PERIYAR CENTENARY POLYTECHNIC COLLEGE

PERIYAR NAGAR –VALLAM –THANJAVUR-613 403

(AUTONOMOUS INSTITUTION)

DIPLOMA IN
MECHANICAL ENGINEERING

SYLLABUS

MEC/16/00

SEMESTER SYSTEM

C- SCHEME

CONTENT

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PERIYAR CENTENARY POLYTECHNIC COLLEGE

PERIYAR NAGAR- VALLAM -THANJAVUR
(AUTOMOUS INSTITUTION)
DIPLOMA COURSES

(FULL TIME / SANWICH)

C- SCHEME

REGULATIONS*

** Applicable to the Diploma Courses In Engineering/Modern office Practice/ Architectural Assistantship(SW)*

1. Description of the Course: a. Full

Time (3 years)

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

b. Sandwich (3½ years)

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

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

2. Condition for Admission:

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

(Or)

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

(Or)

The Matriculation Examination of Tami Nadu.

(Or)

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

Sl. No	Courses	H.Sc Academic	H.Sc Vocational	
		Subjects Studied	Subjects Studied	
			Related subjects	Vocational subjects
1.	All the Regular and Sandwich Diploma Courses	Maths, Physics & Chemistry	Maths / Physics / Chemistry	Related Vocational Subjects Theory & Practical
2.	Diploma course in Modern Office Practice	English & Accountancy English & Elements of Economics English & Elements of Commerce	English & Accountancy, English & Elements of Economics, English & Management Principles & Techniques, English & Typewriting	Accountancy & Auditing, Banking, Business Management, Co-operative Management, International Trade, Marketing & Salesmanship, Insurance & Material Management, Office Secretary ship.

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

. Age Limit: No Age limit.

5. Eligibility for the Award of Diploma:

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

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

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

7. Subjects of Study and Curriculum outline:

The subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical. The curriculum outline is given in Annexure **- I**

8. Examinations:

Board Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester. The Internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment and 75 marks are allotted for Board Examination.

9. Continuous Internal Assessment:

A . For Theory Subjects:

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

i. Subject Attendance **5 Marks**

(Award of marks for subject attendance to each subject theory/practical will as per the range given below)

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

ii) Test #

2. Tests each of 2 hours duration for a total of 50 marks are to be conducted. Out of which the best one will be taken and the marks to be reduced 05 marks

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

Total **10 marks**

TEST	UNITS	WHEN TO CONDUCT	MARKS	DURATION
Test I	**U**nit – I & II	End of 6 weeks	50	2 Hrs
Test II	Unit –II & IV	End of 12 week	50	2 Hrs
Test III	**Model Examination – Compulsory** Covering all the 5 Units **(**Board Examination –question paper pattern)	End lf 15 th week	75	3 Hrs

 # - From the Academic year 2015-2016 onwards.

Question Paper Pattern for the Periodical Test :(Test - I & Test- II)
With no choice:

PART A type questions:	4Questions X 2 mark	… … 8 marks
PART B type questions:	4Questions X 3 marks	… … 12 marks
PART C type questions:	6Questions X 5 marks	… … 30 marks
	Total	50 marks

iii) Assignment **10 Marks**

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

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

B. For Practical Subjects:

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

a)	Attendance (Award of marks as same as Theory subjects)	:	**5 Marks**
b)	Procedure/ observation and tabulation/ Other Practical related Work	:	**10 Marks**
c)	Record writing	:	**10 Marks**
	TOTAL	:	**25 Marks**

- *All the Experiments/exercises indicated in the syllabus should be completed and the same to be given for final board examinations.*
- The Record for every completed exercise should be submitted in the subsequent Practical classes and marks should be awarded for 20 for each exercise as per the above allocation.
- At the end of the Semester, the average marks of all the exercises should be calculated for 20 marks and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- The students have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.
- *All the marks awarded for assignment, Test and attendance should be entered in the Personal Log Book of the staff, who is handling the subject. This is applicable to both Theory and Practical subjects.*

10. Life and Employability Skill Practical:

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

Much Stress is given to

- Reading Skill
- Listening Skill
- Writing Skill
- Pronunciation
- Interview Techniques
- Writing Resume
- Project Work

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

11. Project Work:

The students of all the Diploma Programmes **(except Diploma in Modern Office Practice)** have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamilnadu. The Project work must be reviewed twice in the same semester**.**

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

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

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

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

Viva Voce	…	**33 marks**
Demonstration/Presentation	…	**30 marks**
Total		**63 marks**

c) Written Test Mark (from 3 topics for 30 minutes duration): $

i) Entrepreneurship	2 questions X 2 marks	= **4 marks**
ii) Environment Management	2 questions X 2 marks	= **4 marks**
iii) Disaster Management	2 questions X 2 marks	= **4 marks**
		12 marks

$ **-** Selection of Questions should be from Question Bank, by the External Examiner. No choice need be given to the candidates.

Project Work & Viva Voce in Board Examination	**63 Marks**
Examination	
Written Test Mark (from 3 topics for 1 hour duration)	**12 Marks**
TOTAL	**75 Marks**

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

12. Scheme of Examinations:

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

13. Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an Training, and pass all the subjects prescribed in the curriculum.

2. A candidate shall be declared to have passed the examination in a subject if he/she secures not less than *40% in theory subjects* and *50% in practical subject* out of the total prescribed maximum marks including both the Sectional and Autonomous examination marks put together, subject to the condition that he/she secures at least a minimum of *30 marks out of 75 marks in the Autonomous examinations and a minimum of 35 marks out of 75 marks in the Autonomous Practical Examinations.*

14. Classification of successful candidates:

Classification of candidates who will pass out the final examinations from April 2018 onwards (Joined in first year in 2015-2016) will be done as specified below.

First Class with Superlative Distinction:

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

First Class with Distinction:

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

First Class:

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

Second Class:

All other successful candidates will be declared to have passed in **Second Class.**
The above mentioned classifications are also applicable for the Sandwich / students who pass out Final Examination from October 2018 /April 2019 onwards (both joined in First Year in 2015-2016)

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

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

Conclusion;

The above Rules Regulations can be revised and altered as per the DOTE norms and Academic Board.

ANNEXURE - I

CURRICULUM OUTLINE

DIPLOMA IN MECHANICAL ENGINEERING (MEC/ 2016/ 00)

THIRD SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial / Drawing	Practical	Total
MEC 310	Strength of Materials	6			6
MEC 320	Manufacturing Processes	5			5
MEC 330	Machine Drawing		4		4
MEC 340	Computer Applications and CAD Practical			6	6
MEC 350	Foundry and Welding Practical			4	4
MEC 360	Lathe and Drilling Practical			4	4
MEC 370	Metrology and Metallography Practical			4	4
	Seminar	1			1
TOTAL		**11**	**4**	**18**	**35**

FOURTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
MEC410	Heat Power Engineering	6			6
MEC420	Special Machines	5			5
MEC430	Fluid Mechanics and Fluid Power	5			5
MEC440	Electrical Drives & Control	6			6
MEC450	Strength of Materials and Fluid Mechanics Practical			4	4
MEC460	Special Machines Practical			4	4
MEC470	Electrical Drives & Control Practical			4	4
	Seminar	1			1
TOTAL		**23**		**12**	**35**

FIFTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
MEC510	Design of Machine Elements	6			6
MEC520	Thermal and Automobile Engineering	6			6
MEC530	Process Planning and Cost Estimation	5			5
Elective - I Theory		5			5
MEC 541	Total Quality Management				
MEC 542	Press Tools				
MEC 540	Renewable Energy Sources and Energy Conservation				
MEC-550	Process Automation Practical			4	4
MEC560	Thermal & Automobile Engineering Practical			4	4
MEB 570	Life and Employability Skill Practical			4	4
	Seminar	1			1
TOTAL		**23**		**12**	**35**

SIXTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
MEC610	Industrial Engineering and Management	6			6
MEC620	Computer Aided Design and Manufacturing	5			5
	Elective - II Theory	5			5
MEC631	Mechanical Instrumentation				
MEC632	Robotics				
MEC633	Refrigeration and Air-conditioning				
MEC640	Computer Aided Design and Manufacturing Practical			6	6
MEC650	Machine Tool Testing and Maintenance Practical			4	4
	Elective - II Practical			4	4
MEC661	Mechanical Instrumentation Practical				
MEC662	Robotics Practical				
MEC663	Refrigeration and Air-conditioning Practical				
MEC670	Project Work			4	4
	Seminar	1			1
	TOTAL	17		18	**35**

ANNEXURE –II
SCHEME OF EXAMINATION
DIPLOMA IN MECHANICAL ENGINEERING

THIRD SEMESTER

Subject Code	SUBJECT	Marks			Minimum marksfor	Duration of Exam
		Internal Assessment				
MEC310	Strength of Materials	25	75	100	40	3
MEC320	Manufacturing Processes	25	75	100	40	3
MEC330	Machine Drawing	25	75	100	40	3
MEC340	Computer Applications and CAD Practical	25	75	100	50	3
MEC350	Foundry and Welding Practical	25	75	100	50	3
MEC360	Lathe and Drilling Practical	25	75	100	50	3
MEC370	Metrology and Metallography Practical	25	75	100	50	3

FOURTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Autonomous Exam	Total		
MEC410	Heat Power Engineering	25	75	100	40	3
MEC420	Special Machines	25	75	100	40	3
MEC430	Fluid Mechanics and Fluid Power	25	75	100	40	3
MEC440	Electrical Drives & Control	25	75	100	40	3
MEC450	Strength of Materials and Fluid Mechanics Practical	25	75	100	50	3
MEC460	Special Machines Practical	25	75	100	50	3
MEC470	Electrical Drives & Control Practical	25	75	100	50	3

FIFTH SEMESTER

Subject Code	SUBJECT	Marks			Minimumfor pass	Duration of Exam Hours
		Internal Assessment	Autonomous Exam	Total		
MEC510	Design of Machine Elements	25	75	100	40	3
MEC520	Thermal and Automobile Engineering	25	75	100	40	3
MEC530	Process Planning and Cost Estimation	25	75	100	40	3
Elective - I Theory						
MEC541	Total Quality Management					
MEC542	Press Tools	25	75	100	40	3
MEC540	Renewable Energy Sources and Energy Conservation					
MEC550	Process Automation Practical	25	75	100	50	3
MEC560	Thermal and Automobile Engineering Practical	25	75	100	50	3
MEC570	Communication & Life Skills Practical **	25	75	100	50	3

SIXTH SEMESTER

Subject Code	SUBJECT	Marks			Minimum for pass	Duration of Exam Hours
		Internal Assessment	Autonomous Exam	Total		
MEC610	Industrial Engineering and Management	25	75	100	40	3
MEC620	Computer Aided Design and Manufacturing	25	75	100	40	3
Elective - II Theory						
MEC631	Mechanical Instrumentation					
MEC632	Robotics	25	75	100	40	3
MEC633	Refrigeration and Air-conditioning					
MEC640	Computer Aided Design and Manufacturing Practical	25	75	100	50	3
MEC650	Machine Tool Testing and Maintenance Practical	25	75	100	50	3
Elective - II Practical						
MEC661	Mechanical Instrumentation Practical					
MEC662	Robotics Practical	25	75	100	50	3
MEC663	Refrigeration and Air-conditioning Practical					
MEC670	Project Work	25	75	100	50	3

MEC- 310 STRENGTH OF MATERIALS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
	Hrs / Week	Hrs / Semester	Marks			Duration
Strength of Materials	6	90	Internal Assessment	Semester End Examination	Total	3 hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	STATICS OF PARTICLE AND FRICTION	17
II	MECHANICAL PROPERTIES, SIMPLE STRESSES AND STRAINS	17
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	17
IV	SHEAR FORCE AND BENDING MOMENT DIAGRAMS, THEORY OF SIMPLE BENDING	14
V	TORSION AND SPRINGS	13
	TEST AND REVISION	**12**
	Total	**90**

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 behavior of objects, when they are subject to actions of forces. Evaluations derived from these basic fields provide the tools for investigation of mechanical structure.

OBJECTIVES

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

COURSE OUTCOMES

MEC – 310 STRENGTH OF MATERIALS	
After successful completion of this course, the students should be able to	
C310.1	Determine the forces and friction acting on a body.
C310.2	Demonstrate about mechanical properties and deformation of materials.
C310.3	Describe the properties and the sectional efficiency of various sections.
C310.4	Identify the shear force and bending moment of the beam section.
C310.5	Description of spring properties and efficient.

MEC- 310 STRENGTH OF MATERIALS

UNIT-I

STATICS OF PARTICLES : [17Hrs]

Introduction –Force - effects of a force - system of forces - resultant of force - **[2Hrs]**

resultant of several forces acting on a particle - polygon law - resolution of a force into rectangular components – resultant of a system of forces acting **[2Hrs]**

on a particle using rectangular components - equilibrium of particles [**2Hrs]**

External and internal forces - moment of a force - Varignon's - moment of a couple - equivalent couples - addition of couples - resolution of a force into a **[2Hrs]**

force and a couple - Free body diagram - Necessary and sufficient conditions for the equilibrium of rigid bodies in two dimension - Support reaction – **[2Hrs]**

types of support - removal of two dimensional supports - Simple problems only. **[2Hrs]**

FRICTION: **[2Hrs]**

Introduction - Definition - Force of friction - Limiting friction - Static friction - Dynamic friction - Angle of friction - co-efficient of friction - **[1Hr]**

Laws of static and dynamic friction. **[2Hrs]**

UNIT -II [17Hrs]

DEFORMATION OF METALS

Mechanical properties of materials: Engineering materials – ferrous and non-ferrous materials **-** Definition of mechanical properties - Alloying elements-effect of alloying element - Fatigue, **[2Hrs]**

fatigue strength, creep – temperature creep – cyclic loading and repeated loading –endurance limit. **[2Hrs]**

Simple stresses and strains: Definition –Load, stress and strain – **[2Hrs]**

Classification of force systems –tensile, compressive and shear force systems –Behavior of mild steel in tension up to rupture –Stress – **[2Hrs]**

Strain diagram –limit of proportionality –elastic limit –yield stress – breaking stress – Ultimate stress – percentage of elongation and **[2Hrs]**

percentage reduction in area –Hooke's –Definition law –Young's to tension and compressive force – Simple problems in tension, **[2Hrs]**

compression and shear force**.**

Definition –Lateral strain –Poisson's–volumetric ratio strain –bulk **[2Hrs]**
modulus – volumetric strain of rectangular and circular bars –
problems connecting linear, lateral and volumetric deformation – {**1Hr]**
stored in a bar due to Axial load –Instantaneous stresses due to gradual, {**2Hrs]**
sudden, impact and shock loads – Problems computing instantaneous

UNIT -III

GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS [17Hrs]

Properties of sections: Definition –center of gravity and centroid – [**2Hrs]**
position of centroids of plane geometrical figures such as rectangle, triangle,
circle and trapezium-problems to determine the centroid of angle, channel, **[2Hrs]**
T and I sections only - Definition-centroidal axis-Axis
of symmetry. Moment of Inertia –Statement of parallel axis theorem and **[2Hrs]**
perpendicular axis theorem. Moment of Inertia of lamina of rectangle, circle
triangle, I and channel sections-Definition-Polar moment of Inertia-radius of **[2Hrs]**
gyration –Problems computing moment of inertia and radius of gyration for angle,
T, Channel and I sections **[2Hrs]**
causes in a thin cylindrical shell subjected to internal pressure– [**2Hrs]**
simple problems – change in dimensions of a thin cylindrical shell
subjected to internal pressure – problems –Derivation of tensile stress [**2Hrs]**
induced in a thin spherical shell subjected to internal pressure –simple **[1Hr]**
problems –change in diameter and volume of a thin spherical shell due [2**Hrs]**
to internal pressure–problems.

IV SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING [14Hrs]

Classification of beams – Definition – shear force and Bending moment –sign [**2 Hrs]**
conventions for shear force and bending moment – types of loadings –Relationship
bending moment diagram of cantilever and simply supported beam subjected to **[2Hrs]**
moment in cantilever beam and simply supported beam when they are subjected **[2Hr**s]
to point load and uniformly distributed load. Theory of simple bending –Assumptions
–Neutral axis –bending stress distribution – moment of resistance – bending **[2Hrs]**
equation – M/I=f/y=E/R –Definition –section modulus - rectangular and circular **[2Hrs]**
sections – strength of beam – simple problems involving flexural **[2Hrs]**
formula for cantilever and simple supported beam. **[2Hrs]**

UNIT –V THEORY OF TORSION AND SPRINGS {**13 Hours}**

Theory of torsion –Assumptions –torsion equation $\frac{T}{J}=\frac{f_s}{R}=\frac{C\theta}{l}$ – strength of solid **[2Hrs]**
and hollow shafts –power transmitted –Definition – Polar modulus –Torsional rigidity **[2Hrs]**

–strength and stiffness of shafts – comparison of hollow and solid shafts in weight and strength considerations – Advantages of hollow shafts over solid shafts – Problems. Types of springs –Laminated and coiled springs and applications – Types of coiled springs –Difference between open and closely coiled helical springs –closely coiled helical spring subjected to an axial load –problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs **[2Hrs]** **[2Hrs]** **[1Hrs]** **[2Hrs]** **[2Hrs]**

Revision and Test **[12Hrs]**

Text Book

Sl.No	Subject	Author	Publication
1	Strength of Materials	R. S. Khurmi	S.Chand & Co., Ram Nagar, New Delhi.
2	Strength of Materials	S. Ramamrutham	15th Edn 2004 DhanpatRai Pub. Co., New Delhi.

Reference Books:

Sl.No	Subject	Author	Publication/Edition
1	Strength of Materials	R.K. Bansal	Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition 2010
2	Strength of Materials	S.S.Rattan	Tata Mcgraw hill, New Delhi.
3	Strength of Materials	B K Sarkar	I Edition, 2003 Tata Mcgraw hill, New Delhi

LEARNING WEBSITES:

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

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
C310.1	3	2	3	2	2	2	3	2	3	1
C310.2	3	2	3	3	2	2	3	2	3	1
C310.3	3	2	3	2	1	2	3	2	3	1
C310.4	3	2	3	2	1	2	3	2	3	1
C310.5	3	2	3	3	1	2	3	2	3	1
Total	15	10	15	12	7	10	15	10	15	5
Correlation Level	3	2	3	2.4	1.4	2	3	2	3	1

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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MEC- 310 STRENGTH OF MATERIALS

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	State parallelogram law of forces.	I	R
2.	State hook's law.	II	R
3.	Define poison' ratio.	II	R
4.	Draw the position of center of gravity of a triangle.	III	R
5.	Define axis of symmetry.	III	R
6.	Define neutral axis.	IV	R
7.	Define bending moment.	IV	R
8.	Define Torsional rigidity.	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	A cement concrete cube of 150mm size crushes at a load of 337.5KN. Determine the working stress, if factor of safety is 3.	II	E
10.	State and prove parallel axis theorem.	III	R
11.	A spherical shell of 2m diameter is subjected to an internal pressure of 1.5N/mm. Find the thickness of the shell, if the ultimate strength of the shell material is 400N/mm. Take factor of safety is 4.	III	R
12.	Name and sketch the different types of beams.	IV	R
13.	State the assumption made in the theory of simple bending.	IV	U
14.	Compare closely coiled helical spring with open coiled helical spring.	V	R
15.	State the laws of static friction.	I	U
16.	State the assumption made in theory of pure torsion.	V	U

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	The following forces is act at a point (i) 200N inclined at 30° towards North to East. (ii) 250N towards North	I	R	10

		(iii) 300N towards North west at 45° (iv) 350 N inclined at 40° towards South of west. Find the magnitude and direction of resultant forces			
		(OR)			
	B	(i) What are the essential conditions for equilibrium of rigid body? (ii) State the law of static friction.	I	R/R	5 5
18.	**A**	List and explain the various mechanical properties of material.	II	R	10
		(OR)			
	B	An axial pull of 50KN is suddenly applied to a steel rod of 2m long and 1000mm^2 in cross section. Calculate (i) Instantaneous stress, (ii) Instantaneous elongation, (iii) Strain energy stored if E = 200GN/m^2.	II	Ap	10
19	**A**	An I – section has the top flange 120mm X 20mm thick, web 180mm X 20mm thick and the bottom flange 200mm X 40mm thick, calculate I_{XX}, I_{YY}, K_{XX} and K_{YY} of the section.	III	Ap	10
		(OR)			
	B	A spherical shell of 1m internal diameter and 5mm thick is filled with a liquid under pressure until its volume increases by 0.2 X 10^6 mm^3. Determine the pressure exerted by the liquid on the shell. Take E = 2 X 10^5 N/mm^2 and 1/m = 0.3.	III	Ap	10
20	**A**	A timber beam is freely supported on supports 6m a part. It carries a udl of 12 KN/m run and a concentrated load of 9 KN at 2.5m from the left support. If the stress in timber is not to exceed 8N/mm^2. Design a suitable section making the depth twice the width.	IV	Ap	10
		(OR)			
	B	State the assumptions in the theory of simple bending.	IV	U	10
21	**A**	(i) List any five assumptions made in theory of pure torsion. (ii) Compare close coil helical spring and open coil helical spring.	V	U/R	5 5
		(OR)			
	B	Calculate the power transmitted by a shaft of 100mm diameter running at 250 rpm. If the shear stress in the shaft material is not to exceed 75 N/mm^2.	V	Ap	10

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%

MEC- 320 MANUFACTURING PROCESSES

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Course	Instructions		Examination			
	Hrs / Week	Hrs / Semester	Marks			Duration
Manufacturing Processes	5	75	Internal Assessment	Semester End Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	FOUNDRY TECHNOLOGY	13
II	WELDING TECHNOLOGY	13
III	FORMING TECHNOLOGY	13
IV	THEORY OF METAL CUTTING & LATHE	12
V	DRILLING & METROLOGY	12
	TEST AND REVISION	12
	TOTAL	**75**

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:

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

COURSE OUTCOMES

MEC – 320 MANUFACTURING PROCESS	
After successful completion of this course, the students should be able to	
C320.1	Demonstrate the various molding techniques for manufacturing different components by using different pattern.
C320.2	Explain the principles & application of welding processes and also know about the various welding processes like Arc welding, TIG & MIG, Oxy-Acetylene welding
C320.3	Recognize about various forging methods and powder metallurgy process.
C320.4	Describe to understand metal cutting principles, single point cutting tool and basic operations of lathe machines.
C320.5	Elaborate about drilling machine operations and also gain knowledge on engineering metrology.

MEC- 320 MANUFACTURING PROCESSES

UNIT –I

FOUNDRY TECHNOLOGY

[13Hrs]

Patterns: Definition –types of pattern –solid piece –split piece -loose piece –match sweep - skeleton –segmental shell–pattern materials –pattern allowances **[2Hrs]**

Moulding: Moulding sand –constituents –types –properties of moulding sand –moulding sand preparation –moulding tools **[2Hrs]**

moulding boxes –types of moulds –green sand mould –dry sand mould –loam mould –methods of moulding –moulding machines **[1Hr]**

– jolting – squeezing – sand slinger construction and working principle. **[2Hrs]**

Cores: Essential qualities of core – materials – core sand preparation

core binders – core boxes - CO_2 process core making –types of Core . **[2Hrs]**

Metallurgy :–Introduction - Iron-carbon diagram

Melting furnaces: Blast furnace – Cupola furnace – crucible furnace types –pit furnace –coke fired –oil fired –electric furnacetypes– **[1Hr]**

direct arc –indirect arc –induction furnace – working principles

Casting: Shell mould casting –investment casting –pressure die casting –hot chamber die casting –cold chamber die casting – **[2Hrs]**

gravity die casting –centrifugal casting –continuous casting - defects in casting –causes and remedies. **[1Hr]**

UNIT -II

Welding Technology **[13Hrs]**

Arc Welding: Definition – arc welding equipment– electrode types –filler and flux materials - arc welding methods –metal arc - **[2Hrs]**

Metal Inert gas (MIG) - Tungsten inert gas (TIG) - Submerged arc - Electro slag welding –resistance welding –spot welding –butt **[2Hrs]**

welding –seam welding –Plasma arc welding –Thermit welding

–Electron beam welding –Laser beam welding –friction welding **[2Hrs]**

– ultrasonic welding – Induction welding - working principle –

– ultrasonic welding – Induction welding - working principle – **[2Hrs]**

applications –advantages and disadvantages.

