryness fraction 0.85, b) dry and saturated and c) super heated, the degree of super heat being 50^0C. The specific heat of super heated steam at constant pressure is 2.1 kJ/kg K.	7	I	AP	D520.1	PO1, PO2,PO3
	(ii) Steam at 10 bar and 0.925 dry is contained in a vessel of volume 1 m^3. The delivery valve is opened and	7	I	E	D520.1	PO1, PO2,PO3

	the steam is blown off. The period of flowing is so regulated that the total heat per kg of steam in the vessel remains constant during the blowing off period and pressure drops to 5 bar. Estimate the mass of steam blown off.					
12 A)	(i) Explain the working of lamont boiler with the lay out.	7	II	U	D520.2	PO1, PO2,PO3
	(ii) A boiler generates 750 kg of steam per hour at 11bar absolute and with 40^0C Super heat and burns 100 kg of coal per hour. If the calorific value of coal is29,300 kJ/kg, feed water temperature is 45^0C and specific heat of super heated Steam is 2.09 kJ/kg K. Calculate a) the factor of evaporation b) the equivalent Evaporation c) boiler efficiency and d) boiler power.	7	II	AP	D520.2	PO1, PO2,PO3
	(OR)					
12 B)	(i) What are the external and internal treatments given to the boiler feed water?	7	II	R	D520.2	PO1, PO2,PO3
	(ii) What are the safety precautions to be adopted during boiler operation?	7	II	R	D520.2	PO1, PO2,PO3
13 A)	(i) Describe the fuel and ash flow circuit in a steam power plant with a line sketch.	7	III	U	D520.3	PO1, PO2,PO3
	(ii) Explain the pressure compounding in a steam turbine with a neat sketch.	7	III	U	D520.3	PO1, PO2,PO3
	(OR)					
13 B)	(i) Explain the working of electrostatic precipitator with sketch.	7	III	U	D520.3	PO1, PO2,PO3
	(ii) Compare impulse and reaction turbine.	7	III	U	D520.3	PO1, PO2,PO3
14 A)	(i) Draw the layout of diesel power plant and explain the working of the plant.	7	IV	U	D520.4	PO1, PO2,PO3
	(ii) Explain the working of CANDU type reactor with a sketch	7	IV	U	D520.4	PO1, PO2,PO3
	(OR)					
14 B)	(i) Explain the methods of disposal of nuclear wastes.	7	IV	U	D520.4	PO1, PO2,PO3
	(ii) Explain any two methods of uranium enrichment.	7	IV	U	D520.4	PO1, PO2,PO3
15 A)	(i) Explain the working of roots blower and vane blower.	7	V	U	D520.5	PO1, PO2,PO3
	(ii) Explain the working of constant pressure gas	7	V	U	D520.5	PO1,

	turbine with sketch.					PO2,PO3
	(OR)					
15 B)	(i) Explain the working of centrifugal air compressor with a sketch.	7	V	U	D520.5	PO1, PO2,PO3
	(ii) Explain the working of solid propellent rocket with sketch.	7	V	U	D520.5	PO1, PO2,PO3

MED531-COMPUTER INTEGRATED MANUFACTURING

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

PART – A (10x3 = 30 Marks)

Note: Answer all the questions. All questions carry equal marks

S.No	Questions	UNIT	Bloom's Level	CO	PO
1	What are the benefits of CAD?	I	R	D 531.1	PO1, PO2,PO3
2	Explain 3D Scaling operation used in CAD.	I	U	D 531.1	PO1, PO2,PO3
3	Define the term group technology.	II	R	D 531.2	PO1, PO2,PO3
4	What is Shop Floor Control system?	II	R	D 531.2	PO1, PO2,PO3
5	What is the ISO designation for CNC tooling?	III	R	D 531.3	PO1, PO2,PO3
6	Define NC programming.	III	R	D 531.3	PO1, PO2,PO3
7	What are the components of FMS?	IV	R	D 531.4	PO1, PO2,PO3
8	What is meant by intelligent manufacturing system?	IV	R	D 531.4	PO1, PO2,PO3
9	What is Value Engineering?	V	R	D 531.5	PO1, PO2,PO3
10	Draw the product development cycle.	V	U	D 531.5	PO1, PO2,PO3

PART B (5x14 = 70Marks)

Note: Answer all questions choosing A Or B in each question. All questions carry equal marks

S.No	Questions	Marks	Unit	Bloom' Level	CO	PO
11 A)	(i) Explain the Shigley's design process.	7	I	U	D 531.1	PO1, PO2,PO3
	(ii) Explain the CSG process with suitable examples.	7	I	U	D 531.1	PO1, PO2,PO3
	(OR)					
11 B)	(i) Explain the Activities of CAD.	7	I	U	D 531.1	PO1, PO2,PO3
	(ii) Write short notes onthe basic steps involved in the FEA.	7	I	R	D 531.1	PO1, PO2,PO3
12 A)	(i) Explain Opitz system of coding structures.	7	II	U	D 531.2	PO1, PO2,PO3
	(ii) Write short notes on MRP in detail	7	II	R	D 531.2	PO1,

						PO2,PO3
	(OR)					
12 B)	(i) Explain the generative type CAPP in detail.	7	II	U	D 531.2	PO1, PO2,PO3
	(ii).Explain MICLASS system of coding structures.	7	II	U	D 531.2	PO1, PO2,PO3
13 A)	(i) Explain the NC dimensioning with neat sketches.	7	III	U	D 531.3	PO1, PO2,PO3
	(ii) Explain the G codes used for linear and circular interpolations with suitable examples and sketches.	7	III	U	D 531.3	PO1, PO2,PO3
	(OR)					
13 B)	Explain Sub Program with suitable examples.	7	III	U	D 531.3	PO1, PO2,PO3
	(ii) Write short notes on Rapid prototyping and Virtual machining.	7	III	R	D 531.3	PO1, PO2,PO3
14 A)	(i) Explain the types FMS.	7	IV	U	D 531.4	PO1, PO2,PO3
	(ii) Write short notes on ASRS.	7	IV	R	D 531.4	PO1, PO2,PO3
	(OR)					
14 B)	(i) Explain the working principle of AGVs.	7	IV	U	D 531.4	PO1, PO2,PO3
	(ii) Write short notes on the applications of robots in welding.	7	IV	E	D 531.4	PO1, PO2,PO3
15 A)	i) Explain the steps involved in failure modes and effects analysis in detail.	7	V	U	D 531.5	PO1, PO2,PO3
	(ii) Exaplain about the House of Quality.	7	V	U	D 531.5	PO1, PO2,PO3
	(OR)					
15 B)	(i) Explain the concept of Augmented Reality.	7	V	U	D 531.5	PO1, PO2,PO3
	(ii) Write short notes on the guide lines of DFMA.	7	V	R	D 531.5	PO1, PO2,PO3

MED532 -GREEN ENERGY AND ENERGY CONSERVATION

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

PART – A (10x3 = 30 Marks)					
Note: Answer all the questions. All questions carry equal marks					
S.No	**Questions**	**UNIT**	**Bloom's Level**	**CO**	**PO**
1	Write breifly about the need of renewable energy sources	I	U	D532.1	PO1, PO2,PO3
2	What are the essential characteristics of Geo Thermal energy.	I	R	D532.1	PO1, PO2,PO3
3	What is solar radiation?	II	R	D532.2	PO1, PO2,PO3
4	What are the main components of a Bio gas plant.	II	R	D532.2	PO1, PO2,PO3
5	Describe about the intrinsic semiconductor?	III	R	D532.3	PO1, PO2,PO3
6	Describe about the fill factor.	III	R	D532.3	PO1, PO2,PO3
7	Describe about the materials used for thin film technologies.	IV	R	D532.4	PO1, PO2,PO3
8	Describe about the charge controllers.	IV	R	D532.4	PO1, PO2,PO3
9	Describe about the Energy Audit.	V	R	D532.5	PO1, PO2,PO3
10	Write breifly about net metering concepts.	V	R	D532.5	PO1, PO2,PO3

PART B (5x14 = 70Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**UNIT**	**Bloom's Level**	**CO**	**PO**
11 A)	(i) Explain the Renewable energy policies in India.	7	I	U	D532.1	PO1, PO2,PO3
	(ii) With a neat sketch explain the working principle of Double flash power plant.	7	I	U	D532.1	PO1, PO2,PO3
	(OR)					
11 B)	(i) Briefly explain about the climate change associated with the Fossil fuels.	7	I	E	D532.1	PO1, PO2,PO3
	(ii) Explain the working principle of a Wind mill.	7	I	U	D532.1	PO1,
12 A)	(i) Explain briefly about theBio gas generation and mention the factors affecting the bio gas generation	7	II	U	D532.2	PO1, PO2,PO3
	(ii) Explain about the solar angles.	7	II	U	D532.2	PO1, PO2,PO3

	(OR)					
12 B)	(i) Explain the factors to be considered for selecting a site for a Bio gas plant.	7	II	U	D532.2	PO1, PO2,PO3
	(ii) With a neat sketch explain about the methods to estimate solar radiation.	7	II	U	D532.2	PO1, PO2,PO3
13 A)	(i) Explain briefly about the P-N junction diode.	7	III	U	D532.3	PO1, PO2,PO3
	(ii) Describe about the production of metallurgical grade (MGS).	7	III	R	D532.3	PO1, PO2,PO3
	(OR)					
13 B)	(i) Explain about the efficiency and losses in solar cells..	7	III	U	D532.3	PO1, PO2,PO3
	(ii) Explain about the process flow of commercial Si cell technology.	7	III	U	D532.3	PO1, PO2,PO3
14 A)	(i) Explain briefly about the solar cell structures.	7	IV	U	D532.4	PO1, PO2,PO3
	(ii) Explain about the the factors affecting battery performance in solar PV system.	7	IV	U	D532.4	PO1, PO2,PO3
	(OR)					
14 B)	(i) Explain about the cell mismatch in a module.	7	IV	U	D532.4	PO1, PO2,PO3
	(ii) Explain about concentrating solar collectors principles and its applications.	7	IV	U	D532.4	PO1, PO2,PO3
15 A)	(i) Enumerate about the salient features of “Energy Conservation Act,2001”.	7	V	U	D532.5	PO1, PO2,PO3
	(ii) Explain the guidelines of waste recovery and usage.	7	V	U	D532.5	PO1, PO2,PO3
	(OR)					
15 B)	(i) Explain about the Energy conservation Guidelines for Industries by BEE,Govt. of India.	7	V	U	D532.5	PO1, PO2,PO3
	(ii) Explain the Tamil Nadu Solar policy 2019.	7	V	U	D532.5	PO1, PO2,PO3

MED 533 -MECHATRONICS

MODEL QUESTION PAPER

Time: 3 Hrs **Max. Marks: 100**

PART – A (10x3 = 30 Marks)					
Note: Answer all the questions. All questions carry equal marks					
S.No	**Questions**	**Unit**	**Bloom's level**	**CO**	**PO**
1	Explain the working of light sensors	I	U	D533.1	PO1, PO2,PO3
2	Discuss about the working of flow sensors	I	AN	D533.1	PO1, PO2,PO3
3	What are the types of motion?	II	R	D533.2	PO1, PO2,PO3
4	What is meant by great train?	II	R	D533.2	PO1, PO2,PO3
5	What is interfacing?	III	R	D533.3	PO1, PO2,PO3
6	What is PIA?	III	R	D533.3	PO1, PO2,PO3
7	What is a ladder diagram?	IV	R	D533.4	PO1, PO2,PO3
8	What are the functions of counters?	IV	R	D533.4	PO1, PO2,PO3
9	How does the car park barrier work?	V	R	D533.5	PO1, PO2,PO3
10	What is meant by vibration monitoring?	V	R	D533.5	PO1, PO2,PO3

PART B (5x14 = 70Marks)						
Note: Answer all questions choosing A Or B in each question. All questions carry equal marks						
S.No.	**Questions**	**Marks**	**Unit**	**Bloom's Level**	**CO**	**PO**
11 A)	i) Write short notes about the working of velocity sensors in detail with neat sketches.	7	I	R	D533.1	PO1,PO2,PO3
	ii) Write short notes on Explain the working of motion sensors in detail with neat sketches.	7	I	R	D533.1	PO1,PO2,PO3
	(OR)					
11 B)	i) Discuss about the applications of Force sensors with neat sketches.	7	I	U	D533.1	PO1,PO2,PO3
	ii) Discuss about the applications of Temperature sensors with neat sketches.	7	I	U	D533.1	PO1,PO2,PO3
12 A)	i) Write short notes on Gear Trains and Pawl & Ratchet	7	II	R	D533.2	PO1,PO2,PO3
	ii) Discuss briefly about the mechanical aspects of motor section.	7	II	U	D533.2	PO1,PO2,PO3
	(OR)					
12 B)	i) Write short notes on selection of Bearing.	7	II	R	D533.2	PO1,PO2,PO3
	ii) Discuss briefly about the Pneumatic systems with neat sketches along with it components.	7	II	U	D533.2	PO1,PO2,PO3
13 A)	i) Write short notes on interface requirements.	7	III	R	D533.3	PO1,PO2,PO3
	ii) Explain the Electrical building blocks with neat sketches.	7	III	U	D533.3	PO1,PO2,PO3

	(OR)					
13 B)	i) Discuss about the interfacing of a seven segment display with a decoder.	7	III	U	D533.3	PO1,PO2,PO3
	ii) Explain the thermal building blocks with neat sketches.	7	III	R	D533.3	PO1,PO2,PO3
14 A)	i) Discuss about the PLC pneumonic and give suitable examples for each.	7	IV	U	D533.4	PO1,PO2,PO3
	ii) Write short notes about the selection of PLC.	7	IV	R	D533.4	PO1,PO2,PO3
	(OR)					
14 B)	i) Write short notes about latching and sequencing.	7	IV	R	D533.4	PO1,PO2,PO3
	ii) Draw a ladder diagram for a sequence operation of forward movement of two pneumatic pistons one after another with a neat sketch.	7	IV	AP	D533.4	PO1,PO2,PO3
15 A)	i) Explain the Car Engine management system with neat sketches.	7	V	U	D533.5	PO1,PO2,PO3
	ii) Write short notes on the supervisory control in manufacturing inspection.	7	V	R	D533.5	PO1,PO2,PO3
	(OR)					
15 B)	(ii) Explain the concept of wind wiper motion system.	7	V	U	D533.5	PO1,PO2,PO3
	(ii) Discuss about any two applications of mechatronics control in automated manufacturing.	7	V	U	D533.5	PO1,PO2,PO3

MED610-INDUSTRIAL ENGINEERING AND MANAGEMENT

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

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

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO.OF HOURS
I	Plant engineering and plant safety	17
II	Work study, method study and work measurement	17
III	Principles, personnel management and organizational behavior	19
IV	Financial and material management	18
V	Engineering ethics and human values	16
Tests and Model Exam		09
TOTAL		**96**

COURSE DESCRIPTION:

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

OBJECTIVES:

On completion of the course the students will be able to

- To study the different types of layout.
- To study the safety aspects and its impacts on an organization.
- To study different work measurement techniques.
- To study engineering ethics and human values.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control system.
- To study about organization and it’s behavior.

COURSE OUTCOMES:

MED 610-INDUSTRIAL ENGINEERING AND MANAGEMENT	
After successful completion of this course the students should be able to	
D610.1	Differentiate the types of layouts and to explain the safety aspects.
D610.2	Explain the various work measurement technique.
D610.3	Explain the functions of management and discuss about organizational behaviour.
D610.4	Describe the functional and material management.
D610.5	Explain the purpose of Engineering ethics and human values.

MED610-INDUSTRIAL ENGINEERING AND MANAGEMENT

DETAILED SYLLABUS

UNIT I - PLANT ENGINEERING AND PLANT SAFETY **[17 Hrs]**

PLANT ENGINEERING

Plant – Selection of site of industry	[1 Hr]
Plant layout– Principles of a good layout – types	[1 Hr]
process, product and fixed position	[1 Hr]
Techniques to improve layout	[1 Hr]
Principles of material handling equipment	[1 Hr]
Plant maintenance – importance – Break down maintenance	[2 Hrs]
Preventive maintenance and scheduled maintenance.	[1 Hr]

PLANT SAFETY

Importance –accident-causes and cost of an accident	[1 Hr]
Accident proneness-prevention of accidents	[1 Hr]
Industrial disputes-settlement of Industrial disputes	[2 Hrs]
Collective bargaining, conciliation, Mediation, arbitration	[2 Hrs]
Indian Factories Act 1948 and its provisions related to health, welfare and safety.	[3 Hrs]

UNIT II WORK STUDY, METHOD STUDY AND WORK MEASUREMENT [17 Hrs]

WORK STUDY

Productivity – Standard of living – method of improving Productivity – Objectives – Importance of good working conditions.	[3 Hrs]

METHOD STUDY

Definition – Objectives – Selection of a job for method study	[2 Hrs]
Basic procedure for conduct of method study – Tools used	[2 Hrs]
Operation process chart, Flow process chart, two handed process chart, Man Machine chart, String diagram and flow diagram.	[2 Hrs]

WORK MEASUREMENT

Definition – Basic procedure in making a time study	[1 Hr]
Employees rating factor – Application of time allowances	[1 Hr]
Rest, Personal, Process, Special and Policy allowances	[1 Hr]
Calculation of standard time – Problems	[1 Hr]
Basic concept of production study – Techniques of work measurement	[2 Hrs]
Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS).	[2 Hrs]

UNIT III PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIONAL BEHAVIOR **[19 Hrs]**

PRINCIPLES OF MANAGEMENT

Definition of management – Administration - Organization – F.W. Taylor's and Henry Fayol's Principles of Management	[2 Hrs]
Functions of Manager – Directing – Leadership –Types of Leadership – Qualities of a good leader	[1 Hr]
Motivation – Positive and negative motivation–Modern management techniques– Management Information Systems	[1 Hr]

Strategic management – SWOT Analysis - Business Process Re-engineering (BPR) [1 Hr]

Enterprises Resource Planning (ERP) –Activity Based Management (ABM) [1 Hr]

Global Perspective – Principles and brief description. [1 Hr]

PERSONNEL MANAGEMENT

Responsibility of human resource management – Selection procedure – Training of workers [1 Hr]

Apprentice training – On the job training and vestibule school training- [1 Hr]

Job evaluation and merit rating – objectives and importance – wages and salary administration – [2 Hrs]

Components of wages – Wage fixation - Type of wage payment – Halsey's 50% plan, [2 Hrs]

Rowan's plan and Emerson's efficiency plan – Problems. [1 Hr]

ORGANIZATIONAL BEHAVIOR

Definition – organization–Types of Organization – Line, Staff, Taylor's Pure functional types [2 Hrs]

Line and staff and committee type –Organizational Approaches, individual behavior – causes [1 Hr]

Environmental effect - Behavior and Performance, Perception - organizational implications, Quality Circle. [2 Hrs]

UNIT IV FINANCIAL AND MATERIAL MANAGEMENT [18 Hrs]

FINANCIAL MANAGEMENT

Fixed and working capital – Resources of capital – shares preference and equity shares [2 Hrs]

Debentures – Type of debentures – Public deposits, Factory costing – [2 Hrs]

Direct cost – indirect cost – Factory overhead – Selling price of a product [1 Hr]

Profit – Problems. Depreciation – Causes – Methods [2 Hrs]

Straight line, sinking fund and percentage on diminishing value method – Problems. [2 Hrs]

MATERIAL MANAGEMENT

Objectives of good stock control system – ABC analysis of inventory [2 Hrs]

Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level [3 Hrs]

Economic order quantity – problems – supply chain management [2 Hrs]

Introduction – Purchasing procedure – Store keeping – Bin card. [2 Hrs]

UNIT V ENGINEERING ETHICS AND HUMAN VALUES [16 Hrs]

ENGINEERING ETHICS

Definition-engineering ethics-personal and business ethics- duties and rights [1 Hr]

Engineering as a profession – core qualities of professional practitioners [2 Hrs]

Environment and their impact code of ethics- procedure for solving ethical conflicts [2 Hrs]

Ethical judgement- Kohlberg's stages of moral development [1 Hr]

Value based ethics- engineers as managers, consultants and leaders [2 Hrs]

Environmental ethics- computer ethics- Intellectual Property Rights (IPRs). [1 Hr]

HUMAN VALUES

Morals – values – integrity- service learning-civic virtue - respect for others [2 Hrs]

Living peacefully- caring – sharing – honesty courage - valuing time cooperation [3 Hrs]

Commitments – empathy-self-confidence – character- stress management. [2 Hrs]

Tests and Model Exam [9 Hrs]

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Industrial Engineering and Management	O.P. Khanna	Revised Edition Publications(P)Ltd – 2004
2	Engineering Economics and Management	T.R. Banga & S.C. Sharma	McGraw Hill Editiion. 2 – 2001, New Delhi
3	Essentials of Management	HeraldKoontz and Heinz Weihrich,'	McGraw Hill Publishing Company
4	Engineering ethics	Govindarajan .M, Natarajan. S, Senthil kumar V.V	prentice hall of India New Delhi
5	Management	Aglobal perspective, Heinz Weihrich, Harold Koontz	McGraw Hill International Edition.Latest
6	Organizational Behaviours	S.Chandran	Vikas Publishing House Pvt. Ltd
7	Principles of Management	M.Govindarajan and S.Natarajan	Prentce Hall of India Pvt.Ltd. NewDelhi.Latest
8	Engineering ethics	Charles B. Fledderman	pearson prentice hall
9	Essentials of Management	Joseph L.Massie	Prentice- Hall of India, NewDelhi 2004.

LEARNING WEBSITES:

1. https://nptel.ac.in/downloads
2. https://www.plantengineering.com/articles/top-safety-concerns-in-the-manufacturing-industry/
3. https://www.onlineclothingstudy.com/2012/10/work-study-and-industrial-engineering.html
4. https://open.lib.umn.edu/organizationalbehavior/
5. https://www.managementstudyguide.com/financial-management.htm

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D610.1	3	1	-	-	3	3	3	1	1	1
D610.2	3	1	-	-	3	3	3	1	1	1
D610.3	3	1	-	-	3	3	3	1	1	1
D610.4	3	1	-	-	3	3	3	1	1	1
D610.5	3	1	-	-	3	3	3	1	1	1
C610 Total	15	5	-	-	15	15	15	5	5	5
Correlation level	3	1	-	-	3	3	3	1	1	1

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTIONS PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED620 E-VEHICLE TECHNOLOGY & POLICY

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Course	Instruction		Examination			
			Marks			Duration
	Hrs/ Week	Hrs / Semester	Internal Assessment	Autonomous Examination	Total	
E Vehicle Technology &Policy	4	64	25	100*	100	3 Hrs

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

TOPICS AND ALLOCATION OF HOURS:

UNIT	TOPICS	NO. OF HOURS
I	Environmental impact and history & Electric vehicle Types	11
II	Electric vehicle & Drive System	11
III	Energy Storages, Charging System, Effects and Impacts	11
IV	Electric Mobility Policy Frame Work	11
V	Tamil Nadu E-Vehicle Policy 2019	11
	Tests and Model Exam	9
TOTAL		**64**

COURSE DESCRIPTION:

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 to the rapid depletion of fossil fuel and increase in fuel cost, environmental pollution, the shift to clean transport is necessary. This subject introduced by keeping all the above factors.

OBJECTIVES:

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

COURSE OUTCOMES

Course	**MED620 E-VEHICLE TECHNOLOGY & POLICY**
After successful completion of this course, the students should be able to	
D620.1	Know the Environmental impact, history and different types of Electric vehicle.
D620.2	Understand the basics of electric vehicles and Electric Propulsion Systems.
D620.3	Analyze the different types of energy storages, chargers for electric vehicles and explain effects and impacts of electric vehicles.
D620.4	Understand the Electric mobility and Policy frame work for Electric Vehicles.
D620.5	Know the Tamil Nadu E-Vehicle Policy 2019.

MED620 E-VEHICLE TECHNOLOGY & POLICY

UNIT I

ENVIRONMENTAL IMPACT AND HISTORY & ELECTRIC VEHICLE TYPES **[11 Hrs]**

1.1 ENVIRONMENTAL IMPACT AND HISTORY

Environmental impact of conventional vehicle - Air pollution – [1 Hr]

Petroleum resources – History of Electric vehicles & Hybrid Electric Vehicles – [1 Hr]

Conventional drive train system – Rear Wheel, Front Wheel and All wheel – [1 Hr]

Parts of Drive train system [1 Hr]

1.2 ELECTRIC VEHICLE TYPES

Introduction to Battery Electric Vehicle (BEV) – Definition BEV – [2 Hrs]

Necessity BEV – Different between BEV and Conventional Vehicle – [1 Hr]

Advantages of BEV - Block diagram of BEV- [2 Hrs]

Hybrid electric Vehicle (HEV) - Plug-in Hybrid Electric Vehicle (PHEV)- [1 Hr]

Fuel Cell Electric Vehicle (FCEV) – Description [1 Hr]

UNIT II

ELECTRIC VEHICLE & DRIVE SYSTEM **[11 Hrs]**

2.1 ELECTRIC VEHICLES

Configurations of Electric Vehicle – Performance of Electric Vehicles – [1 Hr]

Tractive Effort in Normal Driving-energy consumption [1 Hr]

Hybrid Electric Vehicles Concept of Hybrid electric drive trains [1 Hr]

Architecture of Hybrid Electric Drive trains – Series, Parallel and Series & Parallel [2 Hrs]

2.2 ELECTRIC PROPULSION SYSTEMS

Types of EV motors - DC motor drives– [2 Hrs]

Permanent Magnetic Brush Less DC Motor Drives (BLDC) – [1 Hr]

Principles, Construction and Working – Hub motor Drive system – [1Hr]

Merits and Demerits of DC motor drive, BLDC motor drive [2 Hrs]

UNIT III

ENERGY STORAGES, CHARGING SYSTEM, EFFECTS AND IMPACTS **[11 Hrs]**

3.1 ENERGY STORAGES

Electrochemical Batteries – Battery Technologies – [1 Hr]

Construction and working of Lead Acid Batteries, [1 Hr]

Nickel Based Batteries and Lithium Based Batteries [1 Hr]

Role of Battery Management System (BMS)– Battery pack development Technology– [1 Hr]

Cell Series and Parallel connection to develop battery pack. [1 Hr]

3.2 CHARGING

Battery Charging techniques –Constant current and Constant voltage,

Trickle charging – [1 Hr]

Battery Swapping Techniques – DC charging – [1 Hr]

Wireless charging – Maintenance of Battery pack – [1 Hr]

Latest development in battery chemistry [1 Hr]

3.3 EFFECTS AND IMPACTS

Effects of EV – Impacts on Power grid – [1 Hr]

Impacts on Environment – Impacts on Economy [1 Hr]

UNIT IV

ELECTRIC MOBILITY POLICY FRAME WORK [11 Hrs]

Government of India Electric Mobility Policy Frame work – [1 Hr]

Global Scenario of EV adoption – Electric mobility in India – [2 Hrs]