Gas welding: Oxy-acetylene welding –advantages - limitations - gas welding equipment - Three types of flames – welding techniques –filler rods. –Flame cutting –soldering –brazing – difference **[2Hrs]**

between soldering and brazing. Types of welded joints –merits and demerits– inspection and testing of welded joints – destructive and non- **[2Hrs]**

destructive types of tests –magnetic particle test –radiographic and ultrasonic test - defects in welding –causes and remedies **[1Hr]**

UNIT-III

III Forming Technology **[13hrs]**

Forging: Hot working, cold working –advantages of hot working **[2Hrs]**

and cold working–hot working operations –rolling, forging, smith forging, drop forging, upset forging, press forging –roll forging **[2Hrs]**

Press Working: Types of presses - mechanical and hydraulic presses - press tools and accessories - press working operations - **[2Hrs]**

bending operations - angle bending - channel bending –curling drawing - shearing operations - blanking, piercing, trimming – notching –lancing. **[2Hrs]**

Powder Metallurgy: Methods of manufacturing metal powders – **[2Hrs]**

atomization, reduction and electrolysis deposition –compacting – sintering –sizing –infiltration –mechanical properties of parts **[2Hrs]**

made by powder metallurgy –design rules for the power metallurgy process **[1Hr]**

UNIT -IV **[12Hrs]**

Theory of metal cutting: Introduction – orthogonal cutting oblique cutting - single point cutting tool –nomenclature –types **[2Hrs]**

of chips –chip breakers –cutting tool materials –properties –tool wears –factors affecting tool life –cutting fluids –functions – properties of cutting fluid. Advance **[2Hrs]**

metal cutting type.

Centre Lathe: Introduction - specifications –simple sketch – **[2Hrs]**

Principal Parts –Head Stock –Back Geared Type –All Geared Type – feed mechanism - tumbler gear mechanism – quick change chuck –four jaw chuck –centres - faceplate –mandrel –steady rest –follower rest –machining operations done on lathe – straight turning –step turning - taper turning methods: form tool –tailstock **[2Hrs]**

set over method – compound rest method – taper turning

attachment – knurling - Thread cutting – Facing – Boring chamfering –grooving –parting-off –eccentric turning – cutting speed –feed - depth of cut - metal removal rate. **[2Hrs]**

Semi-Automatic Lathes: Types of semi-automatic lathes – capstan and turret lathes –Geneva indexing mechanism –bar feeding mechanism - difference between turret and capstan – work holding devices –tool holders **[2Hrs]**

UNIT -V **[12Hrs]**

Drilling and Metrology

Drilling Machines: Drills - flat drills - twist drills –nomenclature of twist drill - types of drilling machines - bench type - floor type radial type - gang drill –multi spindle type -principle of operation in drilling - methods of holding drill bit - drill chucks - socket and sleeve –drilling operation –reaming - counter sinking - counter boring - spot facing –tapping - deep hole drilling. **[2Hrs]**

Metrology: Definition –need of inspection –precision –accuracy – sensitivity - magnification – repeatability – calibration comparator – Advantages – requirements – mechanical comparator – optical comparator – electrical comparator – pneumatic comparator – Principles – advantages and disadvantages **[2Hrs]**

Measuring instruments: Construction and principles only - Steel rule – Calipers: outside caliper –inside caliper –jenny caliper – Combination set –Feeler gauge –Pitch screw gauge –Vernier calliper –Digital calliper –Vernier height gauge –Micrometer – Inside micrometer – Thread micrometer – Slip gauges – requirement –Indian standard –care and use - Sine bar –types **[2Hrs]**

– uses – limitations – Working principle of clinometers, autocollimator, angle dekkor. **[2Hrs]**

Text Book

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

Reference Books:

Sl.No	Subject	Author	Publication
1	Manufacturing process	Begeman	5th Edition -McGraw Hill, New Delhi 1981.
2	Workshop Technology	Raghuwanshi	Khanna Publishers. Jain & Gupta
3	Production Technology	P. C. Sharma	Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 - 2006
4	Workshop Technology	WAJ Chapman - Volume I, II, & III	Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.

LEARNING WEBSITES:

https://nptel.ac.in/courses/112107144/

https://nptel.ac.in/courses/112105127/

https://nptel.ac.in/courses/112104195/

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
C320.1	2	-	2	3	2	3	3	3	-	3
C320.2	2	-	2	3	2	3	3	3	1	2
C320.3	2	-	2	3	2	3	3	3	-	2
C320.4	2	-	2	3	2	3	3	3	-	3
C320.5	2	-	2	3	2	3	3	3	2	3
Total	10	-	10	15	10	15	15	15	3	13
Correlation Level	2	-	2	3	2	3	3	3	1.5	2.6

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%

****

MEC- 320 MANUFACTURING PROCESSES

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	What is a core?	I	R
2.	What is flux material	II	R
3.	List the hot working operation.	III	R
4.	Define tool wear.	IV	R
5.	What is counter boring?	IV	R
6.	State the types of Core.	I	R
7.	What is Filler rod in gas welding?	II	R
8.	Define Accuracy.	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	Mention any three qualities of Core	I	R
10.	List Arc Welding Equipments?	II	R
11.	What are the applications of powder Metallurgy?	III	R
12.	What is chip breaker? List the types of chip breakers.	IV	R
13.	State the principle of Electrical comparator.	V	R
14.	State the advantages and disadvantages of gas welding.	II	R
15.	What are the applications of Powder Metallurgy?	III	R
16.	What is use of Calipers? List the types of Calipers?	V	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	State the types of Pattern? and Explain any three of them.	I	R/U	10
		(OR)			

	B	Elaborate the defects, causes and their remedies of casting.	I	U	10
18.	**A**	Explain the Laser beam welding with neat sketch and state its application and advantages.	II	U	10
		(OR)			
	B	Elaborate the defects, causes and their remedies of Welding defects.	II	U	10
19	**A**	Explain the drop forging with neat sketch.	III	U	10
		(OR)			
	B	List the various factors considered in Powder Metallurgy, While designing.	III	R	10
20	**A**	Explain the types of chips with neat sketch.	IV	U	10
		(OR)			
	B	Explain the Geneva mechanism with neat sketch.	IV	U	10
21	**A**	Explain the electrical comparator with a neat sketch.	V	U	10
		(OR)			
	B	Write short notes on (i) collimator (ii) Auto collimator.	V	R	10

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%

MEC- 330 MACHINE DRAWING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

Topics and Allocation of Hours:

Unit	**Topics**	**Hours**
I	Sectional Views	5
II	Limits, Fits and Tolerances	5
III	Surface Texture	5
IV	Keys, Screw threads and Threaded fasteners	5
V	Assemble drawing	28
	TEST AND REVISION	12
	Total	60

COURSE DESCRIPTION:

Manufacturing of various parts start from the basic drawing of components. The assembly of components is also carried out from the drawing. So drawing is an important subject to be studied by the students to carry and complete the production and assembly process successfully.

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 330 MACHINE DRAWING	
After successful completion of this course, the students should be able to	
C330.1	Analyze the need of sectioning and its types
C330.2	Elaborate the concepts of machine drawing and know about the fits and tolerance.
C330.3	Explain and classify about various surface texture
C330.4	Develop sectional views of fasteners, joints and couplings
C330.5	Draw and detail the assembly drawing of machine parts

MEC- 330 MACHINE DRAWING

UNIT -I

SECTIONAL VIEWS **[5Hrs]**

Review of sectioning –Conventions showing the section –symbolic **[2Hrs]**

representation of cutting plane- types of section –full section, half **[1Hr]**

section, offset section, revolved section, broken section, removed **[1Hr]**

section –section lining. **[1Hr]**

UNIT -II

LIMITS, FITS AND TOLERANCES **[5Hrs]**

Tolerances –Allowances –Unilateral and Bilateral tolerances. Limits **[2Hrs]**

Methods of tolerances –Indication of tolerances on linear dimension **[1Hr]**

of drawings – Geometrical tolerances – application Fits- **[1Hr]**

Classifications of fits –Selection of fits –examples **[1Hr]**

UNIT -III

SURFACE TEXTURE **[5Hrs]**

Surface texture –importance –controlled and uncontrolled surfaces – **[2Hrs]**

Roughness –Waviness –lay –Machining **[2Hrs]**

symbols **[1Hr]**

UNIT -IV

KEYS, SCREW THREADSANDTHREADEDFASTENERS **[5Hrs]**

Types of fasteners –temporary fasteners –keys –classification of **2Hrs]**

keys – Heavy duty keys – light duty keys. Screw thread-

Nomenclature –different types of thread profiles –threads in sections **[1Hr]**

–threaded fasteners –bolts –nuts –through bolt –tap bolt, stud bolt

–set screw –cap screws –machine screws –foundation bolts **[2Hrs]**

UNIT -V

MANUAL DRAWING PRACTICE **[28Hrs]**

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

bill of materials.

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

Reference Books:

Sl.No	Subject	Author	Publication
1	Machine Drawing	P.S. Gill	Katsan Publishing House, Ludiana.
2	Engineering Drawing	R.B. Gupta, Satya Prakasan	Technical India Publications, New Delhi
3	Engineering Drawing	D.N. Ghose	Dhanpat Rai & Sons, Delhi
4	Geometrical and Machine Drawing	N.D. Bhatt	Cheroter book stalls, Anand, West Railway
5	Mechanical Draughtsmanship	G.L. Tamta	Dhanpat Rai & Sons, Delhi

LEARNING WEBSITES:

http://machinedrawing.blogspot.com/2006/04/chapter-6.html

http://site.iugaza.edu.ps/aabuzarifa/files/METRO20152_CH52.pdf

http://textofvideo.nptel.ac.in/112106179/lec19.pdf

https://nptel.ac.in/syllabus/syllabus_pdf/112106075.pdf

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
C330.1	2	2	3	-	2	-	3	3	-	2
C330.2	2	1	3	-	2	-	3	3	-	2
C330.3	2	2	3	-	2	-	3	3	-	2
C330.4	2	2	3	-	-	-	3	3	-	2
C330.5	2	1	3	-	-	-	3	3	1	2
Total	10	8	15	-	6	-	15	15	1	10
Correlation Level	2	1.6	3	-	2	-	3	3	1	2

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%

****

MEC- 330 MACHINE DRAWING

Time: 3 Hrs Max.Marks:75

PART – A (7 X 5 = 35 MARKS)			
Answer any SEVEN Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Name different types of section. Explain full section and half section with example.	I	R
2.	What is cutting plane? Indicate the cutting plane. Line as per BIS.	I	R
3.	Define hole basis and shaft basis system. Explain with neat sketch.	II	R
4.	Mention any three methods of indicating dimensional tolerance in the drawing.	II	R
5.	Define (i) Surface roughness (ii) Waviness (iii) Lay	III	R
6.	Explain the types of Symbols used for indication of surface finish.	III	U
7.	Explain GIB headed Key with neat sketch.	IV	U
8.	Explain the Nomenclature of screw thread.	IV	U

PART – B (1X 40 = 40 MARKS)					
Answer any ONE Question					
Sl.No			**Unit**	**Bloom's Level**	**Max Marks**
9.	**A.**	Assemble and draw the following views of knuckle joints. (i) Sectional Elevation (ii) Plant (iii) Bill of materials	V	Ap	40
		(OR)			
	B.	Assemble and draw the following views of Screw Jack. (i) Right half sectional Elevation (ii) Plant (iii) Bill of materials	V	Ap	40

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%

MEC– 340 COMPUTER APPLICATION AND CAD PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 Weeks

Course	Instructions		Examination			
Computer Applications and CAD practical	Hours/ Week	Hours/ Semester	Marks			Duration
	6	90	Internal Assessment	Semester End Examination	Total	3Hrs

ALLOCATION OF MARKS

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

OBJECTIVES:

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

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

COURSE OUTCOMES

MEC – 340 COMPUTER APPLICATION AND CAD PRACTICAL	
After successful completion of this course, the students should be able to	
C340.1	Explain the detailed functions of MS Office like Word, Excel and Power Point.
C340.2	Create and manipulate the database
C340.3	Practice on CADD commands in making 2D Drawings.
C340.4	Draw assembled drawings using CADD.
C340.5	Draw sectional views using different types of sections

EQUIPMENTS REQUIRED

Sl.No	Name of the equipment	Required Nos.
1.	Personal computer	30 Nos
2.	Printer	01 No
3.	Required Software's	Office Package, CAD Package –Sufficient to the strength.

MEC– 340 COMPUTER APPLICATION AND CAD PRACTICAL

PART –A: COMPUTER APPLICATIONS (30 Hrs)

WORD PROCESSING

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

<table>
<tr><th>Sl.No</th><th>Name of the exercise</th><th>Course Outcome</th></tr>
<tr><td>1.</td><td>Create a news letter of three pages with two columns text. The first page contains some formatting bullets and numbers. Set the document background colour and add ‘confidential’ as the watermark. Give the d in the header. The header/ footer of the first page should be different from other two pages. Also, add author name and date/ time in the header. The footer should have the page number.</td><td>C340.1</td></tr>
<tr><td>2.</td><td>Create the following table using align, border, merging and other attributes.
E-governance particulars
<table>
<tr><th>Register Number</th><th>June</th><th>July</th><th>August</th><th>September</th><th>Cumulative %</th></tr>
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</table></td><td>C340.2</td></tr>
</table>

SPREADSHEET

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

Sl.No	Name of the exercise	Course Outcome
3.	Create a table of records with columns as Name and Donation Amount. Donation amount should be formatted with two decimal places. There should be at least twenty records in the table. Create a conditional format to highlight the highest donation with blue colour and lowest donation with red colour. The table should have a heading.	C340.2
4.	Prepare line, bar and pie chart to illustrate the subject wise performance of the class for any one semester.	C340.2

DATABASE

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

Sl.No	Name of the exercise	Course Outcome
5.	Prepare a payroll for employee database of an organization with the following details: Employee Id, Employee name, Date of Birth, Department and Designation, Date of appointment, Basic pay, Dearness Allowance, House Rent Allowance and other deductions if any. Perform simple queries for different categories.	C340.2
6.	Design a pay slip for a particular employee from the above database.	C340.2

PRESENTATION

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

Sl.No	Name of the exercise	Course Outcome
7.	Make a presentation with at least 10 slides. Use different customized animation effects on pictures and clip art on any four of the ten slides.	C340.1
8.	a) Copying files into CD/DVD b) Set /change the date & time	C340.1

PART –B: CAD (60 Hrs)

INTRODUCTION

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

DRAWING AIDS AND EDITING COMMANDS

Creating objects (2D) –Using draw commands –Creating text –Drawing with precision –Osnap

options –drafting settings –drawing aids –Fill, Snap, Grid, Ortho lines –Function keys - Editing and modify commands –Object selection methods – Erasing object –Oops –

Cancelling and undoing a command –Copy –Move –Array.–Offset –Scale –Rotate –Mirror –Break –Trim –Extend –Explode. Divide –Measure –stretch –Lengthen –Changing properties – Color –line types –LT scale -Matching properties –Editing with grips –Pedit –Ddedit –Mledit.

BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS

Basic dimensioning –Editing dimensions –Dimension styles –Dimension system variables. Machine drawing with CAD. Creation of blocks –Wblock –inserting a block –Block attributes – Hatching –Pattern types –Boundary hatch –working with layers - Controlling the drawing display – Blipmode – View group commands – Zoom, redraw, regen, regenauto, pan, viewres – Real time zoom. Inquiry groups – calculating area –Distance –Time –Status of drawing –Using calculator.

CAD EXERCISES

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

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

Sl.No	Name of the exercise	Course Outcome
9.	Sleeve & Cotter joint	C340.4/ C340.5
10.	Screw Jack	C340.4/ C340.5
11.	Plummer Block	C340.4/ C340.5
12.	Simple Eccentric	C340.4/ C340.5
13.	Machine Vice	C340.4/ C340.5
14.	Protected Type Flange Coupling	C340.4/ C340.5
15.	Spigot and Cotter Joint	C340.4/ C340.5

Continuous Internal Assessment

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

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

b) Procedure/ observation and tabulation/ Other Practical related work : 10 marks

c) Record writing : 10 marks

Total **25 marks**

LEARNING WEBSITES:

http://www.geo.utep.edu/pub/bkonter/geol_4315/Labs/Lab2/Lab2_MSO_Mac.pdf

https://www.gfmer.ch/Informatics/Presentations/postgrad2005/presentation.pdf

https://en.wikipedia.org/wiki/Microsoft_Office

https://grabcad.com/library/screw-jack-autocad-2014-3d-machine-drawing-assembly-1

https://www.unm.edu/~bgreen/autocad/AutoCAD%208.pdf

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C340.1	3	2	3	2	-	3	3	3	2	-
C340.2	3	2	3	2	-	3	3	3	2	-
C340.3	3	2	3	2	-	3	3	3	2	-
C340.4	3	2	3	2	-	3	3	3	2	-
C340.5	3	2	3	2	-	3	3	3	2	-
Total	15	10	15	10	-	15	15	15	10	-
Correlation Level	3	2	3	2	-	3	3	3	2	-

MEC- 350 FOUNDRY AND WELDING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

ALLOCATION OF MARKS

Foundry **: 35 marks**

- Preparation of sand - 10
- Ramming and vent holes - 15
- Gate cutting / Finish - 10

Welding **: 35 marks**

- Edge preparation - 10
- Welding / Cutting - 15
- Joint strength / Finish - 10

Viva-voce **: 05 marks**

Total **: 75 marks**

OBJECTIVES:

- □ Identify the tools used in foundry.
- □ Identify the tools and equipment used in welding
- □ Prepare sand moulds for different patterns.
- □ Perform welding operation to make different types of joints.
- □ Identify the different welding defects.
- □ Appreciate the safety practices used in welding.
- □ Prepare a record of work for all the exercises.

COURSE OUTCOMES

MEC – 350 FOUNDRY AND WELDING PRACTICAL	
After successful completion of this course, the students should be able to	
C350.1	Identify the tools and equipments used in foundry and welding.
C350.2	Prepare sand moulds for different patterns.
C350.3	Perform welding operation to make different types of joints.
C350.4	Identify the different welding defects.
C350.5	List the safety practices used in welding.

EQUIPMENTS REQUIRED

WELDING		
Sl.No	**Name of the equipment**	**Required Nos.**
1	Arc welding booth	2 nos with welding transformer
2	Gas welding unit	1 set (Oxygen and Acetylene cylinder)
3	Flux	Sufficient quantity
4	Electrode	Sufficient quantity
5	Welding rod	Sufficient quantity
6	Welding shield	5 nos
7	Gas welding goggles	5 nos
8	Leather Gloves 18”	10 sets
9	Chipping hammer	10 nos
10	Spot welding machine	1 no
11	Personal protective equipment	Sufficient quantity
12	Fire safety equipment	Sufficient quantity
FOUNDRY		
Sl.No	**Name of the equipment**	**Required Nos.**
1	Moulding board	15 Nos
2	Cope box	15 Nos
3	Drag box	15 Nos
4	Core box	10 Nos
5	Shovel	5 Nos
6	Rammer set	15 Nos
7	Slick	15 Nos
8	Strike-off bar	15 Nos
9	Riddle	5 Nos

10	Trowel	15 Nos
11	Lifter	15 Nos
12	Cleaning Brush	20 Nos
13	Vent rod	15 Nos
14	Draw spike	15 Nos
15	Gate cutter	15 Nos
16	Runner & riser	15 Nos

MEC- 350 FOUNDRY AND WELDING PRACTICAL

Foundry Section

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

Sl.No	Name of the Exercise	Course Outcome
	FOUNDRY SECTION	
	Solid Pattern	
1.	Stepped pulley	C350.1, C350.2
2.	Gear	C350.1, C350.2
	Split Pattern	
3.	Bent Pipe with Core Print	C350.1, C350.2
4.	T – Pipe with Core Print	C350.1, C350.2
5.	Thumbles	C350.1, C350.2
	Loose Piece Pattern	
6.	Dove Tail	C350.1, C350.2
	Core Preparation	
7.	Core preparation for Bent pipe/T pipe	C350.1, C350.2
	WELDING SECTION	
	ARC welding	
8.	Lap joint	C350.1, C350.3, C350.4, C350.5
9.	Butt joint	C350.1, C350.3, C350.4, C350.5
10.	T - joint	C350.1, C350.3, C350.4, C350.5
11.	V - joint	C350.1, C350.3, C350.4, C350.5
	Gas welding	
12.	Lap joint	C350.1, C350.3, C350.4, C350.5
	Gas cutting	
13.	Profile cutting – Circular profile	C350.1, C350.3, C350.4, C350.5
	Spot welding	
14.	Lap joint	C350.1, C350.3, C350.4, C350.5

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

https://en.wikipedia.org/wiki/Foundry

http://www.themetalcasting.com/foundry-step-by-step-instructions.html

http://www.iitg.ac.in/engfac/ganu/public_html/Metal%20casting%20processes_1.pdf

https://en.wikipedia.org/wiki/Welding

https://www.gopracticals.com/workshop/workshop-practical-welding-lap-joint/

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C350.1	3	2	2	2	-	-	3	2	-	3
C350.2	3	2	3	1	-	2	3	2	-	3
C350.3	3	2	2	1	-	2	3	2	-	3
C350.4	3	2	2	-	-	-	3	3	-	3
C350.5	3	2	2	-	3	-	3	3	-	3
Total	15	10	11	4	3	4	15	12	-	15
Correlation Level	3	2	2.2	1.3	3	2	3	2.4	-	3

MEC -360 – LATHE AND DRILLING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 360 LATHE AND DRILLING PRACTICAL	
After successful completion of this course, the students should be able to	
C360.1	Identify the parts of a lathe.
C360.2	Define the necessary cutting tools and work holding devices for lathe machine.
C360.3	Operate the lathe and machine a component.
C360.4	Identify the parts of drilling machine
C360.5	Demonstrate the various drilling operations.

EQUIPMENTS REQUIRED

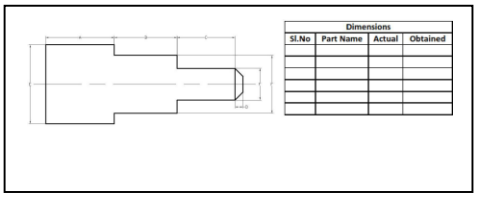
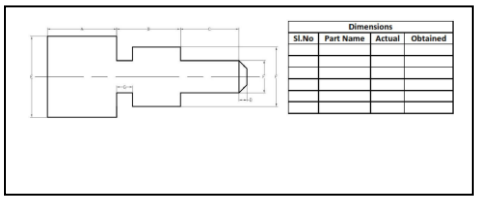
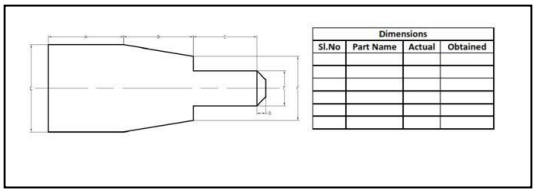
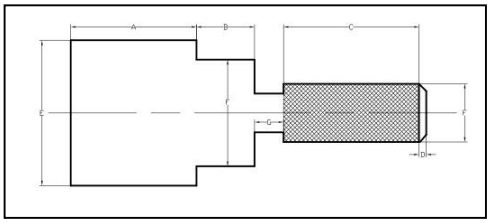
LATHE		
Sl.No	**Name of the equipment**	**Required Nos.**
1	Lathe (Minimum) 4 ½‘	13 Nos
2	All geared lathe	2 Nos
3	4 Jaw / 3 Jaw Chucks	Required Nos
4	Chuck key	Required Nos
5	Spanner	Sufficient quantity
6	Cutting Tools	Sufficient quantity
7	Pitch gauge	5 Nos
8	Thread gauge	5 Nos
9	Vernier Caliper	5 Nos
10	Steel Rule (0-150)	Sufficient quantity
11	Calipers (Inside / Outside / Jenny)	Sufficient quantity
12	Dial Gauge with Magnetic Stand	Sufficient quantity
13	Marking gauge	Sufficient quantity
14	Safety glass	15 Nos
DRILLING		
Sl.No	**Name of the equipment**	**Required Nos.**
15	Upright drilling machine	2
16	Radial drilling machine	1
17	Drill bit & Tap set	Sufficient quantity
18	Reaming bit	Sufficient quantity
19	Counter sinking bit	Sufficient quantity
20	Counter boring bit	Sufficient quantity
21	Plug gauges	Sufficient quantity

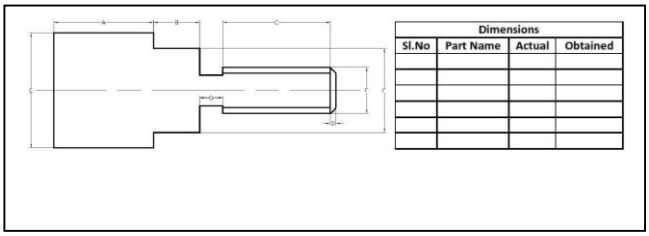
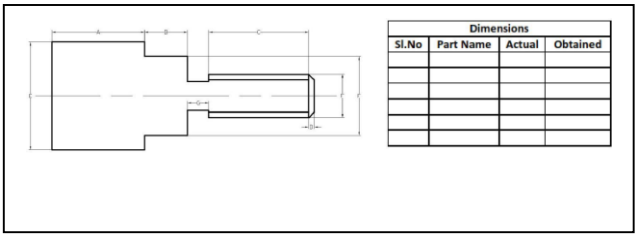
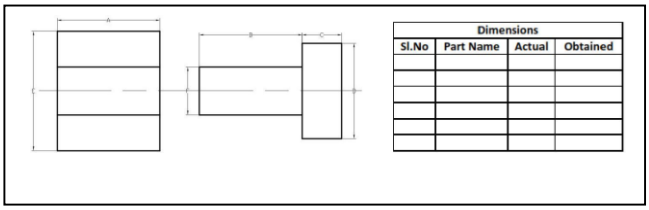
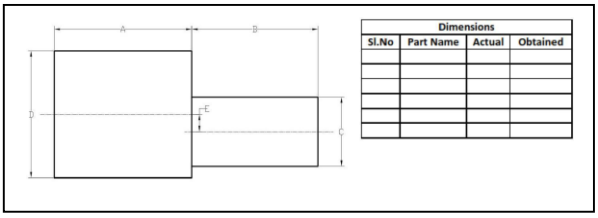
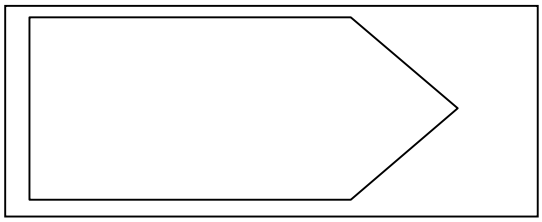
22	Vernier Height Gauge	1
23	Surface plate	2

MEC -360 – LATHE AND DRILLING PRACTICAL

Lathe section:

1. Introduction of safety in operating machines.
2. Study of lathe and its parts.
3. Types of tools used in lathe work.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools.
6. Operation of lathe.
7. Practice on a lathe.
8. Types of measuring instruments and their uses

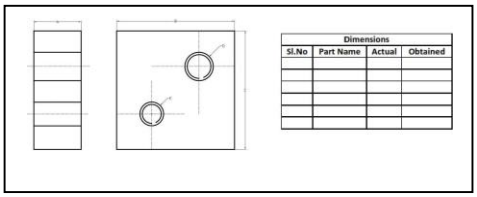
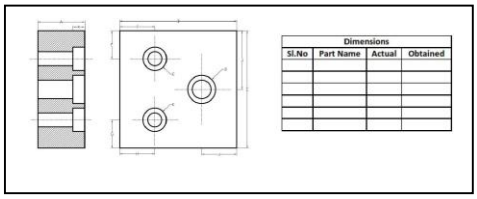
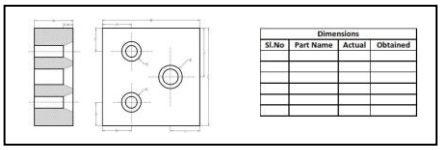
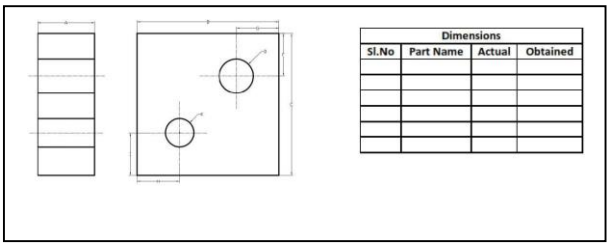
Sl.No	Name of the Exercise	Course Outcome
1.	Facing, Step turning & Chamfering 	C360.1, C360.2, C360.3
2.	Step turning & Groove cutting 	C360.1, C360.2, C360.3
3.	Step turning & Taper turning 	C360.1, C360.2, C360.3
4.	Step turning & Knurling 	C360.1, C360.2, C360.3

5.	Step turning & Thread cutting (L.H.) 	C360.1, C360.2, C360.3
6.	Step turning & Thread cutting (R.H) 	C360.1, C360.2, C360.3
7.	Bush: Turning & Drilling 	C360.1, C360.2, C360.3
8.	Eccentric turning 	C360.1, C360.2, C360.3
9.	Facing and filled 	C360.1, C360.2, C360.3

Drilling section:

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

7. Types of measuring instruments and their uses.

Sl.No	Name of the Exercise	Course Outcome
10.	Drilling & Tapping 	C360.4, C360.5
11.	Drilling & Counter boring 	C360.4, C360.5
12.	Drilling & Counter sinking 	C360.4, C360.5
13..	Drilling and Reaming –Radial drilling machine 	C360.4, C360.5

Continuous Internal Assessment

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

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

b) Procedure/ observation and tabulation/ Other Practical related work : 10 marks

c) Record writing : 10 marks

Total **25 marks**

LEARNING WEBSITES:

https://www.gopracticals.com/workshop/workshop-practical-machine-shop-lathe/

http://www.cittumkur.org/manuals/mech/3rd%20semester/MACHINE%20SHOP.pdf

http://ecoursesonline.iasri.res.in/mod/page/view.php?id=98862

https://archive.hnsa.org/doc/pdf/lathe.pdf

https://en.wikipedia.org/wiki/Drilling

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C360.1	3	2	1	2	-	3	3	2	-	1
C360.2	3	2	2	2	-	3	3	2	-	1
C360.3	3	2	2	2	-	3	3	2	-	3
C360.4	3	2	-	2	-	3	3	2	-	1
C360.5	3	2	2	2	-	3	3	2	-	3
Total	15	10	7	10	-	15	15	10	-	9
Correlation Level	3	2	1.8	2	-	3	3	2	-	1.8

MEC – 370 METROLOGY & METALLOGRAPHY PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 370 METROLOGY & METALLOGRAPHY PRACTICAL	
After successful completion of this course, the students should be able to	
C370.1	Recognize the measuring techniques of metrology instruments.
C370.2	List the least count of measuring instruments.
C370.3	Evaluate the various dimensions using proper measuring instruments.
C370.4	Predict crack on the specimen by using visual inspection or die penetration method or by magnetic particle test.
C370.5	Prepare the record of work for all the exercises.

EQUIPMENTS REQUIRED

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

MEC – 370 METROLOGY & METALLOGRAPHY PRACTICAL

METROLOGY SECTION:

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

Sl.No	Name of the Exercise	Course Outcome
1.	Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper.	C370.3
2.	Measure the diameter of a wire using micrometer and compare the result with digital micrometer	C370.3
3.	Measure the thickness of ground MS plates using slip gauges	C370.3
4.	Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor	C370.3
5.	Measure the angle of the machined surface using sine bar with slip gauges.	C370.3
6.	Measure the geometrical dimensions of V-Thread using thread Vernier gauge.	C370.3
7.	Measure the geometrical dimensions of spur gear.	C370.3
8.	Measure the height of cylindrical bush using Vernier height gauge.	C370.3

METALLOGRAPHY SECTION:

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

Sl.No	Name of the Exercise	Course Outcome
1.	Find the grain structure of the given specimen using the Metallurgical Microscope.	C370.4
2.	Repair a specimen to examine the micro structure of the Ferrous and Non-ferrous metal.	C370.4
3.	Detect the cracks in the specimen using Visual Inspection and ring test.	C370.4
4.	Detect of cracks in specimen using Die penetration test.	C370.4
5.	Detect the cracks in specimen using Magnetic particle test.	C370.4
6.	Surface quenching	C370.4

LEARNING WEBSITES:

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

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

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

Continuous Internal Assessment

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

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

b) Procedure/ observation and tabulation/ Other Practical related work : 10 marks

c) Record writing : 10 marks

Total **25 marks**

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C370.1	3	2	1	1	3	2	3	2	-	3
C370.2	3	2	1	3	3	2	3	2	-	3
C370.3	3	2	1	2	2	2	3	2	-	3
C370.4	3	2	1	3	3	2	3	2	-	3
C370.5	3	2	1	-	2	2	3	2	-	3
Total	15	10	5	9	13	10	15	10	-	15
Correlation Level	3	2	1	2.3	2.6	2	3	2	-	3

MEC -410 HEAT POWER ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
			Marks			Duration
			Internal Assessment	Semester End Examination	Total	
Heat Power Engineering	6	75	25	75	100	3Hrs

Topics and Allocation of Hours:

Unit	Topics	Hours
I	BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES	13
II	THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION	13
III	AIR COMPRESSORS AND GAS TURBINES	13
IV	FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS	12
V	STEAM BOILERS AND PERFORMANCE OF BOILERS	12
	TEST AND REVISION	12
	Total	75

COURSE DESCRIPTION:

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

OBJECTIVES

- □ Explain basics of systems, laws of thermodynamics and thermodynamic processes.
- □ Explain different types of Air Cycles.

- □ Explain the fuels and combustion.
- □ Explain a air compressors and gas turbines.
- □ Explain a formation and properties of steam and steam calorimeters.
- □ Explain a steam boilers and performance of boilers.

COURSE OUTCOMES

MEC – 410 HEAT POWER ENGINEERING	
After successful completion of this course, the students should be able to	
C410.1	Express the basic concepts in thermodynamic and its various processes
C410.2	Distinguish of various air cycles and fuel combustion process
C410.3	Evaluate air compressor performance and knowledge in gas turbines structures
C410.4	Indicate determination experience on steam formation and expansion process
C410.5	Differentiate on various types of boiler structures and boiler performance estimation

MEC -410 HEAT POWER ENGINEERING

UNIT I

BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES **[13Hrs]**

Introduction:- Definitions and units of mass, weight, volume density, specific weight, specific gravity and specific volume – [2Hrs]

pressure –units of pressure – temperature - absolute temperature – S.T.P and N.T.P conditions – heat - specific heat capacity at [1Hr]

constant volume and at constant pressure –work –power –energy –types - law of conservation of energy –thermodynamic system – types – thermodynamic equilibrium - properties of systems – intensive and extensive properties –State of System - process – [2Hrs]

cycle –point and path functions – zeros, first and second laws of thermodynamics.

Perfect gases: - laws of perfect gases –Boyle's, Charles, [2Hrs]

Joule's, Regnault's and Avogadro's laws–

General Gas Equation-Characteristic

gas equation – relation between specific heats and gas constant – [2Hsr]

Universal gas constant –Change in Internal Energy-enthalpy – change in enthalpy –entropy

Thermodynamic processes:- Constant volume,

Constant pressure, Constant temp.(isothermal) ,Isentropic

(reversible adiabatic) and, Polytropic Processes – p-V and

T-s diagrams, work done , change in internal energy , [2Hrs]

heat transfer , change in enthalpy, change in entropy for

above processes –Simple problems –hyperbolic ,

Free expansion and throttling processes(Description only) . [2Hrs]

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

UNIT -II

THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION [13Hrs]

Air cycles: –air standard efficiency – reversible and irreversible [2Hrs]

processes –assumptions in deriving air standard efficiency –Carnot

cycle –Otto cycle –Diesel cycle - Comparison of ideal and actual [2Hrs]

p-v diagrams of Otto and Diesel cycles – Simple problems [2Hrs]

Fuels & Combustion:

Classifications of fuels - merits and demerits –requirements of a good fuel –Octane number –detonation - Pre-ignition –Cetane [2Hrs]

number –Diesel knock –comparison of detonation and diesel knock - fuel additives – Stages of Combustion –Delay period –Variables [2Hrs]

affecting delay period –Methods of generating air swirl in diesel engine combustion chambers –Types of combustion chambers – [2Hrs]

combustion equations – stoichiometric air required for complete [1Hr]

combustion of fuels –excess air –products of combustion –analysis

UNIT-III

AIR COMPRESSORS AND GAS TURBINES [13Hrs]

Air Compressors:- Uses of compressed air –classifications of Air [2Hrs]

compressor –reciprocating compressor - single stage reciprocating compressor –compression processes –clearance volume and its [2Hrs]

effects –volumetric efficiency –multi stage compression –merits and demerits –Two stage compressor with imperfect cooling- with

perfect inter cooling –rotary compressors –Roots blower - vane [2Hrs]

blowers – centrifugal and axial flow air compressors simple problems.

Gas turbines – uses-- classifications – merits and- Demerits [2Hrs]

9constant pressure combustion gas turbine – gas turbine with intercooler,

reheater, regenerator - effects – closed cycle gas turbines - merits and [2Hrs]

demerits –jet propulsion - turbojet engines – turbo propeller engines –

ramjet –Working principle - merits and demerits –Rocket engines – [2Hrs]

applications of rockets. [1Hr]

UNIT -IV

FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS [12Hrs]

Steam - Properties –formation of steam –saturation temperature – [2Hrs]

enthalpy of water –enthalpy of evaporation –conditions of steam –

dryness fraction –enthalpy of wet, dry and superheated steam –

advantages of superheated steam – p-v diagram - T-H diagram – [1Hr]

T-S diagram - H-S diagram –P-H diagram –critical conditions of [2Hrs]

water –specific volume of water and steam –density of steam

external work done during evaporation – internal latent heat – [2Hrs]

internal energy of steam –entropy of water and steam –steam tables .

Expansion process of Steam: Constant Volume process – [2Hrs]
Constant Pressure Process – Constant Temperature process
– Hyperbolic Process – Isentropic process – Polytrophic process [2Hrs]
– Throttling process. –Simple problems.
Steam Calorimeter: Determination of dryness fraction of steam [1Hr]
– bucket calorimeter - combined separating and throttling calorimeters

UNIT -V

STEAM BOILERS AND PERFORMANCE OF BOILERS [12Hrs]

Steam Boilers: Introduction - Classification of boilers –comparison [2Hrs]
of fire tube and water tube boilers – high pressure boilers –
advantages of high pressure boilers - Lamont and BHEL high [2Hrs]
pressure boilers – boiler mountings and accessories - function [1Hr]
- construction and working – comparison of mountings and [2Hrs]
accessories – feed water treatment – internal and external
treatments - starting boiler from cold condition –safety precautions [2Hrs]
in boiler operation –causes of Indian boiler act.
Performance of boilers: Evaporation rate - actual, equivalent and [2Hrs]
factor of evaporation –boiler efficiency –factors influencing boiler
efficiency - boiler power –Simple problems –boiler plant - efficiency
of economizer and super heater –Simple problems - boiler trial – [2Hrs]
heat losses in a boiler- heat balance sheet –Simple problems

Text Book

Sl.No	Text Book	Author	Publisher /Edition
1	Thermal Engg	R.K.Rajput	Laxmi Publisher/8th
2	Applied Thermodynamic	P.K. Nag	Tata Mcgraw Hill Publisher

Reference Book

Sl.No	Text Book	Author	Publisher /Edition
1	Thermal Engg	P.L.Balaney	Khanna Publisher/24th
2	Applied Thermodynamic	B.K./Sarkat	DhanpatRai & Sons/3rd Edition
3	Workshop Tech	WAJ Chapman	Viva Books Pvt Ltd//Vol I,II,III
4	Production Processes	NITTR	Tata Mcgraw Hill Publisher

LEARNING WEBSITES:

https://nptel.ac.in/courses/112106133/

https://nptel.ac.in/courses/112105123/

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

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C410.1	2	2	2	2	-	2	3	-	2	2
C410.2	2	2	2	2	-	2	3	-	2	2
C410.3	2	2	2	2	-	2	3	2	2	2
C410.4	2	2	2	2	-	2	3	-	2	2
C410.5	2	2	2	2	-	2	3	2	2	2
Total	10	10	10	10	-	10	15	4	10	10
Correlation Level	3	2	2	2	-	2	3	2	2	2

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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MEC -410 HEAT POWER ENGINEERING

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	What is meant by adiabatic process? Sketch the process on p-V and T-S diagrams.	I	R
2.	Define air cycles and air standard efficiency.	I	R
3.	Write any four differences between petrol and diesel engines.	II	R
4.	Distinguish between wet steam and superheated steam.	IV	R
5.	What are the various sources of heat losses in a boiler?	V	R
6.	What is a steam condenser? How it is classified?	V	R
7.	What are the uses of compressed air?	III	R
8.	State the advantages of multi stage compression.	III	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	What are the applications of gas turbines?	II	R
10.	Define the ton of refrigeration.	III	R
11.	Define relative humidity.	III	R
12.	Mention any four psychometric processes.	IV	R
13.	Write any four non-conventional sources of energy.	I	R
14.	What are the advantages of solar energy?	I	R
15.	Write any four comparisons between nuclear and thermal power plants.	V	R
16.	What are the application of compressed air?	III	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	A diesel engine has a clearance volume of 0.00025 m3 and a bore & stroke of 152.5 mm & 200 mm respectively. A charge of air at 100 kN/m2 & 20°C is taken into the cylinder & compressed adiabatically. After combustion at	I	Ap	10

		constant pressure the temperature reaches to 1096°C. The expansion, which follows, is adiabatic. The cycle is closed by constant volume process finally. If = 1.4, determine. (i) The temperature & pressure at the end of compression. (ii) The temperature & pressure after expansion. (iii) The ideal thermal efficiency of engine			
		(OR)			
	B	Explain the working of four stroke petrol engine with neat sketches.	I	U	10
18.	**A**	A boiler generates 750 kg of steam per hour at 11 bar absolute and with 40oC superheat and burns 100 kg of coal per hour. If the calorific value of coal is 29,300 kJ/kg, feed water temperature is 45oC and the specific heat of superheated steam is 2.09 kJ/kg K. Calculate (i) actual evaporation, (ii) factor of evaporation, (iii) equivalent evaporation, (iv) boiler efficiency and (v) boiler power.	II	Ap	10
		(OR)			
	B	(i) Explain the principle of operation of a reaction turbine. (ii) What is a steam condenser? Explain with a neat sketch the working of surface condenser.	II	U/R	5 5
19	**A**	Explain the working of a single stage reciprocating air compressor with a neat sketch.	III	U	10
		(OR)			
	B	Explain the working of constant pressure open cycle gas turbine.	III	U	10
20	**A**	Explain the working of vapour compression refrigeration system with a neat sketch.	IV	U	10
		(OR)			
	B	Explain the working of a central air conditioning plant with a neat sketch.	IV	U	10
21	**A**	Draw the schematic layout of thermal power plant and explain.	V	R	10
		(OR)			
	B	(i) Explain the nuclear reactor with a neat sketch. (ii) What are the advantages and disadvantages of wind energy power plant?	V	U/R	5 5

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%

MEC – 420 SPECIAL MACHINES

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

Topics and Allocation of Hours:

Unit	Topics	Hours
I	Manufacturing of Plastic Components and Composite Manufacturing	13
II	Reciprocating Machines and Broaching Machine	13
III	Milling Machines and Gear Generating Processes	13
IV	Abrasive Process and Non- Conventional Machining Processes	12
V	CNC Machine and Its Components	12
	TEST AND REVISION	12
	Total	**75**

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:

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

COURSE OUTCOMES

MEC – 420 SPECIAL MACHINES	
After successful completion of this course, the students should be able to	
C420.1	Describe the plastics, composites and its processing methods
C420.2	Ability to explain the structures and operations in reciprocating machines
C420.3	To define the milling machines and gear generating process
C420.4	Understand the various grinding machines with its operations and new machining processes
C420.5	To describe CNC machines and its components

MEC – 420 SPECIAL MACHINES

UNIT-I

MANUFACTURING OF PLASTIC COMPONENTS [13Hrs]

Plastic Components: Types of plastics - Engineering plastics – [2Hrs]
thermosets –composite - structural foam, elastomers - polymer alloys
and liquid crystal polymers. Factors Influencing the Selection of
Plastics - Mechanical properties – degradation - wear resistance - [2Hrs]
frictional properties - special properties –processing –cost

Processing of Plastics: Extrusion-general features of single screw [2Hrs]
extrusion -twin screw extruders. Injection moulding types: Plunger type
Reciprocating screw injection - details of injection mould - structural [2Hrs]
foam injection mould - sandwich moulding - gas injection moulding -
injection moulding of thermosetting materials - calendaring and [2Hrs]
rotational moulding. Design consideration for plastic components.

Composite manufacturing: Introduction – characteristics [2Hrs]
of composite manufacturing - constituents –Glass fibers
manufacturing process –hand laminating process –autoclave
processing –filament winding –pultrusion process –liquid
composite process –working principles by schematic diagram [1Hr]
only –advantages –disadvantages.

UNIT-II

RECIPROCATING MACHINES [13Hrs]

Planer: Introduction - description of double housing planer – [2Hrs]
specifications -principles of operation – drives - quick return
mechanism - feed mechanism - work holding devices and [2Hrs]
special fixtures - types of tools - operations.

Shaper: Introduction – specifications – principles of operations [2Hrs]
standard shaper –quick return mechanism - crank and slotted link
hydraulic shaper - feed mechanism - work holding devices –fixture - [2Hrs]
operations.

Slotter: Introduction –specifications - method of operation – [2Hrs]
Whitworth quick return mechanism - feed mechanism - work holding
devices -types of tools.

Broaching: Types of broaching machine - horizontal, vertical and [2Hrs]

continuous broaching - principles of operation - types of broaches – classification - broach tool nomenclature - broaching operations. [1Hrs]

UNIT -III

MILLING MACHINES AND GEAR GENERATING PROCESSES [13 Hrs]

Milling Machines: Types - column and knee type –plain - universal milling machine - vertical milling machine - principles of operation – [2Hrs]

specification of milling machines - work holding devices - tool holding devices - arbor - stub arbor - spring collet –adapter. Milling cutters: [2Hrs]

cylindrical milling cutter - slitting cutter -side milling cutter - angle milling cutter - T-slot milling cutter - woodruff milling cutter - fly cutter [2Hrs]

- nomenclature of cylindrical milling cutter. Milling operations: straddle milling - gang milling - vertical milling attachment. [2Hrs]

Indexing plate –differential indexing - simple indexing –compound indexing –simple problems. [2Hrs]

Generating Process: gear shaper - gear hobbing - principle of operation only. Gear finishing processes: burnishing – shaving – [1Hr]

grinding and lapping - gear materials. [2Hrs]

UNIT -IV

ABRASIVE PROCESS AND NON- CONVENTIONAL MACHINING PROCESSES **[12Hrs]**

Abrasive Process: Types and classification –specifications - rough [2Hrs]

grinding – pedestal grinders - portable grinders - belt grinders – precision grinding - cylindrical grinder - centerless grinders –surface [2Hrs]

precision grinding - cylindrical grinder - centerless grinders –surface

operations - grinding wheels – abrasives - natural and artificial [2Hrs]

diamond wheels - types of bonds - grit, grade and structure of wheels - wheel shapes and sizes - standard marking systems of grinding [2Hrs]

wheels - selection of grinding wheel - mounting of grinding wheels – Dressing and Truing of wheels - Balancing of grinding wheels. [2Hrs]

Non-Conventional Machining Processes: Construction, working and applications of Ultrasonic machining - chemical [1Hr]

machining - electro chemical grinding - electrical discharge machining - plasma arc machining - LASER machining – [1Hr]

dvantages –Disadvantages.