National Electric Mobility Mission Plan 2020 – [1 Hr]

Action led by Original Equipment Manufacturers – [1 Hr]

Need of EV Policy-Advantage of EV Eco system – [1 Hr]

Scope and Applicability of EV Policy – [1 Hr]

ARAI Standards for Electric Vehicle – AIS 038, AIS 039 &AIS 123- [2 Hrs]

Key Performance Indicator-Global impact – Trends and Future Developments [2 Hrs]

UNIT V

TAMIL NADU E-VEHICLE POLICY 2019 [11 Hrs]

Tamil Nadu E-vehicle Policy 2019 [2 Hrs]

Vehicle Population in Tamil Nadu – [1 Hr]

Objectives of EV Policy – Policy Measures – [2 Hrs]

Demand side incentives – [1 Hr]

Supply side incentives to promote EV manufacturing- [1 Hr]

Revision of Transport Regulation of EV – [1 Hr]

City building codes – Capacity Building and Skilling – [1 Hr]

Charging structure – implementing agencies- [1 Hr]

R&D and Business Incubation – Recycling Ecosystem – Battery and EVs [1 Hr]

Tests and Model Exam [9 Hrs]

TEXT BOOKS

S.No	Title	Author	Publisher with Edition
1.	Electric Vehicles - A future Projection	-	CII October 2020 report.
2.	Design and analysis of aluminum/air battery system for electric vehicles,	Shaohua Yang, Harold Knickle,	Elsevier
3.	Propelling Electric Vehicles in India, Technical study of Electric Vehicles and Charging Infrastructure	-	-
4.	Zero emission vehicles (ZEVs): towards a policy framework	-	Nti Aayog
5.	Faster adoption of electric vehicles in India: perspective of consumers and industry	-	The Energy and Resources Institute, New Delhi.
6.	India EV Story: Emerging Opportunities by Innovation Norway.	-	-
7.	Automotive Industry Standards – AIS 038, AIS 039 & AIS 123 –Manual	-	-

REFERENCE BOOKS

S.No	Title	Author	Publisher with Edition
1.	Modern Electric, Hybrid Electric and Fuel Cell Vehicl	Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi,	CR Press, Lond NewYork
2.	Comparison of Electric and Conventional Vehicles in Indian Market:Total Cost of Ownership, Consumer Preference and Best Segment for Electric Vehicle (IJSR)	AkshatBansal, Akriti Agarwal	-
3.	A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges Impacts, and Future Direction of Development (MDP	Fuad Un-Noor, Sanjeevikumar Padmanaban, Lucian Mihet-Popa, Mohammad Nurunnabi Molla and EklasHossain.	-

LEARNING WEBSITES

1. https://earthjustice.org/features/electric-vehicles
2. https://onlinecourses.nptel.ac.in/noc20_ee18/preview
3. https://www.edx.org/learn/electric-cars
4. https://www.udemy.com/topic/electric-vehicles/

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs &PSOs MAPPING MATRIX

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
D620.1	3	3	3	3	3	3	3	3	2	2
D620.2	3	3	3	3	3	3	3	3	2	2
D620.3	3	3	3	3	3	3	3	3	2	2
D620.4	3	3	3	3	3	3	3	3	2	2
D620.5	3	3	3	3	3	3	3	3	2	2
D620Total	15	15	15	15	15	15	15	15	10	10
Correlation Level	3	3	3	3	3	3	3	3	2	2

Correlation level 1- Slight (low)
Correlation level 2- Moderate (Medium)
Correlation level 3- Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED631- INDUSTRIAL ROBOTICS AND 3D PRINTING

TEACHING AND SCHEME OF EXAMINATION

No. of hours per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours/ Semester	Internal Assessment	Autonomous Examination	Total	
Industrial Robotics And 3D Printing	5	80	25	100*	100	3 Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO.OF. HOURS
I	Fundamentals of robot technology	12
II	Drive systems, end effecters, sensors and machine vision system	12
III	Robot programming, robot applications in manufacturing	12
IV	Introduction and design for additive manufacturing	17
V	Additive manufacturing processes	18
Tests and Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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:

On completion of the course the students will be able to

- 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 Additive Manufacturing.

COURSE OUTCOMES:

Course	**MED631- Industrial Robotics and 3D Printing**
After successful completion of this course the students should be able to	
D631.1	Define fundamentals of Robot technology.
D631.2	Understand the knowledge of drive systems, end effecters, sensors and machine vision system
D631.3	Understand the robot programming, robot applications in manufacturing
D631.4	Impart the knowledge on design and additive manufacturing.
D631.5	Describe about the additive manufacturing processes

MED631- INDUSTRIAL ROBOTICS AND 3D PRINTING

DETAILED SYLLABUS

UNIT- I FUNDAMENTALS OF ROBOT TECHNOLOGY	**[12Hrs]**
Introduction – History of robot– Definitions– Basic configuration of Robotics – Robot Components	[2hrs]
Manipulator, End effecter, Driving system, Controller and Sensors	[1hr]
Degrees of freedom –Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll	[2hrs]
Classification of robots – Work envelope and Work Volume	[1hr]
Effect of structure on Control ,Work envelop and Work volume	[2hrs]
Introduction to PUMA robot- Robot controller –Configuration	[1hr]
Four types of controls – Open loop and closed loop controls	[1hr]
Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability.	[2hrs]
UNIT- II DRIVE SYSTEMS, END EFFECTERS, SENSORS AND MACHINE VISION SYSTEM	**[12Hrs]**
Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives	[1hr]
Stepper motors, DC Servo motors and AC Servo motors– Applications and Comparisons of Drives.	[2hrs]
End effecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers	[2hrs]
Selection and design considerations in robot gripper- Requirements of Sensors	[2hrs]
Position sensors: LVDT, Resolvers, Optical encoders- Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical proximity sensors	[2hrs]
Touch Sensors – Range Sensors- Machine Vision System: Sensing & Digitizing Image Data	[2hrs]
Image Processing and Analysis – Application	[1hr]
UNIT- III ROBOT PROGRAMMING, ROBOT APPLICATIONS IN MANUFACTURING	**[12Hrs]**
Forward kinematics, Inverse kinematics and differences	[1hr]
Forward kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom	[2hrs]
Derivations. Robot programming –Lead through programming, Textual programming	[2hrs]
Teach Pendant for Robot system– Robot programming languages	[2hrs]
Motion commands, Sensor commands, End effecter commands. Robot applications	[2hrs]
Material handling-Spot welding – Arc welding – Spray painting – Assembling – Finishing-AGV-RGV.	[3hrs]
UNIT- IV INTRODUCTION AND DESIGN FOR ADDITIVE MANUFACTURING	**[17Hrs]**
INTRODUCTION ADDITIVE MANUFACTURING	
Additive Manufacturing – 3D Printing – Rapid prototyping – Overview – Need	[2hrs]
Additive manufacturing Vs CNC Machining - Development of Additive Manufacturing Technology	[2hrs]
Principle of AM Process – Generalised Additive Manufacturing Process Chain - Classification – Benefits	[2hrs]
Direct and Indirect process, Prototyping, Manufacturing and Tooling	[2hrs]

DESIGN FOR ADDITIVE MANUFACTURING

Design tools: Data processing - CAD model preparation – STL file	[1hr]
Part orientation and support structure generation - Model slicing	[2hrs]
Tool path generation. Design for Additive Manufacturing: Concepts and objectives	[2hrs]
AM unique capabilities - DFAM for part quality improvement – strategies	[2hrs]
Design Rules – Quality aspects – Software for AM – MIMICS, etc.	[2hrs]

UNIT- V ADDITIVE MANUFACTURING PROCESSES **[18Hrs]**

PHOTO POLYMERIZATION AND POWDER BED FUSION PROCESSES

Photo polymerization: SLA - Photo curable materials - Process - reaction rates – scan patterns - Advantages and Applications.	[2hrs]
Powder Bed Fusion: SLS - Process description - powder fusion mechanism – material feed system	[2hrs]
Process Parameters - Materials and Applications. Electron Beam Melting	[2hrs]

EXTRUSION BASED AND SHEET LAMINATION PROCESSES

Extrusion Based System: FDM – Introduction - Basic Principle – plotting and path control	[2hrs]
Materials - Applications and Limitations- Bio-extrusion.	[1hr]
Sheet Lamination Process: LOM – Materials - Gluing or Adhesive bonding - Thermal bonding – Ultrasonic AM.	[2hrs]

PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES

Droplet formation technologies - Continuous mode - Drop on Demand mode - Three Dimensional Printing – Advantages	[2hrs]
Bio plotter - Beam Deposition Process: LENS- Process description	[1hr]
Material delivery - Process parameters – Materials – Benefits.	[1hr]
Applications of AM technologies in Automotive, Manufacturing, Architectural, Healthcare, and Consumer products.	[3hrs]

Tests and Model Exam [9 Hrs]

TEXT BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Introduction to Autonomous Robots	Nikolaus Correll	Nikolaus Correll
2	Theory of Applied Robotics	Reza N. Jazar	Springer Science & Business Media, 2010
3	3D Printing Technology Applications and Selection	Rafiq Noorani,	Taylor & Francis

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Industrial Robotics – Technology, Programming and Applications	P.Groover,	MCGraw Hill 2001
2	Rapid prototyping: Principles and applications	Chua C.K., Leong K.F., and Lim C.S.,	Third edition, World Scientific Publishers, 2010
3	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing	Ian Gibson, David W. Rosen, Brent Stucker	Springer, 2010

4	Robotics Control, Sensing, Vision and Intelligence	Fu.K.S.Gonzalz.R.C., and Lee C.S.G	McGraw-Hill Book Co., 1987
5	Robotics for Engineers	Yoram Koren	McGraw-Hill Book Co., 1992
6	Robotics and Image Processing	Janakiraman.P.A	Tata McGraw-Hill, 1995
7	Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing	Andreas Gebhardt	Hanser Gardner Publication 2011
8	Rapid Prototyping: Theory and practice	Kamrani A.K and Nasar E.A	Springer, 2006
9	Rapid Prototyping and Engineering applications: A tool box for prototype development	Liou L.W. and Liou F.W	CRC Press, 2007
10	Design for Additive Manufacturing	Tom Page	LAP Lambert Academic Publishing, 2012
11	Additive Manufacturing	Amit Bandyopadhyay and Susmita Bose	CRC press
12	Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical implants, and custom Jewellery	John O Milewski	Springer series in Materials science
13	Additive Manufacturing: Advanced Manufacturing Technology in 3d Print Deposit	Sabrie Soloman	-
14	Advances in 3D Printing and Additive Manufacturing Technologies	David lan Wimpenny and Pulak M Pandey	-
15	Understanding Additive Manufacturing	Andreas Gebhardt, hanser	-

LEARNING WEBSITES:

1. https://www.infineon.com/cms/en/discoveries/fundamentals-robotics/
2. https://www.futurelearn.com/info/courses/robotics-with-raspberry-pi/0/steps/75888
3. https://www.roboticsbusinessreview.com/manufacturing/7-key-robot-applications-in-automotive manufacturing/
4. https://www.jabil.com/blog/design-for-additive-manufacturing.html

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D631.1	3	2	2	2	2	3	3	2	2	2
D631.2	3	2	2	2	2	3	3	2	2	2
D631.3	3	2	2	2	2	3	3	2	2	2
D631.4	3	2	2	2	2	3	3	2	2	2
D631.5	3	2	2	2	2	3	3	2	2	2
D631Total	15	10	10	10	10	15	15	10	10	10
Correlation level	3	2	2	2	2	3	3	2	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTIONS PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED632-REFRIGERATION AND AIR-CONDITIONING

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16 Weeks

Course	Instructions		Examination			
			Marks			
	Hours / Week	Hours Semester	Internal Assessment	Autonomous Examination	Total	Duration
Refrigeration And Air-Conditioning	5	80	25	100*	100	3 Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO.OF HOURS
I	Refrigeration system and refrigeration equipments	14
II	Vapour compression refrigeration system and vapour absorption refrigeration system	14
III	Refrigerant flow controls, refrigerants and lubricants, applications of refrigeration	15
IV	Psychrometry and comfort air conditioning	14
V	Air Conditioning Systems And Cooling load calculations	14
Tests and Model exam		9
TOTAL		**80**

COURSE DESCRIPTION:

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

On completion of the course the students will be able to

- Explain the working of open and closed air system of refrigeration.
- Describe the working and construction of compressors used for air-conditioning
- 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.

COURSE OUTCOMES:

Course	**MED632-REFRIGERATION AND AIR-CONDITIONING**
After successful completion of this course the students should be able to	
D632.1	Define the refrigeration system and refrigeration equipments.
D632.2	Explain about vapour compression refrigeration system, vapour absorption refrigeration system
D632.3	Explain the refrigerant flow controls, refrigerants and lubricants, application of refrigeration.
D632.4	Define the psychometry properties and comfort air conditioning.
D632.5	Determine the air conditioning system and cooling load calculation.