UNIT -V

- CNC MACHINE AND ITS COMPONENTS [12Hrs]

CNC Machines:- Numerical control –definition- working principle of a [2Hrs]
CNC system – Features of CNC machines - advantage of CNC
machines – difference between NC and CNC – Construction [2Hrs]
and working principle of turning centre –Construction and working
principle of machining centre –machine axes conventions turning [2Hrs]
centre and machining centre –Coordinate measuring machine –
construction and working principle. Hydraulic operations using [2Hrs]
for CNC machine

Components of CNC machine: Slide ways –requirement –types [2Hrs]
– friction slide ways and antifriction slide ways - linear motion bearings
– recirculation ball screw –ATC –tool magazine –feedback devices [1Hr]
– linear and rotary transducers –Encoders - in process probing –
tool material –tool inserts. [1Hr]

Text Book

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

Reference Book

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./18th
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:

https://nptel.ac.in/courses/112105126/20

https://nptel.ac.in/courses/112105127/pdf/LM-20.pdf

https://nptel.ac.in/courses/112105126/33

https://nptel.ac.in/courses/112106137/pdf/2_5.pdf

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:

(v) 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
C420.1	2	3	-	2	2	3	3	3	-	3
C420.2	2	3	-	2	2	3	3	3	-	3
C420.3	2	-	-	2	2	3	3	3	-	3
C420.4	2	-	-	2	2	3	3	3	-	3
C420.5	2	3	-	2	2	3	3	3	-	3
Total	10	9	-	10	10	15	15	15	-	15
Correlation Level	2	3	-	2	2	3	3	3	-	3

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%

****

MEC – 420 SPECIAL MACHINES

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Different types of plastics?	I	R
2.	Define calendaring?	I	R
3.	What is shaper?	II	R
4.	What are work holding device?	II	R
5.	What do you mean by universal milling machine?	III	R
6.	Define gear hobbing.	III	R
7.	What is the type of Abrasive?	IV	R
8.	What is the CNC machine?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	What are the constitutions of the composite manufacturing?	I	R
10.	Explain the types of plastics?	I	U
11.	What are the classifications of Broaching?	II	R
12.	Explain the different types of Operation in plane?	II	U
13.	Explain the gear finishing process?	III	U
14.	What are the types of Grinding Process?	IV	R
15.	Explain the Plasma Arc Machining?	IV	U
16.	Explain ATC?	V	U

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Explain in detail about plutonian process?	I	U	10
		(OR)			
	B	Explain with neat sketch about Inject Moulding?	I	U	10
18.	**A**	Explain the quick return mechanism?	I	U	10
		(OR)			
	B	Illustrate with neat sketch explain the Broaching Operation?	I	R	10
19	**A**	Explain with neat sketch about Universal Milling Machine?	I	U	10
		(OR)			
	B	Explain the gear Finish process?	I	U	10
20	**A**	Explain Principle Operation of Grinding Wheels?	I	U	10
		(OR)			
	B	Explain the LASER machine its advantages and disadvantages?	I	U	10
21	**A**	Explain the linear and rotation Transducer?	I	U	10
		(OR)			
	B	Explain Constitution and Working Principle of Co-ordinate measuring machine?	I	U	10

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%

MEC-430 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	Semester End Examination	Total	3Hrs
	5	75	25	100*	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	PROPERTIES OF FLUIDS AND PRESSURE	13
II	FLOW OF FLUIDS AND FLOW THROUGH PIPES & IMPACT OF JET	13
III	HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS	13
IV	HYDRAULIC SYSTEMS	12
V	PNEUMATIC SYSTEMS	12
	TEST AND REVISION	12
	Total	75

COURSE DESCRIPTION:

The main objective of this subject Fluid mechanics and Fluid power is to study the behavior of fluids under the condition of rest and motion. This chapter deals with fluid pumps, turbines, hydraulic and pneumatic operation. The overall object is to impart knowledge of pumps, hydraulic and pneumatic operation of tools and equipments.

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 430 FLUID MECHANICS AND FLUID POWER	
After successful completion of this course, the students should be able to	
C430.1	Express the knowledge in properties of fluids and pressure measurements
C430.2	To identify the discharge and frictional loss respectively in orifice and flow through pipes
C430.3	Explain the construction and working principle of hydraulic machines
C430.4	Define the pneumatic system application and system elements
C430.5	Explode knowledge in hydraulic circuits and machine tool application

MEC-430 FLUID MECHANICS & FLUID POWER

UNIT -I

PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS [13Hrs]

Introduction - Definition of fluid - Classification of Fluids - ideal and [2Hrs]
real fluids -Properties of a fluid –definition and units - Pressure-units [1Hrs]
of Pressure - Pressure head-atmospheric, gauge and absolute [2Hrs]
pressure –problems - Pascal's law- proof - applications of Pascal's law [2Hrs]
- Hydraulic press - Hydraulic jack - Pressure measurement [2Hrs]
Piezometer tube - Simple U-tube manometer - Differential U-tube [1Hr]
manometer - Inverted Differential manometer - Micro-manometer –
Inclined tube micro-manometer - Mechanical Gauges -Bourdon's tube [1Hr]
Pressure Gauge - Diaphragm pressure gauge - Dead weight pressure [2Hrs]
gauge.

UNIT -II

FLOW OF FLUIDS AND FLOW THROUGH PIPES [13Hrs]

Buoyancy and equilibrium of floating bodies- types of fluid flow – [2Hrs]
path line and stream line - mean velocity of flow - discharge of a
flowing fluid - equation of continuity of fluid flow - energies of fluid – [2Hrs]
Bernoulli's theorem - statement, assumptions and proof - applications and
limitations of Bernoulli's– theorem problems on Bernoulli's theorem – venturime [2Hrs]
- derivation for discharge - orifice meter - derivation for discharge - difference
between venturimeter and orifice meter -problems on venturimeter and orifice [2Hrs]
meter - Pitot tube –description only –orifice –types –applications - hydraulic
co-efficient - determining hydraulic c o-efficient –problems - discharge through [1Hr]
a small orifice discharging freely only - problems – experimental method of
finding Cv, Cc and Cd - Flow through pipes - laws of fluid friction - hydraulic [2Hrs]
gradient line - total energy line - wetted perimeter - hydraulic mean radius –
loss of head due to friction–Darcy - Weisbach equation and Chezy's formula –
problems - minor losses (description only) - Power transmission through pipes
- problems. [2Hrs]

UNIT-III

IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS [13Hrs]

Impact of jet - on a stationary flat plate held normal to the jet and inclined to the direction of jet - Impact of jet on a flat plate [1Hr]

moving in the direction of jet - Impact of jet on a series of moving plates or vanes - force exerted and work done by the jet - problems [2Hrs]

Hydraulic turbines –classifications - Pelton wheel - components and working [2Hrs]

Hydraulic turbines –classifications - Pelton wheel - components and working components and working - draft tube - functions and types - surge tank – differences between impulse and reaction turbines. [1Hr]

Centrifugal Pumps – classifications - construction and working of single stage centrifugal pumps - components with types - theory [2Hrs]

only - multi stage pumps –advantages - priming –cavitation. [2Hrs]

Reciprocating Pumps –classifications - construction and working of single acting and double acting reciprocating pumps – plunger and piston pumps – discharge of a reciprocating pump - theoretical power [2Hrs]

required - coefficient of discharge –slip –problems - negative slip - [1Hrs]

icator diagram –separation - air vessel (functions and working) -

Special pumps - Jet pump - Turbine pump - Submersible pump.

UNIT-IV

PNEUMATIC SYSTEMS [12Hrs]

Pneumatic Systems –elements –filter –regulator - lubricator unit - [2Hrs]

pressure control valves - pressure relief valves - pressure regulation valves - directional control valves - 3/2 DCV - 5/2 DCV – 5/3 DCV flow [2Hrs]

control valves –throttle valves –shuttle valves –quick exhaust valves – ISO symbols of pneumatic components –pneumatic circuits –direct [2Hrs]

control of single acting cylinder –operation of double acting cylinder – operation of double acting cylinder with metering-in control – operation [2Hrs]

of double acting cylinder with metering-out control –use of shuttle valve in pneumatic circuits –use of quick exhaust valve in pneumatic circuits [2Hrs]

- automatic operation of double acting cylinder single cycle –multiple cycle –merits and demerits of pneumatic system - applications. [2Hrs]

UNIT-V

HYDRAULIC SYSTEMS [12Hrs]

Hydraulic system-– Merits and demerits—Service- properties of Hydraulic- accumulators– Weight of- gravity type [2Hrs]

accumulator –Spring loaded type accumulator - Gas filled accumulator –Pressure intensifier –Fluid power pumps –External and internal gear [2Hrs]

pump, Vane pump, Radial piston pump –ISO symbols for hydraulic components –Hydraulic actuators –Cylinders and motors –Valves – [2Hrs]

Pressure control valves, Flow control valves and direction control valves –types –including 4/2 DCV and 4/3 DCV –their location in the circuit [2Hrs]

Hydraulic operation of double acting cylinder with metering-in and metering-out control – application of hydraulic circuits – Hydraulic [2Hrs]

circuit for - shaping machine - table movement in surface grinding machine and milling machine –comparison of hydraulic and pneumatic systems. [2Hrs]

Text Book

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 Book

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

LEARNING WEBSITES:

https://nptel.ac.in/courses/112104117/33

https://nptel.ac.in/courses/112105182/

https://nptel.ac.in/courses/112102011/2

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
C430.1	2	2	-	-	-	2	3	2	3	-
C430.2	3	2	-	-	-	2	3	2	3	-
C430.3	2	2	2	-	-	2	3	3	3	-
C430.4	3	2	2	2	-	2	3	2	3	-
C430.5	3	2	2	3	-	2	3	2	3	-
Total	13	10	6	5	-	10	15	11	15	-
Correlation Level	2.6	2	2	2.5	-	2	3	2.2	3	-

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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MEC-430 FLUID MECHANICS & FLUID POWER

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Define specific gravity.	I	R
2.	Define pressure.	I	R
3.	What is real fluid?	II	R
4.	Define viscosity.	II	R
5.	What is an orifice?	II	R
6.	State any two application of Bernoulli's theorem.	III	R
7.	Define turbulent flow.	III	R
8.	What is vena-conteacta?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	State the function of draft tube.	III	R
10.	Define slip.	II	R
11.	Define negative slip.	II	R
12.	What is meant by priming?	III	R
13.	What is the use of pressure regulator?	IV	R
14.	Name any two types of DCV's.	IV	R
15.	Mention any two pneumatic system.	IV	R
16.	Draw the ISO symbol for check valve.	V	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	(i) A simple manometer is used to measure the pressure of oil of relative density 0.8 flowing in a pipe. Its right limb is open to the atmosphere and the left limb is connected to the pipe. The centre of the pipe is 150mm below the level of mercury in the right limb. If the difference of mercury level in the two limbs in250mm. Determine the absolute pressure of oil in the pipe in KN/m^2. ii) List the applications of Pascal's law and explain anyone with a neat sketch.	I	Ap	10
		(OR)			
	B	Explain with a neat sketch the working principle of Bourdon's tube pressure gauge.	I	R	10
18.	**A**	State and prove Bernoulli's theorem.	II	R	10
		(OR)			
	B	Derive an expression for the discharge through venturimeter.	II	R	10
19	**A**	i) What is meant by impact of jet? ii) Sketch and explain working of pelt on wheel.	III	R/U	5 5
		(OR)			
	B	A single acting reciprocating pump having cylinder, diameter of 150mm and a stroke of 300mm is required to raise water through a height of 20m. The crank rotates at 60rpm and the discharge is 5 liters per second. Find i) Theoretical discharge of the pump ii) Percentage slip of the pump iii) Theoretical power required to drive the pump. iv) Compare impulse turbine and reaction turbine	III	Ap	10
20	**A**	i)Explain FRL unit with a neat sketch. ii) Explain the following i) check valve ii) shuttle valve.	IV	U/U	5 5
		(OR)			
	B	Explain automatic operation of double acting cylinder with a sketch.	IV	U	10
21	**A**	i) Explain with neat sketch the elements of hydraulic system ii) Explain the working of internal gear pump.	V	U	5 5
		(OR)			
	B	Draw and explain hydraulic circuit for shaping machine.	V	R	10

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%

MEC-440 ELECTRICAL DRIVES AND CONTROL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
			Marks			
			Internal Assessment	Semester End Examination	Total	
Electricals Drives and Circuits	6	90	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit	Topics	Hours
I	DC CIRCUITS AND DC MACHINES	16
II	AC CIRCUITS AND AC MACHINES	16
III	STEPPER AND SERVO MOTORS & DRIVES	16
IV	POWER SUPPLIES AND LOGIC GATES	15
V	CONTROL ELEMENTS AND PLC	15
	TEST AND REVISION	12
	Total	**90**

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:

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

COURSE OUTCOMES

MEC – 440 ELECTRICAL DRIVES AND CONTROL	
After successful completion of this course, the students should be able to	
C440.1	Learnt about the direct current circuits, construction of DC generators and DC motors
C440.2	Understood the fundamentals of AC circuits, transformers and AC machines
C440.3	Gaining the knowledge about stepper and servo motor with induction in electrical safety
C440.4	Having the knowledge about the logic gates, UPS and inverters
C440.5	Necessity of plc and usage of various sensors

MEC-440 ELECTRICAL DRIVES AND CONTROL

UNIT-I [16Hrs}

DC CIRCUITS AND DC MACHINES

Definition- Electric current, voltage and resistance -Ohm's [2Hrs]
Kirchoff's law. Resistance in s– simple problems electromagnetism [2Hrs]
(definitions only) –magnetic flux, [2Hrs]
flux density magnetic field intensity, MMF, permeability, reluctance [2Hrs]
Faraday's law of induction, electromagnetic, electrical and mechanical Units [2Hrs]
DC generators – construction, principle of operation, types and [2Hrs]
Publication
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 [16Hrs]

Fundamentals of AC voltage, and current – peak, average, RMS [2Hrs]
value of sine wave, frequency, time period, amplitude, power and [2Hrs]
power factor (definition only)- star and delta connection relationship [2Hrs]
between phase, line voltage and current in star and delta connections [2Hrs]
Transformer: Principle of operation and construction –EMF equation [2Hrs]
(no definition)- losses in Transformer –efficiency –application Alternator
construction -– principle of operation and applications. [2Hrs]
AC machine: AC motors- Principle of operation of single phase
capacitor start and universal motor induction motor- applications- [2Hrs]
Three phase induction motors –Squirrel cage and slip ring Induction
motors (construction and working principle only) - application –speed [2Hrs]
control of3Φ -Induction Necessity of starters motor–DOL and star/delta starter.

UNIT-III

STEPPER AND SERVO MOTORS & DRIVES [16Hrs]

PMDC, Stepper motor- construction and working principle and [2Hrs]
applications - Servo motor –types: brushless servo motor, permanent [2Hrs]
magnet servo motor construction and applications [2Hrs]
Industrial drives- types, group drive, individual drive, multi motor drive [2Hrs]
block diagram of Variable frequency drive , stepper motor drive [2Hrs]
single stepping and half stepping. Servo drives. [2Hrs]

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

precautions - causes of accident and their preventive measures [2Hrs]

Energy conservation.

UNIT-IV

POWER SUPPLIES AND LOGIC GATES [15Hrs]

Diode –terminals: anode and cathode, forward biasing and reverse [2Hrs]

biasing – use of diode in rectifiers – half wave and full wave – necessity [2Hrs]

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

UPS and Inverters – General description and their applications. [2Hrs]

Display devices –LED, 7 segment LED, LCD [2Hrs]

Logic gates: Positive and negative logic, definition, symbol truth table, [2Hrs]

Boolean expression for OR, AND, NOT, NOR, NAND, EXOR AND [2Hrs]

EXNOR gates –Universal logic Gates: NAND, and NOR [1Hr]

UNIT-V

CONTROL ELEMENTS AND PLC [15Hrs]

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

Photo electric sensor, Inductive proximity sensors, Temperature sensors. [2Hrs]

Switches: Push button switch, selector switch, limit switch, pressure [2Hrs]

switch,

temperature switch, float switch and reed switch Relays –NO, NC –usage- [2Hrs]

bimetallic thermal overload relays

Contactors- usage –necessity of contactor- Solenoid type contactor [2Hrs]

Circuit breakers – Miniature case Circuit breaker (MCCB) and [2Hrs]

Miniature Circuit [2Hrs]

breaker (MCB), Oil Circuit breakers (OCB), Earth leakage circuit [1Hr]

breaker (ELCB)

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:

https://nptel.ac.in/courses/108104011/

https://nptel.ac.in/courses/108102046/

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
C440.1	3	-	-	2	-	-	3	2	2	2
C440.2	3	-	-	2	-	-	3	2	2	2
C440.3	2	-	2	2	2	-	3	2	2	2
C440.4	3	-	-	2	-	-	3	2	2	2
C440.5	3	-	2	2	-	-	3	2	2	2
Total	14	-	4	10	2	-	15	10	10	10
Correlation Level	2.8	-	2	2	2	-	3	2	2	2

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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MEC-440 ELECTRICAL DRIVES AND CONTROL

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	State Ohms law	I	R
2.	If R1=10ohms and r2=12ohms r1 and r2 are connected in series find the effective resistance.	I	R
3.	Give an application of dc motor.	I	R
4.	Why a starter to necessary of dc motor?	I	R
5.	Define peak value.	II	R
6.	List any two losses of transformer?	II	R
7.	What is meant by power factor?	II	R
8.	State an application of alternator?	II	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	What is meant by energy conservation?	III	R
10.	List any 2 types of servomotor?	III	R
11.	State an application of stepper motor?	III	R
12.	Write one precaution of ovoid electric shock?	III	R
13.	Why do you need filter in rectifier?	III	R
14.	Write the symbol and truth table of AND gate?	IV	R
15.	Draw the symbol of LED?	IV	R
16.	Expand SMPS?	V	U

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Draw the circuit of four point starter and explain its working?	I	R	10
		(OR)			
	B	State faraday law of electromagnetic induction?	I	R	10
18.	**A**	i) Explain the relationship between phase and line voltage and current in star? ii) Explain the principle of working of a 3b slipping induction motor?	II	U/U	5 5
	B	Describe the construction principals of operation of transformer.	II	R	10
19	**A**	What is meant by an industrial drive list the types and explain any two in details?	III	R	10
		(OR)			
	B	i) State the importance of earthing? ii) List the causes of accident and their preventive measures?	III	R/R	5 5
20	**A**	Explain the working of full wave rectifier with a neat diagram. Also draw the input and output waveforms.	IV	U	10
		(OR)			
	B	i) Write a short note on 7segment LED ii) Draw the symbol and write the truth table of OR, NOT, NAND and NOR gates	IV	R/R	5 5
21	**A**	Explain the working of Full wave rectifier with a neat diagram also draw the input and output wave form?	V	U	10
		(OR)			
	B	i) What in meant by a contactor and explain? ii) State the necessity of a contactor and explain solenoid type contactor.	V	R/R	5

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%

MEC-450-STRENGTH OF MATERIALS AND FLUID POWER MECHANICS PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Strength of Materials and Fluid Mechanics Practical	4	60	Internal Assessment	Semester End Examination	Total	3 Hrs
			25	75	100	

ALLOCATION OF MARKS

Strength of material lab

Part A	**-**		**35 marks**
Observation	-	10	
Tabulation / Calculation	-	20	
Result / Graph	-	5	

Fluid mechanics lab

Part B	**-**		**35 marks**
Observation	-	10	
Tabulation / Calculation	-	20	
Result / Graph	-	5	
Viva-voce	**-**		**05 marks**
Total	**-**		**75 marks**

OBJECTIVES:

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

- □ Conduct performance test on centrifugal and reciprocating pumps.
- □ Conduct performance test on impulse and reaction turbines.

COURSE OUTCOMES

MEC – 450 STRENGTH OF MATERIALS AND FLUID POWER PRACTICAL	
After successful completion of this course, the students should be able to	
C450.1	Acquire skills on different types of testing methods of metals.
C450.2	Conduct material testing on elasticity, hardness, shear strength
C450.3	Determine modulus of rigidity of open spring and closed coil springs.
C450.4	Calibrate flow discharge measuring device used in pipes, channels and tanks.
C450.5	Test the performance of pumps and turbines.

EQUIPMENTS REQUIRED

LATHE		
Sl.No	**Name of the equipment**	**Required Nos.**
1	UTM	01
2	Rockwell 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 a small orifice / an external mouth piece and a collecting tank with Piezometer	01
10	A Centrifugal pump having the discharge line with venturimeter / orifice meter arrangement	01
11	An arrangement to find friction factor of pipe	01
12	A reciprocating pump with an arrangement for collecting data to find out the efficiency and plot the characteristics curves.	01
13	A centrifugal pump with an arrangement for collecting tank to find out the efficiency and plot the characteristics curves.	01
14	A impulse turbine with an arrangement for calculating data to find out the efficiency	01
15	A reaction turbine with an arrangement for collecting data to find out the efficiency	01

MEC-450-STRENGTH OF MATERIALS AND FLUID POWER MECHANICSPRACTICAL

PART – A STRENGTH OF MATERIALS		
Sl.No	**Name of the Exercise**	**Course Outcome**
Ex.1	**Test on Ductile Materials:** Finding Young's Modulus of Elasticity, yield percentage reduction in area, stress strain diagram plotting, tests on mild steel.	C450.2
Ex.2	**Hardness Test:** Determination of Rockwell's Number for various materials like mild steel, high carbon steel, brass, copper and aluminium	C450.2
Ex.3	**Torsion test:** Torsion test on mild steel – relation between torque and angle of twist-determination of shear modulus and shear stress	C450.2
Ex.4	**Impact test:** Finding the resistance of materials to impact loads by Izod test and Charpy test.	C450.2
Ex.5	**Tests on springs of circular section:** Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)	C450.2
Ex.6	**Shear test:** Single or double shear test on M.S. bar to finding the resistance of material to shear load.	C450.2
PART – B **FLUID MECHANICS LABORATORY**		
Ex.7	Verify the Bernoulli's. Theorem	C450.4
Ex.8	Determination of co-efficient of discharge of a mouth piece / orifice by variable head method.	C450.4
Ex.9	Determination of co-efficient of discharge of a venturimeter / orifice meter.	C450.4
Ex.10	Determination of the friction factor in a pipe.	C450.4
Ex.11	Performance test on reciprocating pump / centrifugal pump and to draw the characteristics curves	C450.5
Ex.12	Performance test on impulse turbine / reaction turbine and to find out the Efficiency.	C450.5

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

https://nptel.ac.in/courses/112107146/

https://nptel.ac.in/courses/112107146/2

https://nptel.ac.in/courses/112104117/

https://nptel.ac.in/courses/112105182/

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
C450.1	2	-	2	2	2	3	3	2	2	3
C450.2	2	-	2	3	2	3	3	2	3	3
C450.3	2	-	3	2	2	3	3	3	2	3
C450.4	2	-	3	3	2	3	3	3	3	3
C450.5	2	-	2	3	2	3	3	2	3	3
Total	10	-	12	13	10	15	15	12	13	15
Correlation Level	2	-	2.4	2.6	2	3	3	2.4	2.6	3

MEC- 460- SPECIAL MACHINES PRACTICAL

No. of weeks per semester: 15 Weeks

Course	Instructions		Examination			
	Hrs /Week	Hrs/ Semester	Marks			Duration
Special Machines Practical	4	60	Internal Assessment 25	Semester End Examination 75	Total 100	3 Hrs

ALLOCATION OF MARKS

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

OBJECTIVES:

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

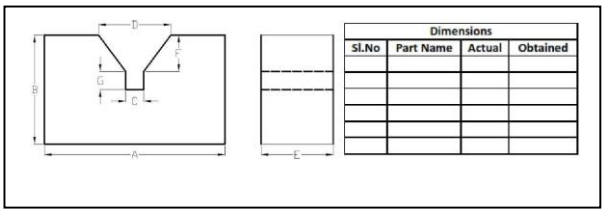
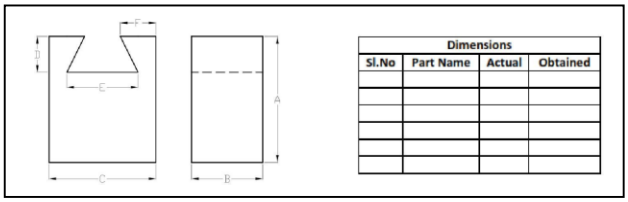
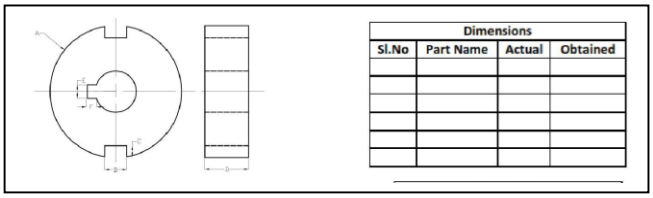
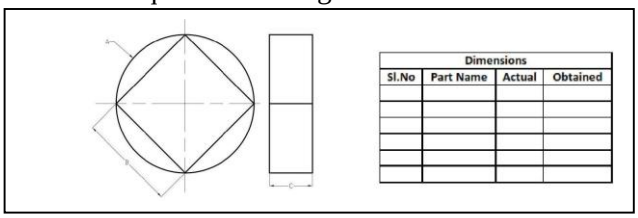
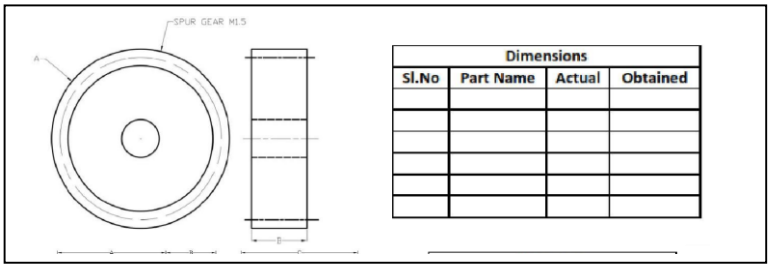
COURSE OUTCOMES

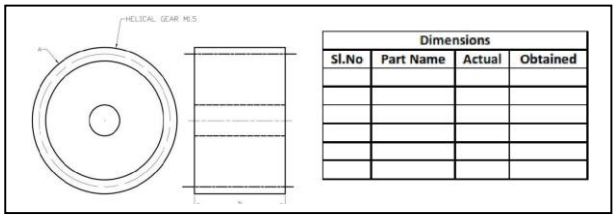
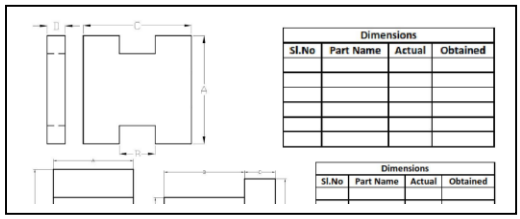
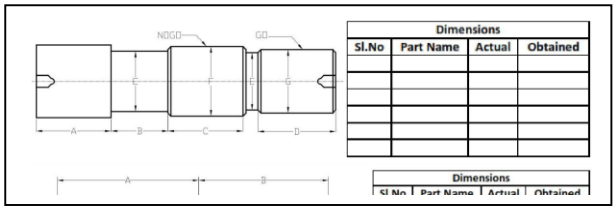
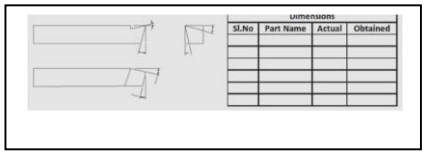
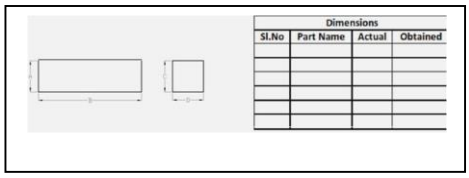
MEC – 460 SPECIAL MACHINES PRACTICAL	
After successful completion of this course, the students should be able to	
C460.1	Recognize machines such as milling, cylindrical grinding, surface grinding, shaping, slotting machines and its parts.
C460.2	Identify the necessary tools, instruments and various work holding devices.
C460.3	Calculate the indexing for a work.
C460.4	Develop a component as per drawing using proper machine tools.
C460.5	Prepare a record of work for all the exercises.

EQUIPMENTS REQUIRED

LATHE		
Sl.No	**Name of the equipment**	**Required Nos.**
1	Vertical milling machine Vertical attachment	02
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	Tools and Measuring instruments	Sufficient quantity
9	Consumables	Sufficient quantity

MEC- 460- SPECIAL MACHINES PRACTICAL

Sl.No	Name of the exercise	Course Outcome
Ex.1	Make 'V' Block using shaping machine 	C460.4
Ex.2	Make dovetail using shaping machine 	C460.4
Ex.3	Make groove cut using slotting machine 	C460.4
Ex.4	Make round to square in milling machine. 	C460.4
Ex.5	Make Spur Gear using milling machine by Differential Indexing. 	C460.3/ C460.4

Ex.6	Make Helical Gear using milling machine 	C460.3/ C460.4
Ex.7	Make slot cut using milling machine. 	C460.3
Ex.8	Make Progressive type Plug gauge using Cylindrical Grinding machine 	C460.3
Ex.9	Make a turning tool using Tool and Cutter Grinder 	C460.3
Ex.10	Make plain surfaces (four surfaces) using surface Grinder 	C460.3

Continuous Internal Assessment

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

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

b) Procedure/ observation and tabulation/ Other Practical related work : 10 marks

c) Record writing : 10 marks

Total **25 marks**

LEARNING WEBSITES:

https://nptel.ac.in/courses/112105127/pdf/LM-20.pdf

https://nptel.ac.in/courses/pdf_link/112103245/lec22.pdf

https://nptel.ac.in/courses/112105127/pdf/LM-32.pdf

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
C460.1	2	2	-	2	-	2	3	2	3	2
C460.2	2	2	3	2	-	2	3	2	3	2
C460.3	2	2	3	2	-	2	3	2	3	2
C460.4	2	2	3	2	-	2	3	2	3	2
C460.5	2	2	-	2	-	2	3	2	3	2
Total	10	10	9	10	-	10	15	10	15	10
Correlation Level	2	2	3	2	-	2	3	2	3	2

MEC-470- ELECTRICAL DRIVES AND CONTROL PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 470 ELECTRICAL DRIVES AND CONTROL; PRACTICAL	
After successful completion of this course, the students should be able to	
C470.1	Identify the starters for different motors.
C470.2	Test the characteristics of DC and AC machines.
C470.3	Design regulated power supplies.
C470.4	Identify display devices – LED, 7 segment LED, LCD
C470.5	Test the speed control circuit of the special motors.

EQUIPMENTS REQUIRED

LATHE		
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	3 point starter 20A,220V	01 No.
14	DOL starter 16A,415V	01 No.
15	Star /Delta starter 20a,600V	01 No.
16	Over load relay 1 to 2.5A	01 No.
17	Air break contactors 20A,220V	04 Nos.
18	Push button 2A ,220V	02 Nos.
19	Limit switch 20A,220V	01 No.
20	MCB 20A single pole	01 No.
21	MCB 20A double pole	01 No.
22	ELCB 2pole 20A,100mA	01 No.
23	ELCB 4POLE 20A,100mA	01 No.

MEC-470- ELECTRICAL DRIVES AND CONTROL PRACTICAL

PART – A		
Sl.No	**Name of the Exercise**	**Course Outcome**
Ex.1	Verification of Ohm's Law	C470.2
Ex.2	Testing of DC starters –3 point and 4 point starter	C470.2
Ex.3	Load test on DC shunt motor	C470.2
Ex.4	Testing of AC starters - DOL , star - Delta starter	C470.2
Ex.5	Load test on single phase induction motor	C470.2
Ex.6	Load test on three phase squirrel cage motor	C470.2
Ex.7	Testing of relays, contactors, push buttons and limit switch	C470.3
Ex.8	Connection and Testing of MCB, ELCB	C470.3
PART – B		
Ex.9	Construction and testing of Half wave and Full wave rectifier.	C470.4
Ex.10	Construction and testing of IC voltage regulator using IC 7805.	C470.4
Ex.11	Verification of truth tables for logic gates.	C470.4
Ex.12	Verification of universal gates.	C470.4
Ex.13	Identification and testing of display devices- LED, 7 segment LED, Laser diode.	C470.4
Ex.14	Testing of Stepper motor drive.	C470.5
Ex.15	Testing of Servo motor drive.	C470.5

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

http://mgcl.iitr.ac.in/NPTEL-1308-video-courses.pdf

http://videos.gitam.edu/nptel/electrical.html

https://nptel.ac.in/courses/108108076/35

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C470.1	2	-	-	2	-	-	3	1	1	1
C470.2	2	-	1	2	-	-	3	1	1	1
C470.3	2	-	1	2	-	-	3	1	1	1
C470.4	2	-	1	2	-	-	3	1	1	1
C470.5	2	-	1	2	-	-	3	1	1	1
Total	10	-	5	10	-	-	15	5	5	5
Correlation Level	2	-	1	2	-	-	3	1	1	1

MEC –510 DESIGN OF MACHINE ELEMENTS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
Design of machine Elements	Hours/ Week	Hours/ Semester	Marks			Duration
	6	75	Internal Assessment	Semester End Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	Design of Joints And Fasteners	13
II	Design of shafts, couplings and keys	13
III	Design of friction drives (flat belt and v-belt)	13
IV	Design of bearings	12
V	Design of levers and spur gears	12
	REVISION AND TEST	12
	Total	75

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:

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

COURSE OUTCOMES

MEC – 510 DESIGN OF MACHINE ELEMENTS	
After successful completion of this course, the students should be able to	
C510.1	Explain general considerations in machine design and explain the principles of joints and fasteners.
C510.2	Design the shafts, coupling and keys.
C510.3	Develop a strong knowledge to differentiate between various belt drives like flat belt and V belt.
C510.4	Identify and apply the factors to be considered while designing a bearing.
C510.5	Design the levers and spur gears.

MEC –510 DESIGN OF MACHINE ELEMENTS

UNIT -I

ENGINEERING MATERIALS, JOINTS AND FASTENERS [13Hrs]

General Considerations in Machine Design. Engineering materials [2Hrs]

- Factors affecting selection of material – BIS designation of Ferrous [1Hr]

materials – Preferred number - Factor of safety and allowable stress –

Stresses: Tension, Compression, Shear, Bearing pressure Intensity, [2Hrs]

Crushing, bending and torsion - problem.

Creep strain and Creep Curve- Fatigue, S-N curve, Endurance Limit [2Hrs]

Stress Concentration – Causes & Remedies. Theories of Elastic Failures

– Principal normal stress theory ,Maximum shear stress theory & maximum [2Hrs]

distortion energy theory.

Joints: Design of sleeve and cotter joint, knuckle joint and welded joint [2Hrs]

Fasteners: Design of bolted joints - eye bolts - [2Hrs]

UNIT –II

DESIGN OF SHAFTS, COUPLINGS AND KEYS [13Hrs]

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

bending moment – combined twisting and bending moments [2Hrs]

fluctuating loads – design of shafts based on rigidity

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

shaft-problems.

Couplings: Requirements of good couplings – types [2Hrs]

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

marine couplings [1Hr]

pin type flexible coupling (Description only). [2Hrs]

UNIT-III

DESIGN OF FLAT BELTS AND V-BELTS [13Hrs]

Flat Belts: Types of belts - materials for belt -– types of belt drives – [2Hrs]

Speed ratio – effect of slip -length of flat belts–Tension Ratio- power

transmitted– condition forT1/T2=e - centrifugal tension maximum [2Hrs]

power - transmission – Initial Tension - problems – design procedure [2Hrs]

of flat belts - design of flat belt based on manufacturer's [2Hrs]

data only – problems [2Hrs]

V-Belts: V-belt drive - comparison with flat belt drive - designation of [2Hrs]

V-belts – length of belt - power transmitted – Design of V-belt [1Hr]

Using manufacturer's data only – Problem.

UNIT-IV

DESIGN OF BEARINGS [**12Hrs]**

Bearings: Classifications of bearings- sliding contact and rolling

- contact bearings- radial and thrust bearings [2Hrs]

roller bearing – types - Designation of ball bearings [2Hrs]

materials used for bearings – journal bearings - [2Hrs]

heat generated - heat dissipated - cooling oil requirement- problems [2Hrs]

- cooling oil requirement- problems [2Hrs]

design of journal bearings –Problems [1Hr]

Design based on approved data books only [1Hr]

UNIT-V

DESIGN OF LEVERS AND SPUR GEARS **[12Hrs]**

Levers: Types of levers – applications

mechanical advantage- leverage - displacement ratio [2Hrs]

design of-hand lever-foot lever- [2Hrs]

cranked lever - problems [2Hrs]

Spur gears: Gear drives - merits and demerits over belt drive [2Hrs]

Classification of gears - gear materials - spur gear terminology [2Hrs]

design of spur gears based on Lewis & Buckingham equation [1Hr]

Problems – speed reducer – types –(Approved data books only) [1Hr]

Text Book

Sl.No	Subject	Author	Publication/Edition
1	Machine Design	Pandya & Shah,	Charotar Publishing House/ Edn. 1995
2	Machine Design	T.V Sundararajamoorthy & N. Shanmugam	Anuradha Publications/ Edition June-2003
3	Design Data Book	PSG College of Technology	DPV Printers, Coimbatore

Reference Books:

Sl.No	Subject	Author	Publication
1	Machine Design	R.S. Khurmi & J.K.Gupta,	Eurosia Publishing House / Edn. 18
2	Machine Design	Bandari,	
3	Theory and Problems of Machine Design	Holowenko, Laughlin	Schaum's outline Series.

LEARNING WEBSITES:

https://nptel.ac.in/courses/112106137/14

https://nptel.ac.in/courses/112105124/35

https://nptel.ac.in/courses/112102014/39

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	2	-	3	3	3	2	3
C510.2	3	3	3	2	-	3	3	3	2	3
C510.3	3	3	3	2	-	3	3	3	2	3
C510.4	3	3	3	2	-	3	3	3	2	3
C510.5	3	3	3	2	-	3	3	3	2	3
Total	15	15	15	10	-	15	15	15	10	15
Correlation Level	3	3	3	2	-	3	3	3	2	3

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%

****

MEC – 510 DESIGN OF MACHINE ELEMENTS

Time: 3 Hrs Max.Marks:75

PART – A (5 X 15 = 75 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
1.	**A**	Design a knuckle joint to transmit load of 60KN. Take allowable stresses as 60 Mpa in tension, 75 Mpa in compression and 40 Mpa in shear.	I	C	10
		(OR)			
	B	A plate 100mm wide and 10mm thick is to be welded to another plate by means of Double parallel fillets. The plates are subjected to a static load of 80KN. Find the length of weld if allowable shear stress in the weld does not exceed $55N/mm^2$.	I	Ap	10
2.	**A**	A shaft receives 5KW of the power at 600rpm mounted vertically below it. The pulley is situated at a distance of 300mm from one bearing end. Distance between the bearing of the shaft is 500mm. dia of the pulley is 600mm. angle of contact for the pulley is 120 degree and co efficient of friction between the belt and pulley is 0.3. shear stress for the shaft is 120N.mm2. design the shaft, considering fatigue factors.	II	Ap	10
		(OR)			
	B	Design a protective type flange coupling to connect two shafts to transmit 7.5KW at 720rpm. The permissible shear stress for the shaft bolts and key materials is 33N/mm2, permissible crushing strength for bolt and key material is 60N/mm2 and permissible shear stress for cast iron is 15N/mm2	II	C	10
3.	**A**	Design a flat belt drive to transmit 22.5KW at 740rpm to an aluminium rolling machine. The speed ratio is 3. The distance between the pulley is 3m diameter of rolling machine pulley is 1.2 use manufacture's data. Assume :1) load correction factor, ks=1.5 2)pulley correction factor, kd=0.9 3) open belt drive 4) Use fabric high speed duck belt.	III	C	10
		(OR)			
	B	Design V- belt drive to the following specification. Power to be transmitted = 75KW, Speed of driving wheel = 1440rpm, Speed of driven wheel = 400rpm, Dia of driving wheel = 300mm, Centre distance = 2500mm, Small pulley	III	C	10

		factor, kd = 1.14, Service factor, ks = 1.3, Correction factor for length, kl = 1.07			
4.	**A**	A journal bearing is proposed for a centrifugal pump. The diameter of the journal is 150mm and the load on it is 40KW and its speed is 900rpm. Design and give the complete calculations for the bearing.	IV	Ap	10
		(OR)			
	B	A journal bearing 300mm long 150mm dia carries a radial load of 9KN at 1200rpm. The power lost in friction is 6KW. Viscosity of oil at room temperature is 0.018pa-s. find the diameter clearance.	IV	Ap	10
5.	**A**	A hand lever is mounted on a shaft. The maximum force of 150N is applied by the worker. The distance between the centre of the shaft to the point of load is 1m. Determine the diameter of the solid shaft, if the permissible shear stress is limited to20N/mm2. Determine the section of the lever near the boss, if the permissible stress is limited to 85N/mm2. Assume rectangular cross section with sides in the ratio 1:2.	V	Ap	10
		(OR)			
	B	A pinion runs at600rpm drives a gear at a speed ratio of 4:1. Allowable static stress of pinion and gear material is 85N/mm2. Pinion has 16 teeth of module 8mm. teeth are 20 degree F.D system. Face width 90mm. find the power transmitted.	V	Ap	10

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%

MEC – 520 THERMAL AND AUTOMOBILE ENGINEERING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

Topics and Allocation of Hours:

Unit	Topics	Hours
I	THERMAL POWER PLANT, STEAM TURBINES & CONDENSERS, REFRIGERATION AND AIR CONDITIONING	16
II	IC ENGINES AND ITS COMPONENTS	16
III	AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM & FUEL FEED SYSTEMS	16
IV	AUTOMOBILE TRANSMISSION AND POWER TRAINS & CHASSIS	15
V	AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL	15
	REVISION AND TEST	12
	Total	90

COURSE DESCRIPTION:

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 520 THERMAL AND AUTOMOBILE ENGINEERING	
After successful completion of this course, the students should be able to	
C520.1	Define the thermal power plant various circuit systems with basic concepts in steam cycles and refrigeration process.
C520.2	Explain the working principle of IC engines and combustion process.
C520.3	Describe the construction and working of cooling system
C520.4	Express the Automobile power transmissions
C520.5	Explain the structure of Braking system and electrical systems with its working methods

MEC – 520 THERMAL AND AUTOMOBILE ENGINEERING

UNIT-I

THERMALPOWERPLANT,STEAMTURBINES& CONDENSERS, REFRIGERATION AND AIR CONDITIONING [16Hrs]

Layout of thermal power plant - merits and demerits of thermal power plant –pollutants - effects and control –cyclone separator [2Hrs]

– wet scrubber –electrostatic precipitator –control of No_2 and SO_2. – fluidized bed combustion [2Hrs]

Basic steam power cycles –Carnot, Rankine and modified Rankine cycles – classification of steam turbine - Impulse and reaction turbines - Difference – necessity of compounding – Methods of compounding [2Hrs]

Steam condensers –elements of condensing plant –classification of condensers –jet condenser –surface condensers –Comparison of jet and surface condensers – sources of air in condenser – [2Hrs]

condenser vacuum –vacuum efficiency –condenser efficiency - mass of cooling water required –mass of air present –number of tubes –simple problems. [2Hrs]

Refrigeration –Definition –COP –Unit of refrigeration - Vapour Compression system – Absorption system- Refrigerant properties. Air-conditioning- Definition Centralized air- conditioning. conditioning. [2Hrs]

UNIT-II

IC ENGINES AND ITS COMPONENTS [16Hrs]

Internal combustion engines

Classifications of I.C Engines –four stroke cycle petrol and diesel engines –two stroke cycle petrol and diesel engines – comparison of four stroke and two stroke engines. [2Hrs] [2Hrs]

Basic Engine Components:– Functions, types, materials and construction of –Cylinder block –Crankcase –Cylinder head – [2Hrs]

cylinder liners –Comparison of liners –Piston –piston rings –types of compression rings and oil control rings –piston pin –Connecting [2Hrs] [2Hrs]

rod - Crankshaft – flywheel- Cam- shaft-–Valve and Valve mechanism –Types [2Hrs]

Performance of IC Engines: Thermodynamic and commercial tests

–indicated power –brake power –friction power –efficiencies of [2Hrs]
I.C. engines –indicated thermal, brake thermal, mechanical and
relative efficiencies - Specific- fuel consumption – Morse test [2Hrs]
procedure –heat balance sheet –simple problems

UNIT-III

AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM & FUEL FEED SYSTEMS **[16Hrs]**

Cooling systems –purpose –types –air and water cooling systems [2Hrs]
thermo siphon system - pump assisted water cooling systems –
merits and demerits –troubles in cooling system. [2Hrs]
Lubrication systems –purpose –types of lubricants –additives –
Service rating of oil –types of lubricating systems - Full pressure [2Hrs]
system –oil pumps - oil filters –full flow and bypass filter systems - [2Hrs]
Troubles in lubrication system –causes and remedies..

Fuel Feed Systems: [2Hrs]

Layout of fuel feed system of petrol engine –types of fuel feed
systems –A.C. Mechanical fuel pump –S.U. Electrical fuel pump – [2Hrs]
fuel filter –Air cleaners - types –Carburetion –Classification of
Carburetors –Simple carburetor –Solex Carburetor – Construction [2Hrs]
and operation –petrol injection –merits and demerits –DTSI –VTI
–CCVTI –PGMFI –MPFI system description only. [2Hrs]

UNIT-IV

AUTOMOBILE TRANSMISSION AND POWER TRAINS & CHASSIS **[15Hrs]**

Transmission And Power Trains

General arrangement of power transmission system –front engine
rear drive –rear engine rear drive – front engine front drive - four
wheel drive – applications – clutch – function – components – [2Hrs]
Single plate , multi plate and diaphragm spring clutch –
fluid coupling –Clutch troubles and their causes.
Gear box –purpose –types of gear boxes –sliding mesh,
constant mesh and synchromesh – floor shift gear changer – [2Hrs]
gear box troubles and their causes.
Drive line –propeller shaft –Universal joint –Cross type only
–slip joint –final drive –function –types of gear arrangement [2Hrs]
–Hotch kiss drive –Torque tube drive –radius rod.

Differential –purpose –Construction and operation –Self locking and non slip differential –Differential troubles and their Causes – Semi floating, three quarter floating and full floating rear axles. [2Hrs]

Automobile Chassis:

Front axle –Stub axle –Types –Steering system –Ackermann Principle of Steering – Wheel alignment – Factors – Camber , Caster , King pin inclination , Toe in and Toe out on turns - Steering linkages – Steering gears – Cam and double roller , recirculating ball type , Rack and Pinion –Steering troubles and causes –power steering –Necessity –types –Layout of any one type –Collapsible Steering system. [2Hrs]

Suspension system –Functions –Leaf , coil and Torsion bar – Front suspension systems –independent front suspension –merits and demerits –types –rear end suspension –Air suspension – shock absorber – purpose – telescopic type construction and working. [1Hr] [2Hrs]

UNIT-V

AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL **[15Hrs]**

Brake system –functions –classification of brakes –drum brakes – leading shoe and trailing shoe –Self energizing action –hydraulic brake –brake bleeding - Air assisted hydraulic brakes –Air brake – layout – disc brakes –construction and working –brake troubles and their causes – anti lock brake system. Wheels – types of wheels. [2Hrs]

Battery –lead acid battery –Nickel alkaline battery –construction – battery rating –charging - testing –starting circuit - construction and operation of starter motor –starting motor drives –over running clutch and Bendix drive –construction and operation –solenoid switch – [2Hrs] [2Hrs]

Charging circuit –alternator construction and operation – regulators – Dynamo. Ignition system –Types –battery coil ignition system –High tension magneto – electronic ignition – Ignition system troubles and remedies. Lighting system –circuit –Head light –Aiming and adjustment – sealed beam head lights –directional signal circuits –fluorescent lamp Horn circuits –Wind screen wiper. [2Hrs] [2Hrs]

Pollution – Pollutants – source of pollutants – pollution control techniques for petrol and diesel engines emissions –controlling

crankcase emission (PCV) – controlling evaporative emission (VRS , [2Hrs]

VSS , VVR , ECS and EEC) –Treatment of exhaust gas [1Hr]

(Catalytic converter ,

EGR) –introduction to automobile electronics. [2Hrs]

–radio interference –suppressors –audio, video systems.