MED632-REFRIGERATION AND AIR-CONDITIONING

DETAILED SYLLABUS

UNIT-I REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS **[14Hrs]**

REFRIGERATION SYSTEM

Thermodynamic state of a pure substances- modes of heat transfer –laws of heat transfer [2hrs]

Mechanisms of production of cold –unit of refrigeration –types of refrigeration [2hrs]

Reversed Carnot cycle-C.O.P of heat engine–heat pump– refrigerating machine [1hr]

Principle of working of open and closed air system of refrigeration – Advantages and disadvantages –problems. [2hrs]

REFRIGERATION EQUIPMENTS

Compressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors [2hrs]

Condensers–principle of working and constructional details of air cooled and water [1hr]

Cooled Condensers, evaporative condensers- advantages and disadvantages [1hr]

Natural and forced draught cooling towers. Evaporators [1hr]

Natural circulation and forced circulation type principle of working constructional details. [2hrs]

UNIT-II VAPOUR COMPRESSION REFRIGERATION SYSTEM AND VAPOUR ABSORPTION REFRIGERATION SYSTEM **[14Hrs]**

VAPOUR COMPRESSION REFRIGERATION SYSTEM

Principle of working of vapour compression system –analysis of vapour compression cycle using T-s diagram and p-H diagram [2hrs]

Diagram refrigerating effect - compression work – C.O.P – effect of superheating and under cooling – [2hrs]

Problems – effect of evaporative [2hrs]

Pressure – condenser pressure – liquid –vapour refrigeration heat exchangers [2hrs]

Advantages and disadvantages of superheating and Under cooling –use of flash chamber and accumulator. [2hrs]

VAPOUR ABSORPTION REFRIGERATION SYSTEM

Simple absorption system – Electrolux system –Solar absorption system [2hrs]

Absorption system comparison with Mechanical (Compression) refrigeration system. [2hrs]

UNIT-III REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS, APPLICATIONS OF REFRIGERATION **[15Hrs]**

REFRIGERANT FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS

Capillary tube-automatic expansion valve [2hrs]

Thermostatic expansion valve-solenoid valve-evaporator pressure regulator [2hrs]

Suction pressure regulator-selection of a refrigerant [2hrs]

Properties and Applications of following refrigerants SO2, CH4, F11, F12, F22, and NH3 [3hrs]

Lubricants used in refrigeration and their applications, Cryogenics. [2hrs]

APPLICATIONS OF REFRIGERATION

Slow freezing –quick freezing– cold storage–frozen storage freeze drying [2hrs]

Dairy refrigeration –ice cream cabinets–ice making – Water cooler, milk cooler, bottle cooler–frost free refrigeration [2hrs]

UNIT-IV PSYCHROMETRY AND COMFORT AIR CONDITIONING [14Hrs]

Definitions of dry air, moist air, water vapour, Avogadro′ s law, Dalton′ s law of partial pressure [2hrs]

Dry and wet bulb temperature- dew point – humidity [1hr]

Specific and absolute – relative humidity degree of saturation – enthalpy of moist air [1hr]

Adiabatic saturation of air by evaporation of water– psychometric chart and its uses [2hrs]

Psychometric processes – sensible heating and cooling – humidifying and heating [2hrs]

Dehumidifying and cooling – adiabatic cooling with humidification – total heating or cooling processes [2hrs]

Sensible heat factor – by pass factor with simple problems [2hrs]

Governing optimum effective temperature – comfort chart – design consideration. [2hrs]

UNIT-V AIR CONDITIONING SYSTEMS AND COOLING LOAD CALCULATIONS [14Hrs]

AIR CONDITIONING SYSTEMS

Equipment for air conditioning and insulation factors – air purification [1hr]

Temperature control – humidity control – dry and wet filters- centrifugal dust collector [2hrs]

Air washer humidifier – dehumidifier – fans and blowers – grills and registers [1hr]

Summer and winter air conditioning, window type air conditioner – split type air conditioner system [2hrs]

properties of ideal insulator, types of insulating materials –air distribution and duct systems [2hrs]

Tools and Installation, servicing and maintenance of R & AC systems. [1hr]

COOLING LOAD CALCULATIONS

Different heat sources – conduction heat load – radiation Load of sun – occupants load [2hrs]

Equipment load – infiltration air load– miscellaneous heat sources –fresh air load – simple problems. [2hrs]

Tests and Model Exam [9 Hrs]

TEXT BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Refrigeration and air conditioning	P.L . Ballaney,	Khanna Publishers Edition.Latest
2	Refrigeration and air conditioning	V.K.Jain	Industrial refrigeration and Hand book/Revised edition

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Refrigeration and air conditioning	P.L. Ballaney	Khanna Publishers
2	Refrigeration and air conditioning	V.K. Jain	-
3	Industrial Refrigeration Hand Book	Wilbert F. Steocker	-
4	A course in refrigeration and air conditioning	Domkundwar	-
5	Principles of refrigeration	Dossat	-
6	Home refrigeration and air conditioning	Audels	Theo.Audel & Co. publisher
7	Refrigeration and air conditioning	C.P Arora	-
8	Cryogenic systems Randell	Fd Barron	-

LEARNING WEBSITES

1. https://nptel.ac.in/courses/112105128/
2. https://nptel.ac.in/courses/112107208/
3. https://nptel.ac.in/courses/112105128/38
4. http://www.nptelvideos.in/2012/12/refrigeration-and-airconditioning.html
5. http://iitportal.com/Video/Lectures-On-Refrigeration-and-Air-Conditioning-By-NPTEL

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D632.1	2	2	2	2	-	2	3	2	2	2
D632.2	2	2	2	2	-	2	3	2	2	2
D632.3	2	2	2	2	-	2	3	2	2	2
D632.4	2	2	2	2	-	2	3	2	2	2
D632.5	2	2	2	2	-	2	3	2	2	2
D632 Total	10	10	10	10	-	10	15	10	10	10
Correlation level	2	2	2	2	-	2	3	2	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

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% to be included	90%	10%

MED633- AUTOMOBILE TECHNOLOGY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per Semester: 16Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours/ Semester	Internal Assessment	Autonomous Examination	Total	
Automobile Technology	5	80	25	100*	100	3 Hours

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

TOPICS & ALLOCATION OF HOURS

UNIT	TOPICS	NO OF HOURS
I	Automobile Engines	14
II	Fuel Feed Systems and Alternative fuels	14
III	Transmission and Power Trains	14
IV	Automobile Chassis	14
V	Electrical Equipment & Hybrid Electric Vehicles	15
Tests And Model Exam		9
TOTAL		**80**

COURSE DESCRIPTION:

Automobile is one of the key areas of development in India facilitated by Multinational Companies. As Automobile is the Major sources of employing man power a thorough knowledge on Automobile Engine construction and its functioning is required with due consideration on pollution control.

OBJECTIVES:

On completion of the course the students will be able to

- Explain about the constructional details of an Automobile engine including cooling and lubrication system.
- Describe fuel feed systems for petrol and diesel engines with all devices involved in it.
- Explain the construction and functional features of the power transmission systems and various parts involved in it.
- Explain the functions of different types of steering, suspension and brake systems.
- Describe the different types of chassis and their functions.
- Familiarize electrical and electronic equipments used in automobile.
- To understand the emerging trends of electric vehicles, hybrid electric vehicles and solar vehicles.
- To know the automobile emissions and its effects on environment.

COURSE OUTCOMES:

Course	**MED633- Automobile Technology**
After successful completion of this course the students should be able to	
D633.1	To know the Automobile Engines
D633.2	Explain the Fuel Feed Systems and Alternative fuels
D633.3	To know the Transmission and Power Trains
D633.4	Describe about the Automobile Chassis
D633.5	Explain about Electrical Equipment & Hybrid Electric Vehicles

MED633- AUTOMOBILE TECHNOLOGY

DETAILED SYLLABUS

UNIT-I AUTOMOBILE ENGINES [14Hrs]

Basic Engine Components – Functions , types , materials and construction of –Cylinder block – Crankcase	[2hrs]
Oil pan – Cylinder head – Gaskets – cylinder liners– Comparison of liners – Piston-piston rings	[1hr]
Types of compression rings and oil control rings – piston pin – Connecting rod -methods of connecting piston and Connecting rod	[2hrs]
Crankshaft – flywheel –Cam shaft– Valve and Valve mechanism	[1hr]
L-I-F-T.Cooling systems – purpose – types – air and water cooling systems – merits and demerits	[2hrs]
Pump assisted water cooling systems –components – water pump, fan	[1hr]
Thermostat – types - radiator –types –pressure cap - troubles in cooling system	[1hr]
Lubrication systems – purpose – types of lubricants – additives – Service rating of oil – types of lubricating systems	[2hrs]
Full pressure system – techniques of cylinder and piston lubrication –oil filters	[1hr]
Full flow and bypass filter systems – Troubles in lubrication system.	[1hr]

UNIT-II FUEL FEED SYSTEMS AND ALTERNATIVE FUELS [14Hrs]

Requirements of good fuel-Types of fuel feed systems- S.U. Electrical fuel pump	[2hrs]
Fuel filter – Air cleaners – types- petrol injection –merits and demerits	[1hr]
DTSI – VTI – CCVTI – PGMFI – MPFI system.	[2hrs]
Layout of diesel and petrol fuel feed system	[1hr]
Single acting fuel feed pump – fuel injection pumps	[1hr]
Construction and working of distributor type pump – CRDI system	[1hr]
Fuel injectors – types – Single & Multi hole – pintle and pintaux-	[2hrs]
Fuel filters – primary and secondary filters.	[1hr]
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel	[2hrs]
Properties, Suitability, Merits and Demerits - Engine Modifications- Pollution control techniques for petrol and diesel emission	[1hr]

UNIT-III TRANSMISSION AND POWER TRAINS [14Hrs]

General arrangement of power transmission system – Arrangement of front engine rear drive	[1hr]
Rear engine rear drive – front engine front drive - four wheel drive – applications	[1hr]
Clutch – function – Components – Types - Single plate ,multi plate and diaphragm spring clutch	[2hrs]
Fluid coupling – Clutch troubles and their causes.	[1hr]
Gear box – purpose – various resistance to motion – types of gear boxes	[1hr]

Constant mesh and synchromesh-gear box troubles and their causes. [1hr]

Drive line – propeller shaft – Universal joint – Cross type only – slip joint [1hr]

Final drive – function – types of gear arrangement – straight & spiral Bevel , Hypoid [1hr]

Worm and Worm Wheel – merits, demerits and application-Hotch kiss drive –Torque tube drive – radius rod. [2hrs]

Differential – purpose Construction and operation – Self locking and non slip differential [1hr]

Differential troubles and their Causes – Semi floating, three quarter floating and full floating rear axles. [2hrs]

UNIT-IV AUTOMOBILE CHASSIS [14Hrs]

Front axle – Types – Stub axle – Types – Steering system – Ackermann Principle of Steering [1hr]

Wheel alignment – Factors – Camber , Caster , King pin inclination Toe in and Toe out on turns - Steering linkages – Steering gears [2hrs]

Cam and double roller, recirculating ball type , Rack and Pinion [1hr]

Steering troubles and causes – power steering – Necessity – types – Layout of any one type – Collapsible Steering system. [1hr]

Suspension system – Functions – Type of springs – Leaf , coil and Torsion bar [1hr]

Front suspension systems – independent front suspension –merits and demerits – types [1hr]

Rear end suspension –Air suspension - shock absorber –purpose – telescopic type – construction and working. [1hr]

Brake system – functions – classification of brakes – drum brakes – leading shoe and trailing shoe [1hr]

Self energizing action – hydraulic brake – brake bleeding [1hr]

Air assisted hydraulic brakes – Air brake – layout , functions of each component and application only [1hr]

Disc brakes – construction and working – comparison of disc and drum type [1hr]

Brake troubles and their causes – anti lock Brake system. Wheels – types of wheels – brief description and applications [1hr]

Tyres – function– construction of tyres – cross and radial ply tyres – comparison. [1hr]

UNIT-V ELECTRICAL EQUIPMENT & HYBRID ELECTRIC VEHICLES [15Hrs]

Battery – lead acid battery – Nickel alkaline battery – construction – battery rating – charging - testing – starting circuit [2hrs]

Construction and operation of starter motor – starting motor drives [1hr]

Over running clutch and Bendix drive –construction and operation [1hr]

Solenoid switch - Charging circuit – alternator construction and operation – regulators – Dynamo. [1hr]

Ignition system – Types–High tension magneto – electronic ignition – Ignition system troubles and remedies. [2hrs]

Lighting system – circuit – Head light – Aiming and adjustment [1hr]

Sealed beam head lights – directional signal circuits – fluorescent lamp - Horn circuits – Wind screen wiper. [1hr]

Introduction: Concept and environmental importance of EVs, HEVs and solar vehicles. [2hrs]
Electric vehicles: Layout, construction and working.

Hybrid electric vehicles: Types, layout, hybridization factor, plug in hybrid electric vehicles, fuel efficiency analysis, Challenges and future scope of EVs and HEVs. [2hrs]

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act. [2hrs]

Tests and Model Exam [9 Hrs]

TEXT BOOKS

Sl.No	Title	Author	Publisher & Edition
1	Automobile Engineering	G.B.S.Narang	Khanna Publishers, NewDelhi
2	AutomotiveMechanics	William H.crouse and Donald .L. Anglin, Tata McGraw	Hill Publishing CompanyLtd, NewDelhi

REFERENCE BOOKS

Sl.No	Title	Author	Publisher & Edition
1	The Automobile	Harbans Singh Reyat	S.Chand &Co Ltd, NewDelhi
2	Vehicle and Engine technology	Vol. I,HeinzHeisler	ELBS
3	Automotive Mechanics	Joseph Heitner	East–west Press (P) Ltd, NewDelhi
4	Internal Combustion engines	M.L.Mathur &R.P.Sharma	Dhanpat Rai & Sons
5	Modern Electric, Hybrid Electric and Fuel Cell Vehicles	Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi	CR Press, London, New York
6	Electric & hybrid Vehicle	A.K.babu	Khanna Publications, New delhi.

LEARNING WEBSITES:

1. https://nptel.ac.in/courses/112105128/
2. https://nptel.ac.in/courses/112107208/
3. https://nptel.ac.in/courses/112105128/38
4. https://en.wikipedia.org/wiki/Automotive_engine
5. https://www.britannica.com/technology/automobile/Chassis
6. https://en.wikipedia.org/wiki/Hybrid_vehicle

CONTINUOUS INTERNAL ASSESSMENT

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

i)	Attendance	-	5 Marks
ii)	Test	-	10 Marks
iii)	Assignment	-	5 Marks
iv)	Seminar	-	5 Marks

	Total	-	**25 Marks**

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D633.1	3	-	2	2	2	3	3	2	3	-
D633.2	3	-	2	2	2	3	3	2	3	-
D633.3	3	-	2	2	2	3	3	2	3	-
D633.4	3	-	2	2	2	3	3	2	3	-
D633.5	3	-	2	2	2	3	3	2	3	-
D633 Total	15	-	10	10	10	15	15	10	15	-
Correlation level	3	-	2	2	2	3	3	2	3	-

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand, Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED640- SOLID MODELLING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

Course	Instructions		Examination			
	Hours/ Week	Hours / Semester	Marks			Duration
Solid Modelling Practical	6	96	Internal Assessment	Autonomous Examinations	Total	3 Hrs.
			25	100*	100	

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

S.NO	DETAILED ALLOCATION OF MARKS	
Part A – 3D Component Modelling		
1	Sketching	15
2	3D Modeling	15
Part B – Assemble Drawing Modelling		
3	Sketching / Part modeling	20
4	Assembly	25
5	Solid Model / Views	10
6	Viva voce	05
7	Mini Project	10
	TOTAL	**100**

MINI PROJECT EVALUATION (10 MARKS)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

COURSE DESCRIPTION:

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.

EQUIPMENTS REQUIRED: (For a batch of 30 students)

Sl.No	Name of the equipment	Required Nos.
1	Personal computer	30 No's
2	Laser Printer	1 No
3	Software	GUI System Software Modelling package (Sufficient to the strength)

OBJECTIVES

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

COURSE OUTCOMES:

Course	**MED640- Solid Modelling Practical**
After successful completion of this course the students should be able to	
D640.1	Summarize 3D commands of Auto CAD.
D640.2	Relate the part model and assembly of parts using solid works.
D640.3	Define the working principles of parametric CAD software.
D640.4	Determine to prepare, edit and execute the drawing.
D640.5	Develop components as per drawings using solid works and develop the mini projects with report.

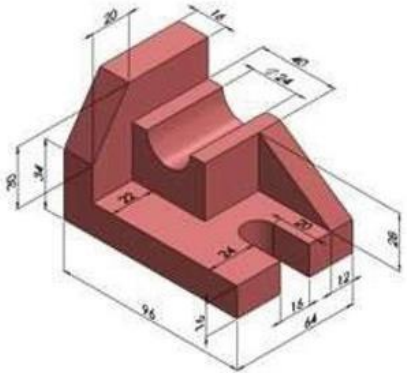
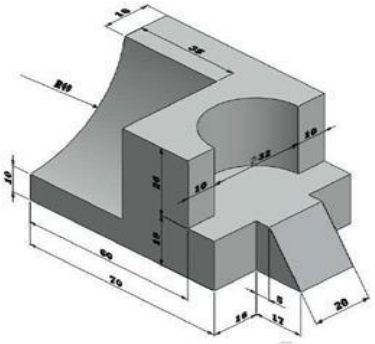
MED640- SOLID MODELLING PRACTICAL

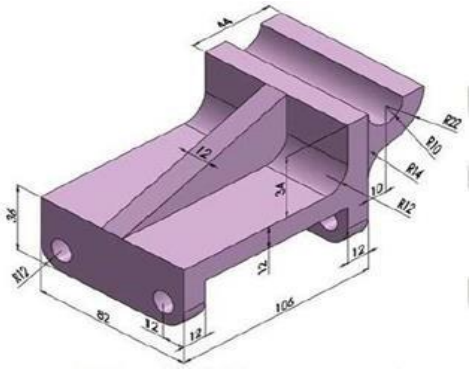
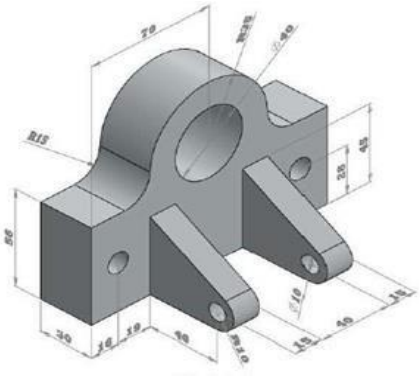
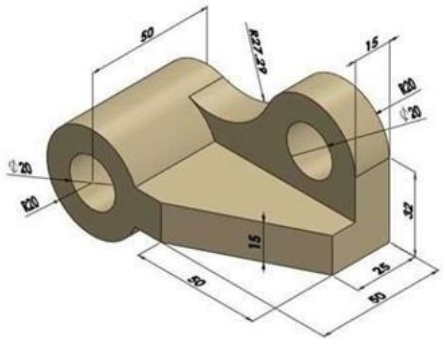
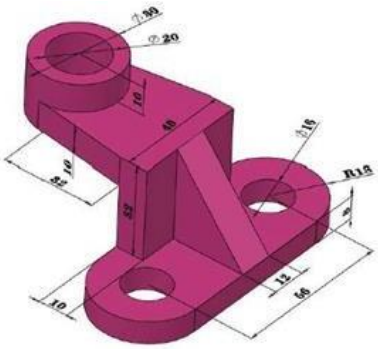
Detailed Syllabus

Introduction

Parametric CAD software – sketch – elements – entities: line – circle – arc – ellipse – polygon – text – dimensions – sketch tools – fillet – chamfer – offset – trim – extend – mirror – rotate – block. Part modelling– 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.

Exercise:

Name of the Exercise	
PART A: Draw the given 3D drawing using 3D modeling commands.	
Ex.1	Model 1 
Ex.2	Model 2 

Ex.3	Model 3 
Ex.4	Model 4 
Ex.5	Model 5 
Ex.6	Model 6 

PART B: Draw the part models and assemble the components using 3D modeling.	
Ex.7	Revolving Centre
Ex.8	Tail stock
Ex.9	Machine Vice
Ex.10	Crane hook
Ex.11	Petrol Engine Connecting Rod
Ex.12	Pipe Vice
Ex.13	Cam shaft
Ex.14	Mini Project

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

LEARNING WEBSITE:

https://nptel.ac.in/courses/112105128/
https://nptel.ac.in/courses/112107208/
https://nptel.ac.in/courses/112105128/38
https://en.wikipedia.org/wiki/Solid_modeling
https://www.youtube.com/watch?v=bXsQNzurLSM
https://www.youtube.com/watch?v=uOs3o40XgKQ

Autonomous Examination

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

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

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D640.1	3	-	3	3	-	3	3	3	2	2
D640.2	3	-	3	3	-	3	3	3	2	2
D640.3	3	-	3	3	-	3	3	3	2	2
D640.4	3	-	3	3	-	3	3	3	2	2
D640.5	3	-	3	3	-	3	3	3	2	2
D640 Total	15	-	15	15	-	15	15	15	10	10
Correlation level	3	-	3	3	-	3	3	3	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

B loom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

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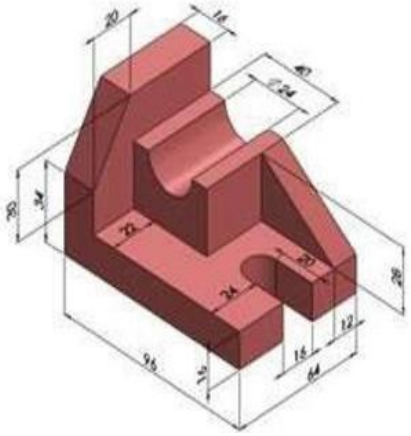
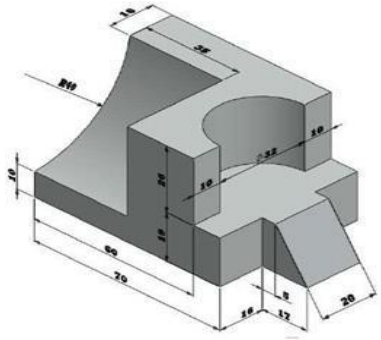
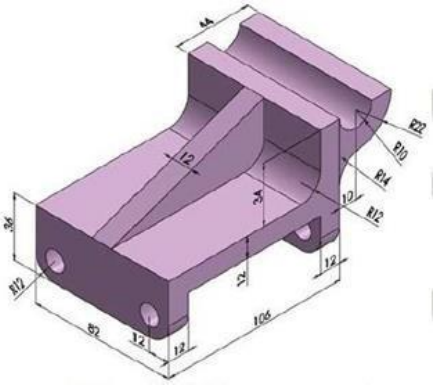
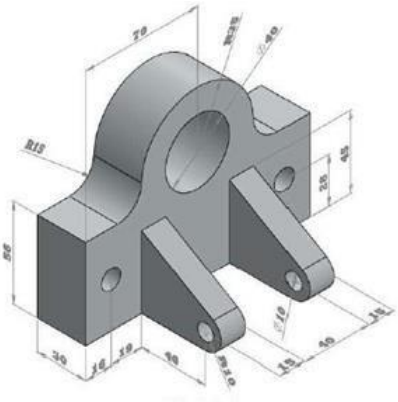
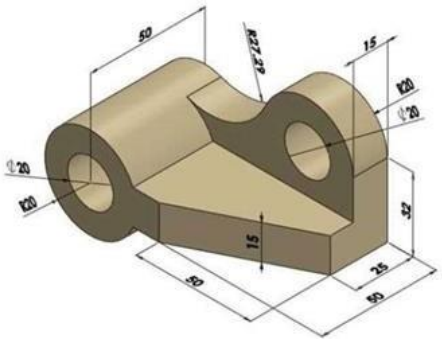
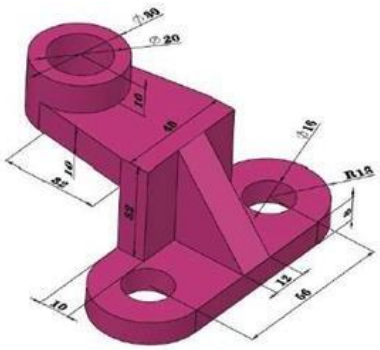
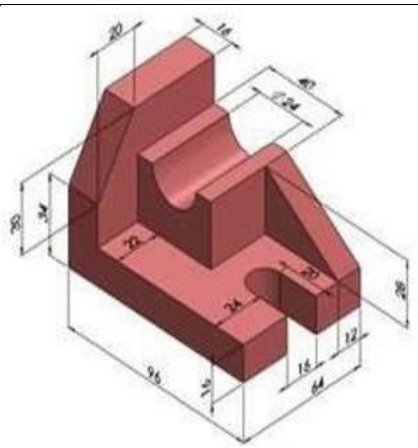
MED640- SOLID MODELLING PRACTICAL

MODEL QUESTION PAPER

Sl.	Name of the exercise	CO	PO
1	1. Draw the given 3D drawing using 3D modeling commands for Model 1  2. Draw the part models and assemble the components using 3D modeling for Revolving Centre	D640.1, D640.2 D640.3, D640.4	PO3,PO 4,PO7 PO3,PO 4,PO7
2	1. Draw the given 3D drawing using 3D modeling commands for Model 2  2. Draw the part models and assemble the components using 3D modeling for Tail stock	D640.1, D640.2 D640.3, D640.4	PO3,PO 4,PO7 PO3,PO 4,PO7
3	1. Draw the given 3D drawing using 3D modeling commands for Model 3  2. Draw the part models and assemble the components using 3D modeling for Machine Vice	D640.1, D640.2 D640.3, D640.4	PO3,PO 4,PO7 PO3,PO 4,PO7
4	1. Draw the given 3D drawing using 3D modeling commands for Model 4	D640.1,	PO3,PO

	 2. Draw the part models and assemble the components using 3D modeling for Crane hook	D640.2 D640.3, D640.4	4,PO7 PO3,PO 4,PO7
5	1. Draw the given 3D drawing using 3D modeling commands for Model 5  2. Draw the part models and assemble the components using 3D modeling for Petrol Engine Connecting Rod	D640.1, D640.2 D640.3, D640.4	PO3,PO 4,PO7 PO3,PO 4,PO7
6	1. Draw the given 3D drawing using 3D modeling commands for Model 6  2. Draw the part models and assemble the components using 3D modeling for Pipe Vice	D640.1, D640.2 D640.3, D640.4	PO3,PO 4,PO7 PO3,PO 4,PO7
7	1. Draw the given 3D drawing using 3D modeling commands for Model 1	D640.1, D640.2	PO3,PO 4,PO7

	 2. Draw the part models and assemble the components using 3D modeling for Cam shaft	D640.3, D640.4	PO3,PO 4,PO7
8	Mini project	D640.1 to D640.5	PO1,PO 3, PO4, PO7

MED651- INDUSTRIAL ROBOTICS AND 3D PRINTING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

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

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

DETAILED ALLOCATION OF MARKS		
Part A – Robot Programming		
Robot Program	:	20
Simulate / Execution	:	25
Result	:	10
Part B – 3D Prinitng		
CAD – Modelling	:	15
3D Printing	:	15
Vivavoce	:	05
MINI PROJECT	:	10
TOTAL	**:**	**100**

MINI PROJECT EVALUATION (10 MARKS)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

OBJECTIVES

On the completion of the course the students can be able to

- 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 Modeling
- Create STL files to manufacture components using 3D Printer

COURSE OUTCOMES:

Course	**MED651- INDUSTRIAL ROBOTICS AND 3D PRINTING PRACTICAL**
After successful completion of this course the students should be able to	
D651.1	Study of Robot.
D651.2	Define the techniques of programming.
D651.3	Various methods of positioning and placing objects
D651.4	Command and practice
D651.5	Prepare a record of work done and develop the mini projects with report

EQUIPMENTS REQUIRED: **(For a batch of 30 students)**

S.No.	**Name of the equipment**	**Required Nos.**
1	Personal computer	10 No's
2	6 Axis Robot	1 No.
3	3D Printer	1 No.
4	Software	GUI System Software Modeling package / 3D Printer (Sufficient to the strength)

MED651- INDUSTRIAL ROBOTICS AND 3D PRINTING PRACTICAL

Detailed Syllabus

Contents:

3D Printing: Getting to know the User Interface of the Modeling 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 Modeling Considerations – Describe part creation within the design process. Add placed features to existing parts. Create complex 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 – Additive Manufacturing – types of 3D Printers – orientation and positioning of parts - producing 3D working models using 3D Printers.