Alternative fuels used for pollution control.

Text Book

Sl.No	Subject	Author	Publication/Edition
1	Thermal Engg,	R.K . Rajput,	Laxmi publications Pvt Ltd , , New Delhi/8th Edition
2	Applied Thermodynamics	T,P.K. Nag	TATA Mcgraw - Hill Publishing Co, New Delhi/ 2nd Edition.
3	Automobile Engineering	G.B.S.Narang	Khanna Publishers, New Delhi.
4	Automotive Mechanics	William H.crouse and Donald .L. Anglin	Tata Mc Graw –Hill Publishing Company Ltd, New Delhi.

Reference Books:

Sl.No	Subject	Author	Publication
1	Thermal Engineering	P.L Ballaney	,Khanna Publishers,New Delhi/24th Edition
2	Applied Thermodynamics	Domkundwar C.PKothandaraman	Khanna publishers, New Delhi//2nd Edition
3	Automotive Mechanics	Joseph Heitner	East –west Press (P) Ltd, New Delhi
4	Internal Combustion engines	M.L.Mathur& R.P.Sharma	Dhanpat Rai & Sons,

LEARNING WEBSITES:

https://www.youtube.com/channel/UCGLlbmSTaLNUPhDwsMe-SgQ

https://nptel.ac.in/courses/125106001/

https://nptel.ac.in/courses/125106002/

https://www.youtube.com/watch?v=uVPp8wml9iU

CONTINOUS 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
C520.1	3	2	-	2	-	2	3	1	3	3
C520.2	3	2	-	2	-	2	3	1	3	3
C520.3	3	-	-	-	-	2	3	1	3	2
C520.4	3	-	-	-	-	2	3	1	3	2
C520.5	3	-	-	3	2	2	3	1	3	2
Total	15	4	-	7	2	10	15	5	15	12
Correlation Level	3	2	-	2.3	2	2	3	1	3	2.4

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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MEC – 520 THERMAL AND AUTOMOBILE ENGINEERING

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Name the pollutants of thermal power plant.	I	R
2.	What is mean by refrigeration?	I	R
3.	State the function of a piston?	II	R
4.	Define indicated power.	II	R
5.	Name the type of cooling system in IC engine.	III	R
6.	Name the type of lubricants.	III	R
7.	Write the any three ignition system in IC engine.	III	R
8.	What is the function of clutch?	IV	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	Explain the water and steam circuit of steam power plant with sketches?	I	U
10.	Write the any five application of refrigeration.	I	R
11.	Write the classification of IC engine.	II	R
12.	Define camshaft, and crank shaft,	II	R
13.	Write and explain any one type of lubricants system.	III	R
14.	Explain the layout of diesel fuel feed system?	III	U
15.	Draw the battery coil ignition system.	V	R
16.	Explain the evaporation emission.	V	U

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Explain and neat sketch the layout of thermal power plant,	I	U	10
		(OR)			
	B	Explain and neat sketch the vapour compression refrigeration	I	U	10
18.	**A**	Briefly explain the four stroke petrol engine.	II	R	10
		(OR)			
	B	Explain the any two engine components.	II	U	10
19	**A**	What is the purpose of lubrication and explain any type of lubrication system?	III	R	10
		(OR)			
	B	What is MPFI system? Explain with a neat sketch.	III	R/U	5 5
20	**A**	i. Explain the single plate clutch. ii. Explain the various. Resistance to motion.	IV	U/U	5 5
		(OR)			
	B	Explain the constant mesh gear box with sketch	IV	U	10
21	**A**	Explain the construction and working of hydraulic brake with layout.	V	U	10
		(OR)			
	B	Explain the construction and working of a lead acid battery.	V	U	10

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%

MEC -530 PROCESS PLANNING AND COST ESTIMATION

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

Topics and Allocation of Hours:

Unit	Topics	Hours
I	PROCESS PLANNING	13
II	PROCESS SELECTION	13
III	WORK STUDY	13
IV	COST ESTIMATION	12
V	MACHINING TIME CALCULATIONS	12
	REVISION AND TEST	12
	Total	**75**

COURSE DESCRIPTION:

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

OBJECTIVES:

- Understand the process planning.
- Study the process selection.
- Understand the work study and method study.
- Study the cost estimation.
- Study the machining time calculations.

COURSE OUTCOMES

MEC – 530 PROCESS PLANNING AND COST ESTIMATION	
After successful completion of this course, the students should be able to	
C530.1	Describe and explain the factors affecting process planning.
C530.2	Examine the various steps involved in process selection.
C530.3	Explain the process of work study.
C530.4	Determine the cost estimation of various process planning.
C530.5	Calculate the machining time for different operations.

MEC -530 PROCESS PLANNING AND COST ESTIMATION

UNIT-I

Process Planning [13Hrs]

Introduction - concept – Information required to do process planning - factors affecting process planning - process planning procedure - Make (or) Buy decision using Break Even Analysis - simple problems. Manual process planning - Introduction [2Hrs]

Of Automated process planning and generator process planning – [2Hrs]

Advantage of computer aided process planning –Principle of line balancing -need for line balancing– [2Hrs]

Value Engineering– Definition - cost control Vs cost reduction - value analysis when to do - steps information needed - selection of product. [2Hrs]

UNIT-II

Process Selection [13Hrs]

Process selection -technological choice - specific component choice - Process flow choice –Factors affecting process selection - machine capacity –analysis of machine capacity - process and equipment selection procedure - Determination of man, machine and material requirements - simple problems - selection material– jigs - fixtures etc. - Factors influencing choice machinery - selection of machinery - simple problems - preparation of operation planning sheet for simple components. [2Hrs]

UNIT-III

Work Study [13Hrs]

Objectives of work study - Concept of work content –Techniques to reduce work content - method study –Procedure –Recording techniques used in method study - Micro motion study - Principles of motion economy - Therbligs - Simo chart - cycle graph - Chrono cycle graph - work measurement - Basic Procedures for the conduct of time study - calculation of standard time - simple problems – Ergonomics –definition –objectives –applications - working environment - work place layout - other areas. [2Hrs]

UNIT-IV

Cost Estimation **[12Hrs]**

Introduction – Definition- purpose of cost estimation - cost estimation Vs Cost accounting - components of cost –direct cost - [2Hrs]

indirect cost - overhead expenses - estimation of cost elements - [2Hrs]

set up time and economic lot size - tool change time – Inspection [2Hrs]

time - performance factor – overheads - different methods of [2Hrs]

apportioning overheads-– Data required for cost estimating

Steps in making a cost estimate – problems - estimation of [2Hrs]

production cost of simple components such as coupling, shaft

crank etc. –problems. [2Hr]

UNIT-V

Machining Time Calculations **[12Hrs]**

Elements of metal machining - cutting speed - feed - depth

of cut - procedure for assigning cutting variables - calculation of [2Hrs]

machining time for different lathe operations like - turning – [2Hrs]

facing - chamfering - parting - knurling and forming - Calculation of [2Hrs]

machining time for operations on drilling machine - machining

time for shaping, planning, slotting, broaching and sawing [2Hrs]

operations - Machining time for face milling and slab milling

operations - timing for thread cutting - estimation of total unit time [2Hrs]

- Procedure for doing the above machining calculations with

formulae used - simple problems [2Hrs]

Text book

Sl.No	Subject	Author	Publication/Edition
1	Industrial Engineering & Management	O.P Khanna	Dhanpat Rai & Sons New Delhi
2	Production Planning Control and Industrial Management	Chain KC & Agarwal	Kana Publisher 1998 Edition

Reference Books:

Sl.No	Subject	Author	Publication/Edition
1	Production Engineering	**R.C Gupta**	Prentice hall Private Ltd 2002
2	Manufacturing Planning and Control System	Vollmann & Berri Why barka	Machraw hill 1992

LEARNING WEBSITES:

https://www.digimat.in/nptel/courses/video/110105094/L01.html

https://www.youtube.com/watch?v=yYIVumq6sVM

https://freevideolectures.com/course/2367/industrial-engineering

http://www.nptelvideos.in/2012/12/industrial-engineering.html

https://nptel.ac.in/courses/112107143/

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
C530.1	3	2	-	2	2	3	3	2	-	3
C530.2	2	2	-	2	2	2	3	2	-	2
C530.3	2	2	-	2	2	-	3	2	-	-
C530.4	2	3	-	2	2	3	3	3	-	3
C530.5	3	3	-	2	2	2	3	3	-	2
Total	12	12	-	10	10	10	15	12	-	10
Correlation Level	2.4	2.4	-	2	2	2.5	3	2.4	-	2.5

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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MEC – 530 – PROCESS PLANNING AND COST ESTIMATION

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
S.No		**Unit**	**Bloom's Level**
1.	Define manual process planning?	I	R
2.	Definition of cost control?	II	R
3.	Define process flow choice?	II	R
4.	What is technological choice?	IV	R
5.	State the objective of work study?	III	R
6.	State the objective of the method study?	III	R
7.	Define industrial cost?	V	R
8.	Define cutting speed?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
S.No		**Unit**	**Bloom's Level**
9.	Write the process planning procedure.	I	R
10.	Determination of man, machine and material requirements.	II	U
11.	Write the concept of work content.	II	R
12.	Write the application of work study.	III	U
13.	Define performance factor	IV	R
14.	Definition of cost estimation.	IV	R
15.	Define turning.	V	R
16.	Advantage of Work study.	III	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Explain the automated process planning?	I	U	10
		(OR)			
	B	Explain the generator process planning?	I	U	10
18.	**A**	Briefly explain the process and equipment selection procedure.	II	R	10
		(OR)			
	B	Factors influencing choice machinery.	II	R	10
19	**A**	State the objective of work measurement.	III	R	10
		(OR)			
	B	Explain the method of improving productivity.	III	U	10
20	**A**	Write the different method of apportioning overheads.	IV	R	10
		(OR)			
	B	Define direct cost, indirect cost and overhead expenses.	IV	R	10
21	**A**	Write the procedure for assigning cutting variable.	V	R	10
		(OR)			
	B	Write the machining time for shaping, planning, slotting.	V	R	10

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%

MEC 531 - TOTAL QUALITY MANAGEMENT

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	**Instruction**		**Examination**			
Total Quality Management	Hrs/ Week	Hrs/ Semester	**Marks**			**Duration**
	5	**75**	Internal Assessment	Semester End Examination	Total	**3Hrs**
			25	**75**	**100**	

Topics and Allocation of Hours:

Unit No	**Topics**	**Hours**
I	Basic Concepts of Total Quality Management	13
II	Continuous process improvement – Q-7 Tools	13
III	Statistical Fundamentals	13
IV	Control charts	12
V	Management Planning tools & Bench marking	12
	Revision and Test	12
	Total	**75**

COURSE DESCRIPTION:

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

OBJECTIVES:

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

- Use Bench Mark and JIT concepts.

COURSE OUTCOMES

MEC – 531 TOTAL QUALITY MANAGEMENT	
After successful completion of this course, the students should be able to	
C531.1	Define the basic concepts of total quality management
C531.2	Describe about the continuous process improvement tools.
C531.3	Express the various statistical fundamentals
C531.4	Explain about the control charts
C531.5	Description about management planning tool and bench marking.

MEC 531 - TOTAL QUALITY MANAGEMENT

UNIT-I

BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT **[13Hrs]**

Quality-Definitions - Dimensions of quality - Brainstorming and its objectives - Introduction to TQM –Characteristics –Basic concepts **[2Hrs]**

– Elements – Pillars – Principles - Obstacles to Tom implementation – Potential benefits of TQM –Quality council – **[2Hrs]**

Duties –Responsibilities –Quality statements –Vision –Mission **[2Hrs]**

Quality policy statements –Strategic planning –Seven steps to **[2Hrs]**

strategic planning –Deming philosophy- Customer delight - ISO **[2Hrs]**

9001:2008 Quality Management System requirements and **[2Hrs]**

implementation. **[1Hr]**

UNIT -II

CONTINUOUS PROCESS IMPROVEMENT –Q7 TOOLS **[13Hrs]**

Input / Output process model –Juran Trilogy –PDCA (Deming **[2Hrs]**

Wheel) cycle –5S Concepts –SEIRI, SEITON, SEISO, SEIKETSU **[2Hrs]**

and SHITSUKE –needs and objectives –effective implementation of **[2Hrs]**

5S concepts in an organisation - Housekeeping –Kaizen. **[2Hrs]**

Seven tools of quality control (Q-7 tools) –Check sheet –Types of

check sheet – Histogram – Cause and effect diagram - Pareto **[2Hrs]**

diagram – Stratification Analysis – Scatter diagram-Graph/run

charts –Control charts - Construction of above diagrams **[2Hrs]**

Quality circle - concept of quality circle - Organisation of Quality

circle and objectives of Quality circle. **[1Hr]**

UNIT-III

STATISTICAL FUNDAMENTALS **[13Hrs]**

Types of Data – Collection of Data – Classification of Data **[2Hrs]**

Tabular presentation of Data – Graphical representation of a **[2Hrs]**

frequency distribution – Comparison of Frequency distribution **[2Hrs]**

Mean – Median – Mode – Comparison of measures of central **[2Hrs]**

tendency – Introduction to measures of dispersion – Sample **[2Hrs]**

sampling - Normal curve – Sigma – Concept of six sigma **[2Hrs]**

Principles –Process- Problems. **[1Hr]**

UNIT-IV

CONTROL CHARTS **[12Hrs]**

Control chart –Types of control charts –Control chart for variables **[2Hrs]**

Construction of X and R charts –control limits Vs specification **[2Hrs]**

limits –Process capability –Method of doing process capability **[2Hrs]**

Analysis –Measures of process capability –Problems.

Attributes –Control charts –P chart –np chart –c chart –u chart – **[2Hrs]**

Construction of above diagrams –Problems - Comparison between **[2Hrs]**

variable chart and Attribute chart. **[2Hrs]**

UNIT-V

MANAGEMENT PLANNING TOOLS & BENCH MARKING **[13Hrs]**

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

Relationship diagram) –Tree diagram - Prioritization matrix –Matrix **[2Hrs]**

diagram –Decision tree –Arrow diagram –Matrix data analysis **[2Hrs]**

diagram - Construction of above diagrams.

Bench marking –Objectives of bench marking –Types –Bench **[2Hrs]**

marking process - Benefits of Bench marking –Pit falls of Bench

marking-Just In Time(JIT) concepts and its objectives - Total **[2Hrs]**

Productive Maintenance(TPM) - Introduction, Objectives of TPM -

steps in implementing TPM. **[2Hrs]**

Text book

Sl.No	Subject	Author	Publication/Edition
1	Total Quality Management	Besterfiled	Pearson Education, Asia
2	Total Quality Management	V. Jeyakumar	Laxmi Publication

Reference Books:

Sl.No	Subject	Author	Publication/Edition
1	Total Quality Management	J.S. Butter worth	Oxford
2	Total Quality Management	Zeire	Wood head publishers

LEARNING WEBSITES:

https://www.youtube.com/watch?v=ksR4Xy6tFcM

https://nptel.ac.in/courses/112107238/47

https://nptel.ac.in/courses/110104085/

https://nptel.ac.in/courses/110104080/

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
C531.1	3	2	-	2	2	3	3	2	-	3
C531.2	2	2	-	2	2	2	3	2	-	2
C531.3	2	2	-	2	2	-	3	2	-	-
C531.4	2	3	-	2	2	3	3	3	-	3
C531.5	3	3	-	2	2	2	3	3	-	2
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Correlation Level	2.4	2.4	-	2	2	2.5	3	2.4	-	2.5

QUESTION PAPER SETTING

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% to be included	90%	10%

****

MEC 531 - TOTAL QUALITY MANAGEMENT

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Define TQM.	I	R
2.	What are the pillars of TQM?	I	R
3.	List out any two barriers to TQM implementation.	I	R
4.	What is vision statement?	I	R
5.	List various techniques to sustain continuous improvement.	I	R
6.	What are the three elements of Juran trilogy?	II	R
7.	What is Kaizen?	II	R
8.	What is 5S practice?	II	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	What is check sheet?	III	R
10.	What is Histogram?	III	R
11.	Define data and information?	IV	R
12.	What are control charts?	IV	R
13.	Give the types of variations?	IV	R
14.	Define fraction defective	V	R
15.	Differentiate defect and defective?	V	U
16.	When u-chart is used?	IV	R

ART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Explain the seven steps of Strategic planning with a block diagram.	I	U	10
		(OR)			

<table>
<tr><td></td><td>B</td><td>Describing the Deming philosophy fourteen points on route to quality.</td><td>I</td><td>U</td><td>10</td></tr>
<tr><td>18.</td><td>A</td><td>Explain the various aspects of Kaizen.</td><td>II</td><td>U</td><td>10</td></tr>
<tr><td></td><td></td><td>(OR)</td><td></td><td></td><td></td></tr>
<tr><td></td><td>B</td><td>What is 5S? Explain all the elements of 5S principle in detail?</td><td>II</td><td>R/U</td><td>10</td></tr>
<tr><td>19</td><td>A</td><td>The following are scores of two batsmen Sachin and Dravid in a series of innings
<table>
<tr><td>Sachin</td><td>12</td><td>115</td><td>6</td><td>73</td><td>7</td><td>19</td><td>119</td><td>36</td><td>84</td></tr>
<tr><td>Dravid</td><td>47</td><td>12</td><td>16</td><td>42</td><td>4</td><td>51</td><td>37</td><td>48</td><td>13</td></tr>
</table>
Who is the better score getter and who is more consistent?</td><td>III</td><td>R</td><td>10</td></tr>
<tr><td></td><td></td><td>(OR)</td><td></td><td></td><td></td></tr>
<tr><td></td><td>B</td><td>Discuss why standard deviation is considered to be the ‘best’ measure of dispersion.</td><td>III</td><td>U</td><td>10</td></tr>
<tr><td>20</td><td>A</td><td>Compare X and R charts. Discuss the circumstances in which either of the two or a combination of these will be used for the purpose of control.</td><td>IV</td><td>R</td><td>10</td></tr>
<tr><td></td><td></td><td>(OR)</td><td></td><td></td><td></td></tr>
<tr><td></td><td>B</td><td>For the following sample of data draw X and R chart
<table>
<tr><td rowspan="2">Sub group Number</td><td colspan="5">Observation</td></tr>
<tr><td>X1</td><td>X2</td><td>X3</td><td>X4</td><td>X5</td></tr>
<tr><td>1</td><td>6.0</td><td>5.8</td><td>6.1</td><td>6.1</td><td>6.9</td></tr>
<tr><td>2</td><td>5.2</td><td>6.4</td><td>6.9</td><td>6.2</td><td>5.2</td></tr>
<tr><td>3</td><td>5.5</td><td>5.8</td><td>5.2</td><td>4.9</td><td>6.6</td></tr>
<tr><td>4</td><td>5.0</td><td>5.7</td><td>6.5</td><td>7.0</td><td>6.4</td></tr>
<tr><td>5</td><td>6.7</td><td>6.5</td><td>5.5</td><td>5.4</td><td>6.5</td></tr>
<tr><td>6</td><td>5.8</td><td>5.2</td><td>5.0</td><td>6.6</td><td>7.0</td></tr>
<tr><td>7</td><td>5.6</td><td>5.1</td><td>5.2</td><td>4.2</td><td>6.2</td></tr>
<tr><td>8</td><td>6.0</td><td>5.8</td><td>6.0</td><td>6.7</td><td>5.4</td></tr>
</table></td><td>IV</td><td>R</td><td>10</td></tr>
<tr><td>21</td><td>A</td><td>Explain briefly the method of drawing matrix diagram.</td><td>V</td><td>U</td><td>10</td></tr>
<tr><td></td><td></td><td>(OR)</td><td></td><td></td><td></td></tr>
<tr><td></td><td>B</td><td>Describe the steps in Benchmarking process.</td><td>V</td><td>U</td><td>10</td></tr>
</table>

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%

MEC 542 – PRESS TOOLS

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	External End Examination	Total	
Press Tools	**5**	**75**	**25**	**75**	**100**	3 Hrs

Topics and Allocation of Hours:

Unit	Topics	Hours
I	Press working fundamentals, operations, and machinery	13
II	Press & press tool accessories and cutting dies	13
III	Bending and forming dies	13
IV	Drawing dies and dies for secondary operations	12
V	Fine blanking tool and specialized press tool applications	12
	REVISION AND TEST	12
	Total	**75**

COURSE DESCRIPTION:

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

OBJECTIVES:

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

MEC – 542 PRESS TOOLS	
After successful completion of this course, the students should be able to	
C542.1	Define about the fundamentals of press working.
C542.2	Explain the various press and press tool accessories.
C542.3	Describe the various bending, forming other press working operations
C542.4	Define the drawing and other related processes
C542.5	Demonstrate the construction and working principle of various fine blanking dies.

MEC -542 PRESS TOOLS

UNIT - I

PRESS WORKING FUNDAMENTALS, [13 Hrs]

OPERATIONS AND MACHINERY

Shearing Theory-Critical stages of shearing, Features of a punched hole, features of the slug, burr. Clearance - Effects of Optimum **[2Hrs]**

Excessive and Insufficient clearances, Clearance for blanking and Piercing, Land and Angular Clearance. Cutting Force –Methods to **[2Hrs]**

reduce cutting force, stripping force.

Press working operations - Blanking, Piercing, Cutting off, Parting off **[2Hrs]**

perforating, embossing, coining, bending, forming, drawing, curling, bulging, extrusion, swaging, trimming, and shaving. Safety in press **[2Hrs]**

working.

Presses - Common types of Presses, Main parts of a typical power press, OBI Press, Specification of presses, Comparison of **[2Hrs]**

Mechanical, hydraulic and Pneumatic presses. Single action, double action and triple action presses.

Press operating parameters – Tonnage, shut height, stroke, shut **[2Hrs]**

height adjustment, strokes per minute, die space. Special purpose

presses –Press brake, transfer press, multi slide machine. **[1Hr]**

UNIT -II

PRESS & PRESS TOOL ACCESSORIES AND CUTTING DIES [13Hrs]

Press Feeding Mechanisms - Uncoilers, Straighteners and recoilers **[2Hrs]**

Hand feed, hitch/grip feed, Roll feed, Hopper feeds, dial feeds

chutes, slides, magazine feeds. **[2Hrs]**

Ejection mechanism –Ejection by Gravity, air ejection, mechanical

ejection, semi automatic and automatic ejection, Mechanical hands, **[2Hrs]**

ejection by next part.