Name of the Exercise	
PART A- Robot Programming	
Ex.1	Position recording using Cartesian co-ordinate system - (No. of positions - 9)
Ex.2	Position recording using Polar co-ordinate system - (No. of positions - 9)
Ex.3	Pick and place the objects - No. of objects - 6)
Ex.4	Pick and stack the objects - (No. of objects - 6)
Ex.5	Spray painting practice - (Area - 300mm x 300mm)
Ex.6	Spot welding practice - (No. of spots - 9)
Ex.7	Arc welding practice – (Length of weld 50 mm)
Ex.8	Assembling practice - (Minimum 3 Components)
Ex.9	Profile cutting practice - (Complicated profile – combination of lines and arcs)
PART B - 3D Printing	
Ex.11	Create the model and produce the Gear Train in 3D printing.
Ex.12	Create the model and produce the Geneva Gear & Ratchet mechanism.
Ex.13	Create the model and produce the Slide-crank mechanism.
Ex.14	Mini Project The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

LEARNING WEBSITES:

1. https://www.youtube.com/watch?v=0yD3uBshJB0
2. https://nptel.ac.in/courses/112105249/
3. https://www.youtube.com/watch?v=DaWMvEY3Qgc
4. https://nptel.ac.in/courses/112101099/32

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.

AUTONOMOUS EXAMINATION

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

Two exercises will be given for examination by selecting one exercise in each PART.

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D651.1	3	-	3	3	-	3	3	2	2	2
D651.2	3	-	3	3	-	3	3	2	2	2
D651.3	3	-	3	3	-	3	3	2	2	2
D651.4	3	-	3	3	-	3	3	2	2	2
D651.5	3	-	3	3	-	3	3	2	2	2
D651 Total	15	-	15	15	-	15	15	10	10	10
Correlation level	3	-	3	3	-	3	3	2	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching leering process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

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MED651- INDUSTRIAL ROBOTICS AND 3D PRINTING PRACTICAL

MODEL QUESTION PAPER

Sl. No	Name of the exercise	CO	PO
1	1.Robot Programming for Position recording using Cartesian co-ordinate system - (No. of positions - 9) 2. 3D Printing for Create the model and produce the Gear Train in 3D printing.	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
2	1.Robot Programming for Position recording using Polar co-ordinate system - (No. of positions - 9) 2. 3D Printing for Create the model and produce the Geneva Gear & Ratchet mechanism	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
3	1.Robot Programming for Pick and place the objects - No. of objects - 6) 2. 3D Printing for Create the model and produce the Slide-crank mechanism	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
4	1.Robot Programming for Pick and stack the objects - (No. of objects - 6) 2. 3D Printing for Create the model and produce the Gear Train in 3D printing.	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
6	1.Robot Programming for Spray painting practice - (Area - 300mm x 300mm) 2. 3D Printing for Create the model and produce the Geneva Gear & Ratchet mechanism Create the model and produce the Slide-crank mechanism	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
7	1.Robot Programming for Spot welding practice - (No. of spots - 9) 2. 3D Printing for Create the model and produce the Slide-crank mechanism	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
8	1.Robot Programming for Arc welding practice – (Length of weld 50 mm) 2. 3D Printing for Create the model and produce the Gear Train in 3D printing.	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
9	1.Robot Programming for Assembling practice - (Minimum 3 Components) 2. 3D Printing for Create the model and produce the Geneva Gear & Ratchet mechanism	D651.1, D651.2, D651.3, D651.4, D651.5	PO4, PO7
10	Mini Project	D651.1 to D651.5	PO7

MED652- 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
Refrigeration and Air-Conditioning Practical	5	80	Internal Assessment	Autonomous Examinations	Total	3 Hrs.
			25	100*	100	

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

DETAILED ALLOCATION OF MARKS

Part A

Procedure	:	10
Formulae / Observation	:	20
Calculation / Result	:	15

Part B

Description / Procedure	:	15
Tool handling	:	15
Conclusion / Report	:	10
Viva-voce	:	05
Mini Project	:	10
TOTAL	**:**	**100**

MINI PROJECT EVALUATION (10 MARKS)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

OBJECTIVES

On the completion of the course the students can be able to

- 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 OUTCOMES:

Course	MED652- REFRIGERATION AND AIR-CONDITIONING PRACTICAL
After successful completion of this course the students should be able to	
D652.1	Define about basic refrigeration operations.
D652.2	Demonstrate knowledge about water coolers and split type air conditioners.
D652.3	List about the various methods of setting and adjustment of thermostat and expansion valves.
D652.4	Illustrate the electrical circuits of air conditioning systems.
D652.5	Outline the various service procedures of refrigeration & air conditioning system and develop the mini projects with report

EQUIPMENTS REQUIRED: (For a batch of 30 students)

WORKING MODELS OF THE FOLLOWING WITH ARRANGEMENTS FOR CONDUCTING TESTS	
1	Refrigerator with test rig
2	Water cooler
3	Window A/C with test rig
4	Split A/C
5	Cooling tower
WORKING MODEL OF THE FOLLOWING TO CONDUCT EXPERIMENTS	
1	Thermostat units
2	Cut off units
3	Thermostatic expansion valve unit
4	Automatic expansion valve unit
5	Sealed compressor with experimental setup
TOOLS	
1	Mechanics tool set
2	Tube cutter
3	Tube bender type
4	Tube bender spring
5	Swaging tool
6	Flaring block
7	Flaring nut
8	Pinching tool
9	Capillary tube testing gauge
10	Blow Lamp
SERVICE TOOLS	
1	Gas cylinder with receiver valve and key
2	Charging System
3	Blow lamp
4	Stem key
5	Spring remover
6	Service valve
7	‘t’ connector
8	High pressure gauge
9	Compound gauge
10	Leak detector
11	Soldering and Brazing kit.

MED652- REFRIGERATION AND AIR-CONDITIONING PRACTICAL

Name of the Exercise	
PART A:	
Ex.1	Determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with any one expansion device (Thermostatic expansion valve, Capillary tube, Automatic Expansion Valve)
Ex.2	Determine the C.O.P of sealed system by using electrical measurements.
Ex.3	Determine the capacity of a window air conditioner.
Ex.4	Determine the efficiency of a cooling tower.
Ex.5	Conduct Leak tests in a split air conditioning system, detect the failures and suggest the remedies. Conduct the Refrigerant Charge Test.
Ex.6	Conduct the flush test to remove the contaminants of refrigeration system and recharge.
PART B:	
Ex.7	Study the various sizes of copper and steel tubing. To study the various tools used for operations.
Ex.8	Study and carry out the various operations on copper and steel tubing– Flaring, Swaging and Soldering methods used in R& A.C.
Ex.9	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.
Ex.10	Conduct the service to change refrigerant into service cylinder from storage cylinder.
Ex.11	Conduct the service to pump down the system and to purge air from the system.
Ex.12	Conduct the service to check the oil level in the compressor and trace the common faults in R& A.C units and their remedies.
Ex.13	Mini Project

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks

Total		25 Marks

LEARNING WEBSITE:

1. http://mgcl.iitr.ac.in/49200-nptel-video-lecture-topics.pdf
2. https://www.youtube.com/watch?v=nlsNmhiID74
3. https://nptel.ac.in/courses/112105128/10
4. https://nptel.ac.in/courses/112105128/

AUTONOMOUS EXAMINATION

NOTE:

1. All the experiments in both sections should be completed. Two experiments will be given for examination by selecting one from PART A and one from PART B.
2. All the experiments should be given in the question paper and students are allowed to select by a lot or Question paper issued from the Autonomous should be followed.
3. All regular students appearing for first attempt should submit record notebook for the examination.
4. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
5. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D652.1	3	2	2	2	2	3	3	2	2	2
D652.2	3	2	2	2	2	3	3	2	2	2
D652.3	3	2	2	2	2	3	3	2	2	2
D652.4	3	2	2	2	2	3	3	2	2	2
D652.5	3	2	2	2	2	3	3	2	2	2
D652 Total	15	10	10	10	10	15	15	10	10	10
Correlation level	3	2	2	2	2	3	3	2	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

QUESTION PAPER SETTING

The teaching leering process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

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MED652- REFRIGERATION AND AIR-CONDITIONING PRACTICAL

MODEL QUESTION PAPER

Sl.No	Name of the exercise	CO	PO
1	1. Determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with any one expansion device (Thermostatic expansion valve, Capillary tube, Automatic Expansion Valve) 2. Study the various sizes of copper and steel tubing. To study the various tools used for operations.	D652.1 D652.4	PO4,PO5,PO7
2	1. Determine the C.O.P of sealed system by using electrical measurements. 2. Study and carry out the various operations on copper and steel tubing– Flaring, Swaging and Soldering methods used in R& A.C.	D652.1 D652.4	PO4,PO5,PO7
3	1. Determine the capacity of a window air conditioner 2. 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.	D652.2 D652.4	PO4,PO5,PO7
4	1. Determine the efficiency of a cooling tower. 2. Conduct the service to change refrigerant into service cylinder from storage cylinder.	D652.2 D652.5	PO4,PO5,PO7
5	1. Conduct Leak tests in a split air conditioning system, detect the failures and suggest the remedies. Conduct the Refrigerant Charge Test. 2. Conduct the service to pump down the system and to purge air from the system.	D652.3 D652.5	PO4,PO5,PO7
6	1. Conduct the flush test to remove the contaminants of refrigeration system and recharge. 2. Conduct the service to check the oil level in the compressor and trace the common faults in R& A.C units and their remedies.	D652.3 D652.5	PO4,PO5,PO7
7	MINI PROJECT	D652.1 to D652.5	PO4,PO5,PO7

MED653- AUTOMOBILE TECHNOLOGY PRACTICAL

TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

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

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

DETAILED ALLOCATION OF MARKS

Part A		
Dismantling Procedure	:	15
Tools handling methods	:	15
Assembly / Report	:	10
Part B		
Dismantling Procedure	:	20
Tools handling methods	:	15
Assembly / Report	:	10
Viva voce	:	05
Mini Project	:	10
TOTAL	**:**	**100**

Mini Project Evaluation (10 marks)

Breakup Details

1	Project Description	05
2	Project Demo	05
	Total	**10**

OBJECTIVES

On the completion of the course the students can be able to

- 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 AC fuel pump, oil pump and water pump.
- Dismantle and assemble fuel injection pump..
- Dismantle and assemble steering gear box.
- Testing and charging of batteries.

- Overhauling of starter motor, alternator.
- Troubleshoot the electrical circuits in automobile.

COURSE OUTCOMES:

Course	**MED653- AUTOMOBILE TECHNOLOGY PRACTICAL**
After successful completion of this course the students should be able to	
D653.1	Identify the various tools and their applications used in automobiles.
D653.2	Dismantle and assembly of various automobile circuits.
D653.3	To know the automobile parts
D653.4	To know the purpose of automobile tools
D653.5	Identify the Electronic assembles parts and develop the mini projects with report

EQUIPMENTS REQUIRED: (For a batch of 30 students)

1	Automobile Mechanic's tools-Complete Set
2	Internal circlip plier, bearing puller
3	Feeler gauge to check valve clearance, hammer and accessories
4	Compressor to supply high pressure air to clean oil and water filters.
5	4 stroke petrol engine- with all accessories
6	4 stroke Diesel engine- with all accessories
7	Engine cylinder with liner and cylinder bore dial gauge
8	Oil pump and water pump.
9	MPFI.
10	Inline Fuel Injection Pump
11	CRDI
12	Injectors.
13	Clutch set arrangement with tools
14	Complete gear box with tools
15	Complete steering arrangement
16	Battery and charging set up.
17	Measuring instruments
18	Consumables

MED653- AUTOMOBILE TECHNOLOGY PRACTICAL

Name of the Exercise	
PART A:	
Ex.1	Dismantling and assembling of four stroke petrol engine and identification of parts.
Ex.2	Removing camshaft, replacing timing gears, removing valves, lapping and adjusting valve clearance.
Ex.3	Removing, servicing and replacing of fuel pump, oil pump & water pump.
Ex.4	Removing, servicing & replacing MPFI system.
Ex.5	Dismantling and assembling of inline fuel injection pump / CRDI system.
Ex.6	Test a battery with specific gravity test and charge the battery with constant amperage / voltage method.
PART B:	
Ex.7	Removing and replacing of pressure plate and clutch plate, fingers adjustment
Ex.8	Dismantling, inspecting and assembling of constant mesh gear box and find out the gear ratios.
Ex.9	Dismantling, assembling and adjusting of steering gear box.
Ex.10	Dismantling, overhauling and assembling of starter motor / alternator
Ex11	Trace the automobile electrical system with respect to battery coil ignition system
Ex.12	Trace the automobile electrical system with respect to (i) horn relay circuit, (ii)Wiper circuit & explain with neat circuit diagram.
Ex.13	Dismantling Assembling and testing of injectors
Ex.14	Mini Project The mini project is activity based and it may be given to group of maximum of six students for hands on experience and to create scientific temper.

CONTINUOUS INTERNAL ASSESSMENT

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

a) Attendance (Award of marks same as theory courses)	:	05 Marks
b) Procedure/ observation and tabulation/ Other Practical related Work	:	05 Marks
c)Tests	:	10 Marks
d) Student Centered Learning (SCL) work sheet	:	05 Marks
Total		25 Marks

LEARNING WEBSITE:

1. https://nptel.ac.in/courses/112105128/
2. https://nptel.ac.in/courses/112107208/
3. https://nptel.ac.in/courses/112105128/38
4. https://www.youtube.com/watch?v=x70VqMrXrbs
5. https://www.youtube.com/watch?v=SDkYKvh7Z08

AUTONOMOUS EXAMINATION

Note:

1. All the exercises in both sections should be completed. Two exercises will be given for examination by selecting one from PART A and one from PART B.
2. All the exercises should be given in the question paper and students are allowed to select by a lot or question paper issued from the Autonomous should be followed.
3. All regular students appearing for first attempt should submit record notebook for the examination.
4. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
5. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

CO-POs & PSOs MAPPING MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
D653.1	3	2	3	2	-	3	3	2	2	2
D653.2	3	2	3	2	-	3	3	2	2	2
D653.3	3	2	3	2	-	3	3	2	2	2
D653.4	3	2	3	2	-	3	3	2	2	2
D653.5	3	2	3	2	-	3	3	2	2	2
D653 Total	15	10	15	10	-	15	15	10	10	10
Correlation level	3	2	3	2	-	3	3	2	2	2

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

MED653- AUTOMOBILE TECHNOLOGY PRACTICAL

MODEL QUESTION PAPER

Sl.No	Name of the exercise	CO	PO
1	1. Dismantling and assembling of four stroke petrol engine and identification of parts. 2. Removing and replacing of pressure plate and clutch plate, fingers adjustment	D653.1, D653.2, D653.3, D653.4, D653.5	PO1, PO2, PO3
2	1. Removing camshaft, replacing timing gears, removing valves, lapping and adjusting valve clearance. 2. Dismantling, inspecting and assembling of constant mesh gear box and find out the gear ratios.	D653.1, D653.2, D653.3, D653.4, D653.5	PO1, PO2, PO3
3	1. Removing, servicing and replacing of fuel pump, oil pump & water pump 2. Dismantling, assembling and adjusting of steering gear box.	D653.1, D653.2, D653.3, D653.4, D653.5	PO1, PO2, PO3
4	1. Removing, servicing & replacing MPFI system. 2. Dismantling, overhauling and assembling of starter motor / alternator	D653.1, D653.2, D653.3, D653.4, D653.5	PO1, PO2, PO3
5	1. Dismantling and assembling of inline fuel injection pump / CRDI system 2. Trace the automobile electrical system with respect to battery coil ignition system	D653.1, D653.2, D653.3, D653.4, D653.5	PO1, PO2, PO3, PO4, PO7
6	1. Test a battery with specific gravity test and charge the battery with constant amperage / voltage method. 2. Trace the automobile electrical system with respect to (i) horn relay circuit, (ii)Wiper circuit & explain with neat circuit diagram.	D653.1, D653.2, D653.3, D653.4, D653.5	PO1, PO2, PO3, PO4, PO7
7	1. Test a battery with specific gravity test and charge the battery with constant amperage / voltage method. 2.Dismantling Assembling and testing of injectors	D653.1, D653.2, D653.3, D653.4, D653.5	PO1, PO2, PO3,PO4, PO7
8	Mini project	D653.1, to D653.5	PO1, PO2, PO3,PO4, PO7

MED660- PROJECT WORK AND INTERNSHIP

TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

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

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

COURSE DESCRIPTION:

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

OBJECTIVES:

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

a) Internal assessment mark for Project Work and Internship:

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

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of autonomous 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

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

COURSE OUTCOMES:

Course	**MED660- PROJECT WORK AND INTERNSHIP**
After successful completion of this course the students should be able to	
C660.1	Plan and identify materials, processes and other resources optimally.
C660.2	Develop innovative and creative ideas.
C660.3	Develop leadership, interpersonal skill and team work.
C660.4	Purchase raw material/standard parts.
C660.5	Interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.

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.

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.

Autonomous Examination

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

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

CO – PO & PSO's MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C660.1	3	3	3	3	3	3	3	3	3	3
C660.2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
C660.3	3	3	3	3	3	3	3	3	3	3
C660.4	3	3	3	3	3	3	3	3	3	3
C660.5	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	15	15	15
Correlation level	3	3	3	3	3	3	3	3	3	3

Correlation level 1 – Slight (low)
Correlation level 2 – Moderate (Medium)
Correlation level 3 – Substantial (high)

MED610-INDUSTRIAL ENGINEERING AND MANAGEMENT

MODEL QUESTION PAPER					
Duration : 3 Hrs					**Max. Marks: 100**
PART – A (10x3 = 30 Marks)					
Note: Answer all the Questions. All Questions carry equal marks.		**Unit**	**Blooms level**	**CO**	**PO**
1	Name the techniques used to improve layout.	I	R	D610.1	PO1,PO2,PO3
2	What is meant by accident proneness?	I	R	D610.1	PO1,PO2,PO3
3	Describe the objectives of method study.	II	R	D610.2	PO1,PO2,PO3
4	Name the types of allowances.	II	R	D610.2	PO1,PO2,PO3
5	What are the types of leadership?	III	R	D610.3	PO1,PO2,PO3
6	Describe the line of authority.	III	R	D610.3	PO1,PO2,PO3
7	Explain any two factors which determine the amount of working capital	IV	U	D610.4	PO1,PO2,PO3
8	State the functions of material management.	IV	R	D610.4	PO1,PO2,PO3
9	Differentiate between morals and ethics	V	AN	D610.5	PO1,PO2,PO3
10	Describe the term empathy.	V	R	D610.5	PO1,PO2,PO3

BPART B (5 X 14 = 70 Marks)						
Note: Answer all the questions by choosing either (A) or (B)		**Marks**	**Unit**	**Bloom's level**	**CO**	**PO**
11A)	i) Explain the factors to be considered for the selection of a site?	7	I	U	D610.1	PO1,PO2,PO3
	ii) Explain any two material handling equipment with neat sketch.	7	I	U	D610.1	PO1,PO2,PO3
	(OR)					
11B)	i) Explain the different types of layout with sketches	7	I	U	D610.1	PO1,PO2,PO3
	ii) Explain the scheduled maintenance.	7	I	U	D610.1	PO1,PO2,PO

						3
12 A)	i) Explain the basic procedure for conducting method study.	7	II	U	D610.2	PO1,PO2,PO3
	ii) Explain the techniques of work measurement.	7	II	U	D610.2	PO1,PO2,PO3
	(OR)					
12 B)	i) Explain various types of allowances used in time study. (8)	7	II	U	D610.2	PO1,PO2,PO3
	ii) Compare fly back method with continuous method in stop watch time study.	7	II	An	D610.2	PO1,PO2,PO3
13 A)	i) Give a brief account of Taylor's functional organization.	7	III	R	D610.3	PO1,PO2,PO3
	ii) Write short notes on job evaluation and merit rating.	7	III	R	D610.3	PO1,PO2,PO3
	(OR)					
13 B)	i) Write short notes on the SWOT Analysis	7	III	R	D610.3	PO1,PO2,PO3
	ii) Write short notes on the Business process Re - engineering.	7	III	R	D610.3	PO1,PO2,PO3
14 A)	i) Explain depreciation methods with example	7	IV	U	D610.4	PO1,PO2,PO3
	ii) Explain about the supply chain management.	7	IV	U	D610.4	PO1,PO2,PO3
	(OR)					
14 B)	i) Explain the procurement and consumption cycle of stock control system.(8)	7	IV	U	D610.4	PO1,PO2,PO3

	ii) Explain how total cost of inventory can be efficiently controlled by ABC analysis.	7	IV	U	D610.4	PO1,PO2,PO3
15 A)	i). Write short notes on Kohibergg stages of moral development.	7	V	R	D610.5	PO1,PO2,PO3
	ii). Write short notes on Intellectual Property Rights.	7	V	R	D610.5	PO1,PO2,PO3
	(OR)					
15 B)	i). Explain the core human values in detail.	7	V	U	D610.5	PO1,PO2,PO3
	ii). Explain about the engineering ethics.	7	V	U	D610.5	PO1,PO2,PO3

QUESTION PAPER SETTING

The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as Presented below:

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED620 E VEHICLE TECHNOLOGY & POLICY

MODEL QUESTION PAPER

Time: 3 Hrs Max.Marks:100

PART-A (10 X 3 = 30Marks)					
Note: Answer all the questions. All questions carry equal marks					
S.No	**Questions**	**UNIT**	**Bloom's Level**	**CO**	**PO**
1	What is the Parts of Drive train system?	I	R	D620.1	PO1,PO2
2	Draw the block diagram of BEV.	I	U	D620.1	PO1,PO2
3	Define energy consumption.	II	R	D620.2	PO1,PO2
4	What are the types of EV motors?	II	R	D620.2	PO1,PO2
5	What is Electrochemical Batteries?	III	R	D620.3	PO1,PO2
6	Explain Nickel Based Batteries.	III	U	D620.3	PO1,PO2
7	What is Global Scenario of EV adoption?	IV	R	D620.4	PO1,PO2
8	Explain about AIS 038.	IV	U	D620.4	PO1,PO2
9	What is Policy Measures?	V	R	D620.5	PO1,PO2
10	Explain Recycling Ecosystem.	V	U	D620.5	PO1,PO2

PART-B (5 X 14 = 70 Marks)						
Note: Answer all questions choosing A or B in each question. All questions carry equal marks						
S.No	**Questions**	**Marks**	**UNIT**	**Bloom's Level**	**CO**	**PO**
11	(A) (i) Explain about Rear Wheel, Front Wheel and All wheel.	07	I	U	D620.1	PO1,PO2,PO3,PO4,PO5
	(ii) Explain about the Parts of Drive train system.	07	I	U	D620.1	PO1,PO2,PO3,PO4,PO5
	(OR)					
	(B) (i) Explain about Hybrid electric Vehicle (HEV).	07	I	U	D620.1	PO1,PO2,PO3,PO4,PO5
	(ii) Explain about Plug-in Hybrid Electric Vehicle (PHEV).	07	1	U	D620.1	PO1,PO2,PO3,PO4,PO5
12	(A) (i) What is the Concept of Hybrid electric drive trains?	07	II	U	D620.2	PO1,PO2,PO3,PO4,PO5
	(ii) Explain Series, Parallel and Series & Parallel.	07	II	U	D620.2	PO1,PO2,PO3
	(OR)					
	(B) (i) Briefly explain about Permanent Magnetic Brush Less DC Motor Drives (BLDC).	07	II	U	D620.2	PO1,PO2,PO3

	(ii) What are the Merits and Demerits of DC motor drive?	07	II	U	D620.2	PO1,PO2,PO3
13	(A).(i) Explain the Construction and working of Lead Acid Batteries.	07	III	U	D620.3	PO1,PO2,PO3
	(ii) Explain the Lithium Based Batteries Role of Battery Management System (BMS).	07	III	U	D620.3	PO1,PO2,PO3
	(OR)					
	(B) (i) Explain the Latest development in battery chemistry.	07	III	U	D620.3	PO1,PO2,PO3
	(ii) Explain the Impacts on Environment –Impacts on Economy.	07	III	U	D620.3	PO1,PO2,PO3
14	(A) (i) Explain about Government of India Electric Mobility Policy Frame work.	07	IV	U	D620.4	PO1,PO3,PO5
	(ii) Explain the National Electric Mobility Mission Plan 2020.	07	IV	U	D620.4	PO1,PO3,PO5
	(OR)					
	(B) (i) Explain the Scope and Applicability of EV Policy.	07	IV	U	D620.4	PO1,PO3,PO5
	(ii) Explain the ARAI Standards for Electric Vehicle.	07	IV	U	D620.4	PO1,PO3,PO5
15	(A) (i) Briefly explain about Tamil Nadu E-vehicle Policy 2019.	07	V	U	D620.5	PO1,PO3,PO5
	(ii) Explain Demand side incentives.	07	V	U	D620.5	PO1,PO3,PO5
	(OR)					
	(B) (i) Explain the Revision of Transport Regulation of EV.	07	V	U	D620.5	PO1,PO3,PO5
	(ii) Explain and details of R&D and Business Incubation .	07	V	U	D620.5	PO1,PO3,PO5

QUESTION PAPER SETTING

The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as Presented below:

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED631- INDUSTRIAL ROBOTICS AND 3D PRINTING

MODEL QUESTION PAPER

Duration : 3 Hrs | **Max. Marks: 100**

PART – A (10x3 = 30 Marks)