Parts and functions of a press tool - Punches, Dies, Stoppers, Trigger **[2Hrs]**

stops, Strippers –Fixed and Travelling, Gauges, Pilots-Methods of

piloting, shanks -Strip layout, Economy factor **[2Hrs]**

Cutting Dies - Construction and working of Blanking tool, Piercing

tool, Progressive tool, Compound tool. Commercially available die **[2Hrs]**

components –Die sets, die set attachment devices, punches, die

buttons, retainers, springs, fluid springs, die cushion and its types. **[1Hr]**

UNIT -III

BENDING AND FORMING DIES **[13Hrs]**

Bending of sheet metal – Bending theory, neutral axis, metal movement, spring back, methods of overcoming spring back. Bending Operations – Bending, flanging, hemming, curling, seaming, and corrugating. Types of Bending dies (construction and working principle) – V bending and its types, edge bending, U bending Bending operations done using press brake **[2Hrs] [1Hr] [2Hrs] [2Hrs]**

Forming dies –Construction and working principle of solid form dies pad form dies, curling dies, embossing dies, coining dies, swaging dies, bulging dies, crimping, tube forming. Assembly dies - Riveting, tab stake, upset stake, crimping. **[2Hrs] [2Hrs] [2Hrs]**

UNIT-IV

DRAWING DIES AND DIES FOR SECONDARY OPERATIONS **[12Hrs]**

Drawing operations –Shallow drawing, deep drawing. Analysis of cup drawing – Stages of drawing. Variables of drawing – Bending and straightening variables, friction variables, compression variables, stretch forming variables, analysis of draw speed. Draw dies & its construction and working principle –Conventional draw die, inverted draw die, redrawing and reverse drawing dies, drawing of square or rectangular shapes. Blank holders, blank holding pressure and its importance, air vents, drawing inserts, draw beads. Drawing with flexible tooling –Marform process, Hydro form process. Drawing defects, causes and remedies **[2Hrs] [2Hrs] [2Hrs] [2Hrs] [2Hrs] [2Hrs]**

Dies for secondary operations – Construction and working principle of Semi piercing dies, shear form dies, dies for formed contours notching die, shaving die, side piercing die. **[2Hrs]**

UNIT-V

FINE BLANKING TOOL AND SPECIALISED PRESS TOOL APPLICATIONS **[12Hrs]**

Fine blanking - Definition and Applications of fine blanking, Working principle of fine blanking tool, V Ring, function of V ring. Comparison of fine blanking with blanking. Clearance and press force calculations **[2Hrs] [2Hrs]**

Fine Blanking Machines - Working principle, Ram movement Mechanical drives, hydraulic drives, Machine force, Ring indenter force, counter force. Fine blanking tools - Compound die tooling system with sliding punch, compound die tooling with fixed punch **[2Hrs]**

Specialized Press Tool Applications - Construction, advantage and applications of advanced multistage tooling, unit tooling, angular piercing tools, CNC turret press. Principle of Quick Die Change (QDC) – need and advantages. Single Minute Exchange of Dies SMED) – concept need and advantages. Factors Affecting Tool Service Life - Introduction, Elements of Tool performance, Procedure for investigation of tool failure, Trouble shooting in press tools, effect of heat treatment on service life of tools. **[2Hrs]** **[2Hrs]**

Text book

Sl.No	Subject	Author	Publication/Edition
1	Advanced die making	Eugene ostergaard.D,	Tata. McGraw
2	Tool Testing	Donaldson	Tata. McGraw

Reference Books:

Sl.No	Subject	Author	Publication/Edition
1	ToolEngineers Handbook	ASTME	Tata. McGraw
2	Hand book of die design	Ivana Suchy	Tata. McGraw
3	Basic die making	Eugene ostergaard.D,	Tata. McGraw

LEARNING WEBSITES:

https://nptel.ac.in/courses/112107144/7

https://nptel.ac.in/downloads/112105127/

https://nptel.ac.in/courses/112106153/Module%201/Lecture%201/Lecture_1.pdf

https://nptel.ac.in/courses/112107144/6

https://nptel.ac.in/courses/112107144/Metal%20Forming%20&%20Powder%20metallurgy/lecture3/lecture3.htm

https://nptel.ac.in/courses/107103012/module4/lec3.pdf

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
C542.1	2	2	2	2	-	-	3	3	2	2
C542.2	3	2	3	3	-	-	3	2	3	3
C542.3	2	2	2	2	-	-	3	3	2	2
C542.4	2	2	2	2	-	-	3	3	2	2
C542.5	2	2	2	2	-	-	3	2	2	2
Total	11	10	11	11	-	-	15	13	11	11
Correlation Level	2.2	2	2.2	2.2	-	-	3	2.6	2.2	2.2

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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MEC -542 PRESS TOOLS

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Define Clearance	I	R
2.	Define Cutting Force	I	R
3.	Write are the any three type of Ejection	II	R
4.	What is the Economy factor?	III	R
5.	What are the types of Bending dies	III	R
6.	Define neutral axis	IV	R
7.	Define compression variable	IV	R
8.	Define ram movement	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	Methods to reduce cutting force, stripping force.	I	R
10.	What are the Common types of Presses	I	R
11.	Define Progressive tool	II	R
12.	Draw the Strip layout	II	R
13.	Define reveting crimping.	III	R
14.	What are the difference between friction variables and compression variables?	IV	R
15.	What are the difference between notching die, shaving die?	I	R
16.	What are the advantages of fine blanking?	V	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Explain Press working operations	I	U	10
		(OR)			
	B	Explain Effects of Optimum Excessive and Insufficient clearances?	I	U	10
18.	**A**	Explain the Ejection mechanism	II	U	10
		(OR)			
	B	Construction and working of Blanking tool, Piercing	II	R	10
19	**A**	Construction and working principle of solid form dies.	III	R	10
		(OR)			
	B	Construction and working principle curling dies, embossing dies, coining dies.	III	R	10
20	**A**	Construction and working principle of, Semi piercing dies.	IV	R	10
		(OR)			
	B	Explain Drawing operations –Shallow drawing, deep drawing?	IV	U	10
21	**A**	Explain working principle of fine blanking tool?	V	U	10
		(OR)			
	B	Write the Procedure for investigation of tool failure	V	R	10

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%

MEC- 543 RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

Topics and Allocation of Hours:

Unit	Topics	Hours
I	FUNDAMENTALS OF ENERGY, WIND ENERGY	13
II	SOLAR ENERGY,APPLICATION,STORAGE	13
III	SOLAR PHOTO VOLTAIC SYSTEM AND DESIGN OCEAN, TIDAL , WAVE ENERGY	13
IV	BIO-ENERGY	12
V	ENERGY CONSERVATION TECHNIQUES AND ENERGY AUDIT	12
	REVISION AND TEST	12
	TOTAL	**75**

COURSE DESCRIPTION:

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 543 ENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION	
After successful completion of this course, the students should be able to	
C543.1	Discuss the fundamentals of renewable energy and details about wind energy.
C543.2	Explain the functions and applications of solar cells
C543.3	State the economics of solar energy system and discuss about ocean and tidal energy.
C543.4	List out the bio energy applications.
C543.5	Explain and analysis of energy and audit management.

MEC – 543 RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

UNIT-I

FUNDAMENTALS OF ENERGY [13Hrs]

Introduction to Energy-Energy consumption and standard of living- classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources- energy for sustainable development [2Hrs]

WIND ENERGY

Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems-components of conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage–Application of wind energy-Safety and environmental aspects. [2Hrs] [2Hrs] [2Hrs] [2Hrs] [1Hrs]

UNIT-II

SOLAR ENERGY [13Hrs]

Introduction –Solar radiation at the earth's surface-Solar Radiation measurements-Estimation of average solar Radiation [2Hrs]

Solar energy collectors- Classifications-Flat plate collectors Concentrating collectors-performance parameter-tracking system-compound parabolic concentrator-parabolic trough concentrators-concentrator with point focus-heliostats-comparisons of various collectors-efficiency of collector-selection of collector for various applications. [2Hrs] [2Hrs]

Solar Thermal Application: Solar water heaters-Solar industrial heating system –Solar Refrigeration and Air-Conditioning Systems Solar cookers-Solar furnaces-Solar greenhouse-Solar Distillation Solar pond Electric power plant-Distributed Collector- Solar thermal Electric power plant. [2Hrs] [2Hrs]

Solar thermal energy storage: sensible storage-latent heat storage-thermo chemical storage. [1Hr]

UNIT-III

Solar photovoltaic System and Design: [13Hrs]

Solar photovoltaic a brief history of PV,PV in Silicon basis principle, crystalline PV; reducing cost and raising efficiency, thin film [2Hrs]

PV, other innovative technologies, electrical characteristics of silicon PV cells and modules, grid connected PV system, cost of energy from PV ,Environmental impact and safety [2Hrs]

System design of solar photovoltaic system: Load analysis-solar array Design-Battery Design-Simple formulas. System design procedure. Case Studies: Designing solar home lighting system [2Hrs]

Designing stand alone solar PV Power plant - Designing solar PV water pumping system - Only arriving load capacity - solar array sizing - Battery sizing - Inverter capacity and mountings. [1Hr]

Ocean energy, Tidal & Wave energy

Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilization – basic principle of tidal power – components and operations of tidal power plant –Energy and Power [2Hrs]

forms of waves –Wave energy conversion devices [2Hrs]

UNIT-IV

BIO – ENERGY [12Hrs]

Introduction – photo synthesis – usable forms of bio mass, their [2Hrs]

composition and fuel properties-Biomass resources – Biomass [2Hrs]

conversion technologies – Urban waste to energy conversion – [2Hrs]

Biomass gasification – biomass liquefaction – biomass to ethanol [2Hrs]

production – Biogas production from waste Biomass – types of bio [2Hrs]

gas plants - applications – Bio diesel production – Biomass energy programme in India. [2Hrs]

UNIT-V [12Hrs]

Energy Management and Audit, Conservation

Energy Management and Audit, Conservation: Definition, Energy audit - need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel [2Hrs] [2Hrs]

and energy substitution, Energy audit instruments

Energy Conservation Techniques- Need and importance of energy conservation -Principles of energy conservation- Methods of energy conservation-Cogeneration and its application-Combined cycle system-Concept of energy management-Study of different energy management techniques like-Analysis of input-Reuse and recycling of waste. Economic approach of Energy Conservation-Costing of utilities like steam, compressed air, electricity and water-Ways of improving boiler efficiency-Thermal insulation, Critical thickness of insulation-Waste heat recovery systems, their applications, criteria for installing unit-An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans. [2Hrs] [2Hrs] [2Hrs] [2Hrs]

Text Books:

Sl.No	Subject	Author	Publication/Edition
1	Non Conventional Energy Sources -	G.D. Rai	Khanna Publishers, New Delhi,1999.
2	Non Conventional Energy Sources and Utilisation	R.K. Rajput	.Chand & Company Ltd., 2012.

LEARNING WEBSITES:

https://nptel.ac.in/downloads/108108078/

https://nptel.ac.in/courses/113104012/34

https://nptel.ac.in/courses/105105110/pdf/m5l01.pdf

https://nptel.ac.in/courses/102104057/3

https://beeindia.gov.in/sites/default/files/1Ch3.pdf

https://lecturenotes.in/materials/25639-note-of-energy-audit-conservation-and-management-by-guptaji-b

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
C543.1	2	-	2	-	2	2	3	2	2	2
C543.2	2	-	2	-	2	2	3	3	3	3
C543.3	2	-	2	-	2	2	3	2	2	2
C543.4	2	-	2	-	2	2	3	2	2	2
C543.5	2	-	2	-	2	2	3	3	3	3
Total	10	-	10	-	10	10	15	12	12	12
Correlation Level	2	-	2	-	2	2	3	2.4	2.4	2.4

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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543 RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
S.No		**Unit**	**Bloom's Level**
1.	What is primary energy source?	I	R
2.	Define wind energy.	I	R
3.	Define solar thermal system.	II	R
4.	Define solar photovoltaic system.	II	R
5.	Define bio-mass energy.	IV	R
6.	What is photosynthesis?	IV	R
7.	Define energy management.	V	R
8.	Define refrigeration.	V	
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
S.No		**Unit**	**Bloom's Level**
9.	Classify the energy resource.	I	R
10.	State any three application of wind energy.	I	R
11.	What is solar collector?	II	R
12.	Define solar collector efficiency.	II	R
13.	Mention any three bio-mass resources.	IV	R
14.	State any three application of bio-gas plant.	IV	R
15.	Classify the energy audit	V	R
16.	Write the need of energy conservation.	V	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
S.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Explain green house effect	I	U	10
		(OR)			
	B	i)Explain energy chain ii)Define energy storage	I	U/R	7 3
18.	**A**	Explain solar green house	II	U	10
		(OR)			
	B	Explain the solar thermal electric power plant	II	U	10
19	**A**	Explain any two application of photovoltaic system.	III	U	10
		(OR)			
	B	Explain the principle of ocean thermal electric conversion	III	U	10
20	**A**	Explain bio-mass conversion technologies.	IV	U	10
		(OR)			
	B	Explain the process of gasification	IV	U	10
21	**A**	Explain the methods of energy conversion.	V	U	10
		(OR)			
	B	Explain the economic approach of energy conservation	V	U	10

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%

MEC - 550 PROCESS AUTOMATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

ALLOCATION OF MARKS

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

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

MEC – 550 PROCESS AUTOMATION PRACTICAL	
After successful completion of this course, the students should be able to	
C550.1	Develop and operate pneumatic and fluid power circuits.
C550.2	Apply PLC system and its elements for process control.
C550.3	Memorize the working of function blocks in PLC.
C550.4	Demonstrate the automatic operation of pneumatic cylinder using PLC.
C550.5	Record of work to be prepared.

EQUIPMENTS REQUIRED

LATHE		
S.No	**Name of the equipment**	**Required Nos.**
1	Pneumatic Trainer Kit	02
2	Hydraulics Trainer Kit	01
3	PLC kit.	02
4	Computer with software	05

MEC - 550 PROCESS AUTOMATION PRACTICAL

Sl.No	Name of the exercise	Course Outcome
Pneumatics Lab.		
Ex.1	Direct operation of single and double acting cylinder.	C550.1, C550.5
Ex.2	Operation of double acting cylinder with quick exhaust valve.	C550.1, C550.5
Ex.3	Speed control of double acting cylinder using metering-in and metering-out circuits.	C550.1, C550.5
Ex.4	Automatic operation of double acting cylinder in single cycle - using limit switch.	C550.1, C550.5
Ex.5	Automatic operation of double acting cylinder in multi cycle - using limit switch	C550.1, C550.5
Hydraulics Lab		
Ex.6	Direct operation of double acting cylinder	C550.1, C550.5
Ex.7	Direct operations of hydraulic motor.	C550.1, C550.5
Ex.8	Speed control of double acting cylinder metering –in and metering- out control	C550.1, C550.5
PLC Lab.		
Ex.9	Direct operation of a motor using latching circuit	C550.1, C550.2, C550.5
Ex.10	Operation of a motor using 'AND' logic	C550.1, C550.2, C550.5
Ex.11	Operation of a motor using 'OR' 'control	C550.1, C550.2, C550.5
Ex.12	On-Delay control of a motor and Off –Delay control of a motor.	C550.1, C550.2, C550.5
Ex.13	Automatic operation of a Double acting cylinder-single cycle.	C550.1, C550.4, C550.5
Ex.14	Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.	C550.1, C550.4, C550.5
Ex.15	Automatic operation of Double acting cylinder-Multi cycle.	C550.1, C550.4, C550.5
Ex.16	Sequential operation of double acting cylinder and a motor.	C550.1, C550.4, C550.5

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

https://nptel.ac.in/syllabus/syllabus_pdf/108105088.pdf

https://www.youtube.com/watch?v=UQ16Cous_tY

https://www.youtube.com/watch?v=oxMdDsud5vg

https://www.youtube.com/watch?v=rFs0zwx_s9g

https://www.youtube.com/watch?v=lteMiCRHKGE

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C550.1	2	1	2	2	-	2	3	2	-	2
C550.2	3	1	3	3	-	2	3	2	-	2
C550.3	3	1	3	3	-	2	3	2	-	2
C550.4	2	1	2	2	-	2	3	2	2	2
C550.5	2	1	2	2	-	2	3	2	2	2
Total	12	5	12	12	-	10	15	10	-	10
Correlation Level	2.2	1	2.2	2.2	-	2	3	2	2	2

MEC –560 THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

- □ Determine the flash and fire point of oil by using open & closed cup apparatus
- □ Determine the absolute viscosity by using redwood & saybolt viscometer
- □ Draw the valve timing diagram of petrol or diesel engines.
- □ Draw the port timing diagram of petrol or diesel engines.
- □ Conduct performance test on petrol or diesel engines.

- □ Prepare a heat balance sheet petrol or diesel engines
- □ Prepare a Morse test on a petrol or diesel engines
- □ Identify the various tools and their applications used in Automobile.
- □ Dismantle and assemble fuel injection pump & fuel injectors.
- □ Dismantle and assemble of power transmission and differential unit.
- □ Dismantle and assemble steering gear box.
- □ Testing and charging of batteries. Overhauling of starter motor, alternator & dynamo.

COURSE OUTCOMES

MEC – 560 THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL	
After successful completion of this course, the students should be able to	
C560.1	Analyze the flash, fire point and viscosity of oil
C560.2	Sketch the valve timing and port timing diagram of petrol or diesel engine.
C560.3	Express the effect of various operating variables on engine performance.
C560.4	Identify the various tools and their applications used in automobiles.
C560.5	Dismantle and assembly of various automobile circuits.

EQUIPMENTS REQUIRED

THERMAL		
S.No	**Name of the equipment**	**Required Nos.**
1	Open cup apparatus to determine Flash and fire points	2 Nos.
2	Close cup apparatus to determine Flash and fire points	2 Nos.
3	Redwood viscometer	2 Nos.
4	Saybolt viscometer	2 Nos.
5	4 stroke cycle petrol / diesel engine Model	2 Nos.
6	2 stroke cycle petrol / diesel engine Model	2 Nos.
7	Petrol / Diesel engine of any make with following arrangements Load test arrangement Heat balance test arrangement	2 Nos.
8	Multi cylinder petrol engine of any make with Morse test setup	1 No.
AUTOMOBILE PRACTICAL		
9	Automobile Mechanic's-Complete Set tools	2 Set
10	4 stroke petrol engine- with all accessories	1 No.
11	4 stroke Diesel engine- with all accessories	1 No.

12	Internal circlip plier, bearing puller	1 No.
13	Feeler gauge to check valve clearance, hammer and accessories	1 No.
14	SOLEX carburetor	1 No.
15	MPFI.	1 No.
16	Inline Fuel Injection Pump	1 No.
17	CRDI	1 No.
18	Injectors.	1 No.
19	Clutch set arrangement with tools	1 No.
20	Complete gear box with tools	1 No.
21	Complete steering arrangement	1 No.
22	Differential unit with axles	1 No.
23	Battery	1 No.
24	Battery Charger	1 No.
25	Starter Motor	1 No.
26	Alternator	1 No.
27	Dynamo	1 No.

MEC –560 THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL

Sl.No	Name of the exercise	Course Outcome
PART - A		
Ex.1	Determine flash and fire point of the given oil by using open cup apparatus and closed cup apparatus.	C560.1
Ex.2	Determine the absolute viscosity of the given lubricating oil by using Redwood viscometer / say bolt viscometer.	C560.1
Ex.3	Draw a Port timing diagram of two stroke petrol / diesel Engines.	C560.2
Ex.4	Draw a Valve time diagram for four stroke petrol / diesel engines.	C560.2
Ex.5	To conduct a load test on a petrol / diesel Engines.	C560.3
Ex.6	To conduct a Morse test on multi cylinder petrol / diesel engines	C560.3
Ex.7	To conduct a Heat balance test on a Four Stroke Petrol (or) Diesel engines.	C560.3
PART - B		
Ex.8	Dismantling, assembling of pressure plate, clutch plate and steering gear box.	C560.4,C560.5
Ex.9	Dismantling, inspecting and assembling of gear box and find out the gear ratios.	C560.4,C560.5
Ex.10	Dismantling, inspecting and assembling of final drive and differential units. Adjusting of backlash and correct tooth contact of crown and pinion of differential unit.	C560.4,C560.5
Ex.11	Removing camshaft, replacing timing gears, removing valves and adjusting valve clearance.	C560.4,C560.5
Ex.12	Removing, servicing and replacing Solex carburettor (OR) MPFI system.	C560.4,C560.5
Ex.13	Dismantling and assembling of inline fuel injection pump (OR) CRDI system and Injectors	C560.4,C560.5
Ex.14	Test a battery with specific gravity test and charge the battery with constant ampere/ voltage method. Dismantling, overhauling and assembling of starter motor and alternator (OR) dynamo.	C560.4,C560.5

Continuous Internal Assessment

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

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

b) Procedure/ observation and tabulation/ Other Practical related work : 10 marks

c) Record writing : 10 marks

Total **25 marks**

LEARNING WEBSITES:

https://www.youtube.com/watch?v=qDDzbGPQaog

https://www.youtube.com/watch?v=bZ5TOecenyc

https://www.youtube.com/watch?v=xUFZhZLYEgU

https://www.youtube.com/watch?v=PgvD9mx9Doo

https://www.youtube.com/watch?v=DjjbItLWNVQ

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C560.1	3	3	3	3	-	2	3	2	2	3
C560.2	3	2	3	2	-	2	3	3	2	3
C560.3	3	2	3	2	-	2	3	2	3	3
C560.4	2	3	2	3	-	2	3	3	3	2
C560.5	2	2	2	2	-	2	3	2	2	2
Total	13	12	13	12	-	10	15	12	12	13
Correlation Level	2.6	2.4	2.6	2.4	-	2	3	2.4	2.4	2.6

MEC 570- LIFE AND EMPLOYABILITY SKILLS

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 15Weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours/ Semester	Internal Assessment	Board Examination	Total	
Life and Employability Skills	4Hours	60 Hours	25	75	100	3 Hours

ALLOCATION OF MARKS:

INTERNAL MARKS	**25 MARKS**
LISTENING	**25 MARKS**
SPEAKING	**30 MARKS**
WRITING & READING	**20 MARKS**

Topics and Allocation of Hours:

Sl. No.	Section	No. of Hours
1	**Part A- Communication**	**30**
2	**Part B** - Entrepreneurship, Project Preparation, Productivity, occupational safety, health hazards, quality tools & labour welfare	**20**
3	**Part C**- Environment, Global Warming, Pollution	**10**
	TOTAL	**60**

COURSE DESCRIPTION

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

SPECIFIC INSTRUCTIONAL OBJECTIVES

1. Emphasize and Enhance Speaking Skills
2. Increase Ability to Express Views & Opinions
3. Develop and Enhance Employability Skills

4. Induce Entrepreneurship and Plan for the Future
5. Expose & Induce Life Skills for Effective Managerial Ability

COURSE OUTCOMES

MEC – 570 LIFE AND EMPLOYABILITY SKILLS PRACTICAL	
After successful completion of this course, the students should be able to	
C570.1	Emphasize and enhance speaking skills
C570.2	Increase ability to express views and opinions
C570.3	Develop and enhance employability skills
C570.4	Induce entrepreneurship and plan for the future
C570.5	Expose and induce life skills for effective managerial ability

MEC 570- LIFE AND EMPLOYABILITY SKILLS

SYLLABUS

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

V	**Environment, Global Warming, Pollution**	answering questions -- fill in blanks the exact words heard	**10**

LEARNING STRUCTURE **100 Marks**

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

a) Listening **25 Marks**

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

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

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

c) Writing & Reading **20 Marks**

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

d) Continuous Assessment (Internal Marks) **25 Marks**

(search,read, write down, speak, listen, interact & discuss)

1. Cognitive Skills (Google search on focused topics)

2. Presentation Skills& Interactive Skills (after listening, discuss)

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

Attendance **05 Marks**

INTERNAL MARKS **25 MARKS**

EXTERNAL MARKS AT END EXAMINATION **75 MARKS**

INTERNAL ASSESSMENT

Attendance	- 5 marks
Output and record	- 20 marks

Total	**- 25 marks**

CO- POs & PSOs MAPPING MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C570.1	-	-	-	-	3	-	3	3	1	1
C570.2	-	-	-	-	3	-	3	3	1	1
C570.3	-	-	-	-	3	-	3	3	1	1
C570.4	-	-	-	-	3	-	3	3	1	1
C570.5	-	-	-	-	3	-	3	3	1	1
Total	-	-	-	-	15	-	15	15	1	1
Correlation Level	-	-	-	-	3	-	3	3	1	1

MEC – 610 INDUSTRIAL ENGINEERING AND MANAGEMENT

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
Industrial Engineering and Management	5	75	Internal Assessment	Semester End Examination	Total	3 Hours
			25	75	100	

Topics and Allocation of Hours:

UNIT NO.	TOPIC	HOURS
I	PLANT ENGINEERING AND PLANT SAFETY	13
II	WORK STUDY, METHOD STUDY AND WORK MEASUREMENT	13
III	PRODUCTION PLANNING AND QUALITY CONTROL	13
IV	PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR:	12
V	FINANCIAL AND MATERIAL MANAGEMENT	12
	REVISION AND TEST	12
	TOTAL	**75**

COURSE DESCRIPTION:

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 610 INDUSTRIAL ENGINEEERING MANAGEMENT	
After successful completion of this course, the students should be able to	
C610.1	Differentiate the types of layouts and to explain the safety aspects.
C610.2	Explain the various work measurement technique.
C610.3	Define the principles of production, planning and explain the objectives of quality control.
C610.4	Explain the functions of management and discuss about organizational behavior.
C610.5	Describe the functional and material management.