	Note: Answer all Questions. All Questions carry equal marks.	**Unit**	**Bloom's level**	**CO**	**PO**
1.	Define pitch and yaw.	I	R	D631.1	PO1,PO2,PO3
2.	List the four types of control used in robotics.	I	R	D631.1	PO1,PO2,PO3
3.	Compare hydraulic and pneumatic drives.	II	A	D631.2	PO1,PO2,PO3
4.	List the various elements of machine vision system.	II	R	D631.2	PO1,PO2,PO3
5.	Differentiate forward and inverse kinematics.	III	R	D631.3	PO1,PO2,PO3
6.	What is the purpose of teach pendent.	III	A	D631.3	PO1,PO2,PO3
7.	Write any 2 differences between additive manufacturing and CNC machining.	IV	R	D631.4	PO1,PO2,PO3
8.	What is prototyping?	IV	R	D631.4	PO1,PO2,PO3
9.	What are the advantages of SLA Process?	V	R	D631.5	PO1,PO2,PO3
10.	Write any 2 applications of additive manufacturing in healthcare products.	V	R	D631.5	PO1,PO2,PO3

PART B (5x14 = 70 Marks)

	Note: Answer all the questions by choosing either (A) or(B)	**Marks**	**Unit**	**Bloom's level**	**CO**	**PO**
11 A)	(i) List and explain the components of robot.	7	I	R	D631.1	PO1,PO2,PO3
	(ii) Explain any three basic configurations of robotics with neat diagrams.	7	I	U	D631.1	PO1,PO2,PO3
	(OR)					
B)	(i) Explain open loop and closed loop controls with neat diagram.	7	I	U	D631.1	PO1,PO2,PO3
	(ii) Illustrate the four types of joints used in robots.	7	I	U	D631.1	PO1,PO2,PO3
12 A)	(i) Describe the construction and working of magnetic gripper with sketch.	7	II	R	D631.2	PO1,PO2,PO3
	(ii) Compare pneumatic hydraulic and electric drive.	7	II	A	D631.2	PO1,PO2,PO
	(OR)					

B)	(i) Explain optical encoder with neat sketch.	7	II	U	D631.2	PO1,PO2,PO3
	(ii) Describe about machine vision system	7	II	R	D631.2	PO1,PO2,PO3
13A)	(i) Describe teach pendant programming and lead through programming.	7	III	R	D631.3	PO1,PO2,PO3
	(ii)Illustrate the application of robot in spray painting.	7	III	U	D631.3	PO1,PO2,PO3
	(OR)					
B)	(i) Drive expressions for forward kinematics of manipulators with three degrees of freedom.	7	III	An	D631.3	PO1,PO2,PO3
	(ii) Write brief notes on (i) Move commands (ii) End Effector commands	7	III	R	D631.3	PO1,PO2,PO3
14 A)	(i) Explain the principles of additive manufacturing.	7	IV	U	D631.4	PO1,PO2,PO3
	(ii) Write short notes on Direct and Indirect process in additive manufacturing.	7	IV	R	D631.4	PO1,PO2,PO3
	(OR)					
B)	(i) Explain the design rules for additive manufacturing.	7	IV	U	D631.4	PO1,PO2,PO
	(ii) How will generate a STL file from CAD model.	7	IV	R	D631.4	PO1,P
15 A)	(i) Explain the photo polymerisation process in additive manufacturing.	7	V	U	D631.5	PO1,PO2,PO3
	(ii) Explain the principle of Electron beam melting process.	7	V	U	D631.5	PO1,PO2,PO3
	(OR)					
B)	(i) Explain the construction and working principle of FDM process.	7	V	U	D631.5	PO1,PO2,PO3
	(ii) Explain the construction and working principle of ultrasonic additive manufacturing.	7	V	U	D631.5	PO1,PO2,PO3

QUESTION PAPER SETTING

The question paper setters are requested to follow the Revised Bloom's Taxonomy levels as Presented below:

Bloom's Taxonomy	Lower Order Thinking Skills (LOTs)	Higher Order Thinking Skills (HOTs)
Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED632-REFRIGERATION AND AIR-CONDITIONING

MODEL QUESTION PAPER					
Duration : 3 Hrs				**Max. Marks: 100**	
PART – A (10x3 = 30 Marks)					
Note: Answer all Questions. All Questions carry equal marks.		**Unit**	**Bloom's level**	**CO**	**PO**
1.	Explain the reversed Carnot cycle refrigeration system.	I	U	D632.1	PO1,PO2,PO3
2.	Define Ton of refrigeration.	I	R	D632.1	PO1,PO2,PO3
3.	Difference between the vapour compression and vapour absorption Refrigeration system.	II	A	D632.2	PO1,PO2,PO3
4.	What are the effects of super heating?	II	R	D632.2	PO1,PO2,PO3
5.	What are the types of refrigerants?	III	R	D632.3	PO1,PO2,PO3
6.	Write short notes on cold storage.	III	R	D632.3	PO1,PO2,PO3
7.	Describe about the Sensible heat factor.	IV	R	D632.4	PO1,PO2,PO3
8.	What are the uses of psychometric chart and draw it?	IV	R	D632.4	PO1,PO2,PO3
9.	What is occupant load?	V	R	D632.5	PO1,PO2,PO3
10.	What are different heat sources?	V	R	D632.5	PO1,PO2,PO3

PART B (5x14 = 70 Marks)						
Note: Answer all the questions by choosing either (A) or(B)		**Marks**	**Unit**	**Bloom's level**	**CO**	**PO**
11 A)	i) Explain the working of an air cooled condenser with suitable sketch.	7	I	U	D632.1	PO1, PO2, PO3
	ii) Explain the principle of working with constructional details of forced circulation type evaporator.	7	I	U	D632.1	PO1, PO2, PO3
(OR)						
B)	i) Find the least KW required by a perfect reversed heat engine that will make 450kg of ice per hour at -3°C from the water at 20.5°C. Take latent heat of ice as 340kJkg and specific heat as 2 kJ/kg K.	7	I	Ap	D632.1	PO1, PO2, PO3
	ii) Explain the working principle of open and closed air system of refrigeration	7	I	U	D632.1	PO1, PO2, PO3
12 A)	i) Explain the working principle of Electrolux	7	II	U	D632.2	PO1, PO2,

<table>
<tr><td></td><td>refrigerator with a neat diagram. (8)</td><td></td><td></td><td></td><td></td><td>PO3</td></tr>
<tr><td></td><td>ii) Explain the working principle of vapour compression system</td><td>7</td><td>II</td><td>U</td><td>D632.2</td><td>PO1, PO2, PO3</td></tr>
<tr><td colspan="7">(OR)</td></tr>
<tr><td>B)</td><td>i) A CO2 refrigeration system works between 56.25 bar and 21.2 bar. The refrigerant leaves the compressor at 32˚C with total heat 246.2 kJ/kg. Determine the theoretical co efficient of performance of the plant. The properties of CO2 are,
<table>
<tr><th rowspan="2">Saturation Pressure(Bar)</th><th rowspan="2">Saturation temperature (˚C)</th><th colspan="2">Enthalpy(kJ/kg)</th><th colspan="2">Entropy (kJ/kg)</th></tr>
<tr><th>Liquid</th><th>vapour</th><th>Liquid</th><th>Vapou</th></tr>
<tr><td>56.25</td><td>18.5</td><td>52.75</td><td>214.7</td><td>0.167</td><td>0.7244</td></tr>
<tr><td>21.2</td><td>-18</td><td>37.68</td><td>234.9</td><td>-0.15</td><td>0.917</td></tr>
</table></td><td>7</td><td>II</td><td>Ap</td><td>D632.2</td><td>PO1, PO2, PO3</td></tr>
<tr><td></td><td>ii) Explain the use of flash chamber and accumulator.</td><td>7</td><td>II</td><td>U</td><td>D632.2</td><td>PO1, PO2, PO3</td></tr>
<tr><td>13 A)</td><td>i) Explain with neat sketch working principle of types of water cooler.</td><td>7</td><td>III</td><td>U</td><td>D632.3</td><td>PO1, PO2, PO3</td></tr>
<tr><td></td><td>ii) Write short notes about slow freezing and quick freezing.</td><td>7</td><td>III</td><td>R</td><td>D632.3</td><td>PO1, PO2, PO3</td></tr>
<tr><td colspan="7">(OR)</td></tr>
<tr><td>B)</td><td>i) Explain with neat sketch working principle of Automatic Expansion valve.</td><td>7</td><td>III</td><td>U</td><td>D632.3</td><td>PO1, PO2, PO3</td></tr>
<tr><td></td><td>ii) Write short notes on the selection of a refrigerant.</td><td>7</td><td>III</td><td>R</td><td>D632.3</td><td>PO1, PO2, PO3</td></tr>
<tr><td>14 A)</td><td>i) Explain any two types of psychometric processes.</td><td>7</td><td>IV</td><td>U</td><td>D632.4</td><td>PO1, PO2, PO3</td></tr>
<tr><td></td><td>ii) Write short notes about the governing optimum effective temperature</td><td>7</td><td>IV</td><td>R</td><td>D632.4</td><td>PO1, PO2, PO3</td></tr>
<tr><td colspan="7">(OR)</td></tr>
</table>

B)	i) Find Air at atmospheric pressure and DBT &WBT of 25˚C & 15˚C respectively enters a heating coil whose temperature is 35˚C. The bypass factor of the heating coil is 0.25. Determine the DBT, WBT and RH of air leaving the heating coil. Also find the sensible heat added to air per kg of dry air.	7	IV	Ap	D632.4	PO1, PO2, PO3
	ii) Write short notes on dry bulb temperature, wet bulb temperature and dew point.	7	IV	R	D632.4	PO1, PO2,
15 A)	i) Explain with neat sketch window type refrigeration systems.	7	V	U	D632.5	PO1, PO2, PO3
	ii) Explain about the air washer humidifier.	7	V	U	D632.5	PO1,P
	(OR)					
B)	i) Explain the air distribution system with neat sketch.	7	V	U	D632.5	PO1, PO2, PO3
	ii) Write short notes about different heat sources in cooling load calculation.	7	V	U	D632.5	PO1, PO2, PO3

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Level	R-Remember, U-Understand , Ap-Apply	An-Analyze, E-Evaluate, C-Create
% to be included	90%	10%

MED633- AUTOMOBILE TECHNOLOGY

MODEL QUESTION PAPER

Duration : 3 Hrs | **Max. Marks: 100**

PART – A (10x3 = 30 Marks)

	Note: Answer all Questions. All Questions carry equal marks.	**Unit**	**Bloom's level**	**CO**	**PO**
1.	State the principle of compression rings.	I	R	D633.1	PO1,PO2,PO3
2.	Sketch a cam shaft.	I	R	D633.1	PO1,PO2,PO3
3.	List out merits and demerits of injection system.	II	R	D633.2	PO1,PO2,PO3
4.	Define CRDI system.	II	R	D633.2	PO1,PO2,PO3
5.	Sketch the arrangement of front engine rear wheel	III	R	D633.3	PO1,PO2,PO3
6.	What is the purpose of clutch?	III	R	D633.3	PO1,PO2,PO3
7.	What is wheel alignment?	IV	R	D633.4	PO1,PO2,PO3
8.	State the functions of anti lock brake system.	IV	R	D633.4	PO1,PO2,PO3
9.	State any testing procedure of battery.	V	R	D633.5	PO1,PO2,PO3
10.	What are the concepts of EVs?	V	R	D633.5	PO1,PO2,PO3

PART – B (5x14 = 70 Marks)

	Note: Answer all the questions by choosing either (A) or (B)	**Marks**	**Unit**	**Bloom's level**	**CO**	**PO**
11 A)	i) Sketch the cross section of various types of piston rings and briefly explain about their functions.	7	I	R	D633.1	PO1, PO2, PO3
	ii) Explain the pump assisted water cooling system.	7	I	U	D633.1	PO1, PO2, PO3
	(OR)					
B)	i) Explain the full pressure system of lubricating systems.	7	I	U	D633.1	PO1, PO2, PO3
	ii) Sketch the side valve mechanism and explain.	7	I	R	D633.1	PO1,
12 A)	i) Explain the CRDI system.	7	II	U	D633.2	PO1, PO2, PO3
	ii) Explain with a neat sketch the working and advantages of a radiator pressure cap.	7	II	U	D633.2	PO1, PO2, PO3
	(OR)					
B)	i) Sketch and explain briefly about oil bath type air cleaner.	7	II	R	D633.2	PO1, PO2, PO3
	ii) Explain advantages and disadvantages of LPG and Bio diesel.	7	II	U	D633.2	PO1, PO2, PO3

13 A)	i) Explain with neat diagram the working of synchromesh gear box.	7	III	U	D633.3	PO1, PO2, PO3
	ii) Explain the transmission system arrangement of rear engine rear drive.	7	III	U	D633.3	PO1, PO2, PO3
	(OR)					
B)	i) Explain with neat diagram the working of three quarter floating and full floating rear axles.	7	III	U	D633.3	PO1, PO2, PO3
	ii) Write short notes about the differential troubles and their causes	7	III	R	D633.3	PO1, PO2, PO3
14 A)	i) Explain the construction and working of telescopic type shock absorber.	7	IV	U	D633.4	PO1, PO2, PO3
	ii) Explain with neat diagram working of Air assisted hydraulic brake with layout.	7	IV	U	D633.4	PO1, PO2, PO3
	(OR)					
B)	i) Explain with neat diagram the working of power steering.	7	IV	U	D633.4	PO1, PO2, PO3
	ii) Explain the construction of cross and radial ply tyres.	7	IV	U	D633.4	PO1, PO2, PO3
15 A)	i) Explain with neat diagram the working of Alternator and Dynamo.	7	V	U	D633.5	PO1, PO2, PO3
	ii) Write short notes about emission standards.	7	V	R	D633.5	PO1, PO2, PO3
	(OR)					
B)	i) Explain construction and working principles of Electric vehicles.	7	V	U	D633.5	PO1, PO2, PO3
	ii) Explain the high tension magneto electronic ignition system.	7	V	U	D633.5	PO1, PO2, PO3

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