MEC – 610 INDUSTRIAL ENGINEERING AND MANAGEMENT

UNIT –I

PLANT ENGINEERING AND PLANT SAFETY [13Hrs]

Plant Engineering : Plant – Selection of site of industry – Plant [2Hrs]
layout – Principles of a good layout – types – process, product and
fixed position – techniques to improve layout – Principles of material [2Hrs]
handling equipment – Plant maintenance – importance – Break
down maintenance, preventive maintenance and scheduled [2Hrs]
maintenance. **Plant Safety:** Importance –accident-causes and cost [2Hrs]
of an accident-accident proneness-prevention of accidents-Industrial [2Hrs]
disputes-settlement of Industrial disputes-Collective bargaining [1Hr]
conciliation, Mediation, arbitration-Indian Factories Act 1948 and its [2Hrs]
provisions related to health, welfare and safety .

UNIT –II

WORK STUDY, METHOD STUDY AND WORK MEASUREMENT [13Hrs]

Work Study: Productivity – Standard of living – method of
improving productivity– Objectives – Importance of good working [2Hrs]
conditions.
Method Study: Definition – Objectives – Selection of a job for [2Hrs]
method study –Basic procedure for conduct of method study –
Tools used – Operation process chart, Flow process chart, two [2Hrs]
handed process chart, Man machine chart, String diagram and flow diagram.
Work Measurement: Definition – Basic procedure in making a time study – [2Hrs]
Employees rating factor – Application of time allowances
Rest, Personal, Process, Special and Policy allowances – [2Hrs]
Calculation of standard time – Problems – Basic concept of
production study – Techniques of work measurement-Ratio delay [2Hrs]
study, Synthesis from standard data, analytical estimating and Pre
determined Motion Time System (PMTS). [1Hr]

UNIT-III

PRODUCTION PLANNING AND QUALITY CONTROL [13Hrs]

Production Planning and Control: Introduction – Major functions of production planning and control – Pre planning – Methods of [2Hrs]

forecasting – Routing and scheduling – Dispatching and controlling – Concept of Critical Path Method (CPM)-Description only. [2Hrs]

Production – types-Mass production, batch production and job order production- Characteristics – Economic Batch Quantity (EBQ) – [2Hrs]

Principles of product and process planning – make or buy decision

Quality Control: Definition – Objectives – Types of inspection – [2Hrs]

First piece, Floor and centralized inspection – Advantages and disadvantages. Quality control – Statistical quality control – Types of [2Hrs]

measurements – Method of variables – Method of attributes – Uses of X, R, p and c charts – Operating Characteristics curve (O.C [2Hrs]

curve) – Sampling inspection – single and double sampling plan – Concept of ISO 9001:2008 Quality Management System [1Hr]

Registration Certification procedure – Benefits of ISO to the Organization- National Trading System.

UNIT-IV

PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR: [12Hrs]

Principles of Management: Definition of management – Administration - Organization – F.W. Taylor's and Henry Fayol's [2Hrs]

Principles of Management – Functions of Manager – Directing – Leadership -Styles of Leadership – Qualities of a good leader – Motivation – Positive and negative motivation --Modern [2Hrs]

management techniques- Just In Time – Total Quality Management (TQM) – Quality circle – Zero defect concept – 5S Concept-

Management Information Systems – Strategic management – [2Hrs]

SWOT Analysis --Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) –Supply Chain Management SCM) – Activity Based Management (ABM) – Global Perspective – Principles and brief describtion.

Personnel Management: Responsibility of human resource [2Hrs]

management – Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school

training – Job evaluation and merit rating – objectives and

importance – wages and salary administration – Components of [2Hrs]

wages – Wage fixation – Type of wage payment – Halsey's 50% plan, Rowan's plan and Emerson's efficiency plan – Problems.

Organizational behavior: Definition – organization--Types of Organization – Line, Staff, Taylor's Pure functional types – Line and staff and committee type –Organizational Approaches, individual behavior—causes—Environmental effect—Behavior and Performance, Perception-organizational implications [1Hr] [1Hr]

UNIT-V

FINANCIAL AND MATERIAL MANAGEMENT [12Hrs]

Financial Management: Fixed and working capital – Resources of capital – shares preference and equity shares – debentures – Type of debentures – Public deposits, Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit – Problems. Depreciation – Causes – Methods - Straight line, sinking fund and percentage on diminishing value method –Problems [2Hrs] [2Hrs] [2Hrs]

Material management: Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level-Economic order quantity problems – supply chain management – Introduction Purchasing procedure – Store keeping – Bin card. [2Hrs] [2Hrs] [2Hrs]

Text Books:

Sl.No	Subject	Author	Publisher/Edition
1	Industrial Engineering and Management	O.P. Khanna	Publications(P)Ltd Revised Edition
2	Engineering Economics and Management	T.R. Banga & S.C. Sharma	McGraw Hill/ Editiion. 2 – 2001,

Reference Books:

Sl.No	Subject	Author	Publisher/Edition
1	Management, A global perspective	Heinz Weihrich, Harold Koontz	10^{th} Edition, McGraw Hill International Edition.Latest
2	Essentials of Management	Joseph L.Massie	, Prentice-Hall of India, 4th Edition
3	Organizational Behaviours	S.Chandran	Vikas Publishing House Pvt. Ltd Edition.Latest

LEARNING WEBSITES:

https://nptel.ac.in/courses/112107142/
http://textofvideo.nptel.ac.in/112107143/lec9.pdf
http://www.nptelvideos.in/2012/12/industrial-engineering.html
https://nptel.ac.in/courses/112107143/35

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
C610.1	3	-	2	-	3	3	3	3	-	1
C610.2	3	-	2	-	3	3	3	3	-	1
C610.3	3	-	2	-	3	3	3	3	-	1
C610.4	3	-	2	-	3	3	3	3	-	1
C610.5	3	-	2	-	3	3	3	3	-	1
Total	15	-	10	-	15	15	15	15	-	5
Correlation Level	3	-	2	-	3	3	3	3	-	1

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%

****

MEC – 610 INDUSTRIAL ENGINEERING AND MANAGEMENT

Time: 3 Hrs

Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	What is a plant?	I	R
2.	State the advantages of a good layout.	I	R
3.	Give any two objectives of work study.	II	R
4.	State the objectives of work measurement.	II	R
5.	What is the definition of EBQ?	III	R
6.	Why pre-planning is done in PPC?	III	R
7.	State any two qualities of a good leadership.	IV	R
8.	What is ABC analysis?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	What is meant by maintenance?	I	R
10.	List any two safety law's.	I	R
11.	Define standard time.	II	R
12.	What is production study?	II	R
13.	What is meant by quality of a product?	III	R
14.	Explain the dispatching.	IV	U
15.	Define: Management and Administration.	IV	R
16.	Explain the concept of Economic Order Quantity.	V	U

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	What are the different types of plant layout? Explain any two with neat sketches.	I	R	10
		(OR)			
	B	What are the cost and causes of accident? Explain each.	I	R	10
18.	**A**	Write down the basic procedure for conduct of method study and explain.	II	R	10
		(OR)			
	B	Explain the various steps involved in the conduct of stop watch time study.	II	U	10
19	**A**	What is forecasting? Explain the different techniques of forecasting.	III	R.U	5 5
		(OR)			
	B	With suitable line diagrams, explain the single and double sampling plan.	III	R	10
20	**A**	State the different types of organization. Explain any one type.	IV	R	10
		(OR)			
	B	What are the different types of wages payment? Discuss the merits and demerits of each.	IV	R/R	5 5
21	**A**	Explain by means of a block diagram how the selling price of a product is determined.	V	U	10
		(OR)			
	B	Explain how total cost of inventory can be efficiently controlled by "ABC" technique.	V	U	10

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%

MEC - 620 COMPUTER AIDED DESIGN AND MANUFACTURING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Course	Instructions		Examination			
Computer Aided Design and Manufacturing	**Hrs / Week**	**Hrs / Semester**	**Marks**			**Duration**
	5	75	**Internal Assessment**	**Semester End Examination**	**Total**	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	COMPUTER AIDED DESIGN	13
II	COMPUTER AIDED MANUFACTURING	13
III	CNC PROGRAMMING, RAPID PROTOTYPING	13
IV	COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT	12
V	CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, AUGMENTED REALITY.	12
	REVISION AND TEST	12
	Total	**75**

COURSE DESCRIPTION:

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 620 COMPUTER AIDED DESIGN AND MANUFACTURING	
After successful completion of this course, the students should be able to	
C620.1	Discuss and explain the various factors in CAD.
C620.2	Explain the functions of Computer Aided Manufacturing (CAM).
C620.3	Describe the G codes, M codes, tool offset, work offset, CNC machining processes and know about rapid prototyping.
C620.4	Differentiate and explain the various functions of Computer Integrated Manufacturing (CIM), Flexible Manufacturing System (FMS), Auto Guided Vehicle (AGV) and Robot.
C620.5	Describe the principles of Concurrent Engineering (CE), Quality Function Deployment (QFD), Product Development Cycle (PDC) and Augmented Reality (AR).

MEC-620 COMPUTER AIDED DESIGN AND MANUFACTURING

UNIT -I

COMPUTER AIDED DESIGN **[13Hrs]**

Computer Aided Design: Introduction – definition – Shigley's design [2Hrs]

process – Ohsuga Model - CAD activities – benefits of CAD – CAD [2Hrs]

software packages.

Transformations: 2D & 3D transformations – translation, scaling, [2Hrs]

rotation and concatenation

Geometric modeling: Techniques - Wire frame modeling – [1Hr]

applications – advantages and disadvantages. Surface modeling –

types of surfaces – applications – advantages and disadvantages [2Hrs]

–solid modeling-entities-advantages disadvantages –Boolean operations

- Boundary representation – Constructive Solid Geometry-

– Comparison [2Hrs]

Graphics standard: Definition – Need - GKS – OpenGL –

IGES – **Finite Element Analysis:** Introduction – Development - Basic steps [2Hrs]

-Advantages-how does fea work?

UNIT-II

COMPUTER AIDED MANUFACTURING [13Hrs]

Computer Aided Manufacturing: Introduction - Definition – [2Hrs]

functions of CAM – benefits of CAM.

Group technology: Part families - Parts classification and coding - [2Hrs]

coding structure – Optiz system, MICLASS system and CODE

System. **Process Planning:** Introduction – Computer Assisted Process [2Hrs]

Planning (CAPP) – Types of CAPP - Variant type, Generative type –

advantages of CAPP. **Production Planning and Control (PPC):** [2Hrs]

Definition – objectives -Computer Integrated Production management

system – Master Production Schedule (MPS) – Capacity Planning –

Materials Requirement Planning (MRP) –material handling- [2Hrs]

Manufacturing Resources Planning

MRP-II) – Shop Floor Control system (SFC) - Just In Time [1Hr]

manufacturing philosophy (JIT) - Introduction to Enterprise Resources Planning (ERP). [2Hrs]

UNIT –III

CNC PROGRAMMING, RAPID PROTOTYPING [13Hrs]

CNC PART PROGRAMMING: Manual part programming [2Hrs]

coordinate system – Datum points: machine zero, work zero, tool

zero - reference points - NC dimensioning – G codes and M codes – [2Hrs]

linear interpolation and circular interpolation

- CNC program procedure - sub-program – canned cycles - stock removal [2Hrs]

– thread cutting – mirroring – drilling cycle – pocketing. [2Hrs]

Rapid prototyping: Classification – subtractive – additive –

advantages and applications - materials. Types - Stereo lithography [2Hrs]

(STL) – Fused deposition model (FDM) – Selective laser sintering [1Hr]

SLS) - three dimensional printing (3D) – Rapid tooling. [2Hrs]

UNIT –IV

COMPUTERINTEGRATED MANUFACTURING,FLEXIBLE [12Hrs]

MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE,

ROBOT

CIM: Introduction of CIM – concept of CIM - evolution of CIM – CIM [2Hrs]

wheel – Benefits – integrated CAD/CAM.

FMS: Introduction – FMS components – FMS layouts – Types of [2Hrs]

FMS: Flexible Manufacturing Cell (FMC) – Flexible Turning Cell

(FTC) – Flexible Transfer Line (FTL) – Flexible Machining System [2Hrs]

(FMS) – benefits of FMS - introduction to intelligent manufacturing - system.

AGV: Introduction – AGV - working principle – types – benefits [2Hrs]

ROBOT: Definition – robot configurations – basic robot motion –

robot programming method – robotic sensors – end effectors – [2Hrs]

mechanical grippers – vacuum grippers - Industrial applications of

Robot**:** Characteristics - material transfer and loading – welding – [2Hrs]

spray coating - assembly and inspection

UNIT –V

CONCURRENTENGINEERING,QUALITYFUNCTION [12Hrs}

DEPLOYMENT,PRODUCTDEVELOPMENTCYCLE,AUGMENTED REALITY

Concurrent Engineering: Definition – Sequential Vs Concurrent

engineering – need of CE – benefits of CE. [2Hrs]

Quality Function Deployment (QFD)**:** Definition – House of Quality [2Hrs]

HOQ) – advantages – disadvantages. Steps in Failure Modes and [2Hrs]

Effects Analysis (FMEA) – Value Engineering (VE) – types of values – identification of poor value areas – techniques – benefits. Guide lines of Design for Manufacture and Assembly (DFMA). [2Hrs]

Product Development Cycle: Product Life Cycle - New product development processes. [2Hrs]

Augmented Reality (AR) – Introduction - concept – Applications [2Hrs]

Text Books:

Sl.No	Subject	Author	Publisher/Edition
1	CAD/CAM/CIM	R.Radhakrishnan, S.Subramanian	New Age International Pvt. Ltd. Edition.Latest
2	CAD/CAM	Mikell P.Groover, Emory Zimmers	Jr.Prentice Hall of India Pvt., Ltd. Edition.Latest

Reference Books:

Sl.No	Subject	Author	Publisher/ Edition
1	CAD/CAM Principles and Applications	Dr.P.N.Rao	Tata McGraw-Hill Publishing Company Ltd. Edition.Latest
2	CAD/CAM	Ibrahim Zeid, Mastering	Tata McGraw-Hill Publishing Company Ltd., New Delhi. Edition.Latest
3	Automation, Production Systems, and Computer-Integrated Manufacturing,	Mikell P. Groover	Pearson Education Asia Edition.Latest
4	Computer control of manufacturing systems	Yoram Koren	McGraw Hill Book Edition.Latest

LEARNING WEBSITES:

https://nptel.ac.in/courses/112102103/16
https://nptel.ac.in/courses/112104228/31
https://www.youtube.com/watch?v=tiarT1YS-lM
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
C620.1	2	-	2	2	2	2	3	3	3	3
C620.2	2	-	2	2	2	2	3	2	2	2
C620.3	-	-	2	2	2	2	3	3	3	3
C620.4	-	-	2	2	2	2	3	2	2	2
C620.5	-	-	2	2	2	2	3	3	3	3
Total	4	-	10	10	10	10	15	13	13	13
Correlation Level	2	-	2	2	2	2	3	2.6	2.6	2.6

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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MEC – 620 COMPUTER AIDED DESIGN AND MANUFACTURING

Time: 3 Hrs

Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Define CAD.	I	R
2.	What is meant by translation?	I	R
3.	Define process planning.	II	R
4.	Define CAM.	II	R
5.	Define CNC.	III	R
6.	Define NC.	III	R
7.	Define ROBOT.	IV	R
8.	What is meant by augmented reality?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	What is meant by solid modeling?	I	R
10.	Discuss in details about GKS.	I	R
11.	What is meant by group technology?	II	R
12.	What is meant by material requirement planning?	II	R
13.	List the materials used in FDM.	III	R
14.	List the types of AGV.	IV	R
15.	Define quality function deployment.	V	R
16.	What is meant by product development cycle?	V	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	.i. Explain Shigley's design process. ii. Explain wire frame modeling.	I	U/U	5 5
		(OR)			
	B	.i. What are the needs for graphic standard? ii. List the benefits of graphic standard.	I	R/R	5 5
18.	**A**	i. Discuss in details about functions of CAM. ii. List the benefits of CAM.	II	R/R	5 5
		(OR)			
	B	Discuss in details about production planning and control.	II	R	10
19	**A**	Explain the CNC system with suitable line diagram.	III	U	10
		(OR)			
	B	Explain the FDM process with neat sketch & list its advantages, disadvantages and applications	III	U	10
20	**A**	i . Explain the concept of CIM. ii. What is meant by integrated CAD/CAM? Explain.	IV	U/R	10
		(OR)			
	B	i. Explain the different types of FMS. ii. Explain the working principle of AGV.	IV	U/U	5 5
21	**A**	Discuss in details about Concurrent Engineering.	V	R	10
		(OR)			
	B	Discuss in details about product development cycle.	V	R	10

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%

MEC-631 MECHANICAL INSTRUMENTATION

Course	**Instruction**		**Examination**			
Mechanical Instrumentation	Hours/Week	Hours/Semester	Marks			Duration
	5	**75**	Internal Assessment	Semester End Examination	Total	3Hrs
			25	**75**	**100**	

Topics and Allocation of Hours

Unit	Topics	Hours
I	TYPES OF MEASUREMENT, MEASUREMENT OF ERROR	13
II	DISPLACEMENT MEASUREMENT-PRESSURE MEASUREMENT	13
III	TEMPERATURE MEASUREMENT	13
IV	MISELLANEOUS MEASURMENT	12
V	CONTROL SYSTEM	12
	REVISION AND TEST	12
	TOTAL	

COURSE DESCRIPTION:

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

OBJECTIVES

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

COURSE OUTCOMES:

MEC – 631 MECHANICAL INSTRUMENTATION	
After successful completion of this course, the students should be able to	
C631.1	Discuss about the different instruments, errors
C631.2	Impart knowledge on displacement measurements
C631.3	Describe about temperature measurement.
C631.4	Define about miscellaneous measurement
C631.5	Describe the application of measurement system.

MEC-631 MECHANICAL INSTRUMENTATION

Unit-I **[13Hrs]**

Types of measurement, classification of instruments - Static terms and **[2Hrs]**

characteristics - Range and Span, Accuracy and Precision, Reliability **[2Hrs]**

Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and **[2Hrs]**

Resolution, Repeatability and Reproducibility, Linearity. **[1Hr]**

Dynamic characteristics – Speed of response, fitelity and dynamic errors, overshoot .

[Measurement of *error* - Classification of errors, environmental errors, [2Hrs]

signal transmission errors, observation errors, operational errors [2Hrs]

Transducers : Classification of transducers, active and passive

resistive, inductive, capacitive, piezo-resistive, thermo resistive. [2Hrs]

[13Hrs]

Unit-II

Displacement Measurement: Capacitive transducer, Potentiometer, [2Hrs]

LVDT, RVDT, Specification, Selection & application of displacement [2Hrs]

transducer. Optical measurement scale andencoders [2Hrs]

Pressure Measurement: Low pressure gauges- McLeod Gauge, [2Hrs]

Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum

gauge, Pirani gauge. [2Hrs]

High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical

resistance type, Photoelectric pressure transducers, piezoelectric type, [2Hrs]

Variable capacitor type [1Hr]

UNIT-III [13Hrs]

Temperature Measurement: Non-electrical methods - Bimetal, Liquid [2Hrs]

in glass thermometer and Pressure thermometer.

Electrical methods - RTD, Platinum resistance thermometer, [2Hrs]

Thermistor, Thermoelectric methods - elements of thermocouple,

[2Hrs]

Seebek series, law of Intermediate metals, thermo emf measurement. [2Hrs]

Flow Measurements: Variable area meter - Rota meter, Variable [2Hrs]

velocity meter – Anemometer, Special flow meter - Hot wire [1Hr]

anemometer, Electromagnetic flow meter, Ultrasonic flow meter

,Turbine meter ,Vortex shedding flow meter [2Hrs]

UNIT-IV [12Hrs]

Miscellaneous Measurement:

Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone. [2Hrs]

Humidity measurement –Hair hygrometer, Sling psychrometer, Liquid level measurement –direct and indirect methods. [2Hrs]

Force & Shaft power measurement - Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. Speed measurement -Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter & timer, Slipping Clutch Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope, Strain Measurement - Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types (foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes. [2Hrs] [2Hrs] [2Hrs] [2Hrs]

UNIT-V [12Hrs]

Block diagram of automatic control system, closed loop system, open loop system, feedback control system, feed forward control system, servomotor mechanism [2Hrs] [2Hrs]

Comparison of hydraulic, pneumatic, electronic control systems, Control action: Proportional, Integral, derivative, PI, PD, PID. Applications of measurements and control for setup for boilers, airconditioners, motor speed control. [2Hrs] [2Hrs] [2Hrs] [2Hrs]

Text Books:

Sl.No	Subject	Author	Publisher/Edition
1	Mechanical Measurment	R.Radhakrishnan, S.Subramanian	New Age International Pvt. Ltd. Edition.Latest
2	Mechanical and Industrial Measurement	Mikell P.Groover, Emory Zimmers	Jr.Prentice Hall of India Pvt., Ltd. Edition.Latest

Reference Books:

Sl.No	Subject	Author	Publisher/ Edition
1	Measurement Systems	Dr.P.N.Rao	Tata McGraw-Hill Publishing Company Ltd. Edition.Latest
2	Mechanical Measurment and Control	Ibrahim Zeid, Mastering	Tata McGraw-Hill Publishing Company Ltd., New Delhi. Edition.Latest
3	Mechanical and industrial measurement	Mikell P. Groover	Pearson Education Asia Edition.Latest

LEARNING WEBSITES:

https://nptel.ac.in/courses/112102103/16
https://nptel.ac.in/courses/112104228/31
https://www.youtube.com/watch?v=tiarT1YS-lM
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
C631.1	2	-	-	2	-	-	3	3	-	3
C631.2	2	-	-	2	-	-	3	3	-	2
C631.3	2	-	-	2	-	-	3	3	-	3
C631.4	2	-	-	2	-	-	3	2	-	2
C631.5	2	-	-	2	-	-	3	2	-	3
Total	2	-	-	2	-	-	15	13	-	13
Correlation Level	2	-	-	2	-	-	3	2.6	-	2.6

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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MEC – 631 MECHANICAL INSTRUMENTATION

Time: 3 Hrs

Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	What is meant by accuracy?	I	R
2.	Define sensitivity.	I	R
3.	Define potentiometer.	II	R
4.	Write about low pressure gauges.	II	R
5.	Define thermistor.	III	R
6.	Define speed measurement.	III	R
7.	Define sound measurement.	IV	R
8.	What is meant by automatic control system?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	List out types of measurement?	I	R
10.	Explain the transducers and its classification?	I	R
11.	Explain the thermocouple vacuum gauge?	II	R
12.	State the law of intermediate metals?	II	R
13.	Explain the hot wire anemometer?	III	U
14.	Define stress – strain relation?	IV	R
15.	Explain the contact less electrical tachometer?	V	U
16.	Define servomotor mechanism?	V	R

PART – C (5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	List out the types of measurement and classification of instruments in details?	I	R	10
		(OR)			
	B	Define measurements of error and describe the classification of errors in details?	I	R	10
18.	**A**	Explain the specification selection and application of displacement transducer?	II	R	10
		(OR)			
	B	Describe the construction of high pressure gauge with neat sketch?	II	R	10
19	**A**	Explain in details the elements of thermocouple with neat sketch?	III	U	10
		(OR)			
	B	List out the flow measurement instruments and explain the ultrasonic flow meter and special flow meter?	III	R	10
20	**A**	Explain the sound measurement and study of electro dynamic and crobon microphone with line diagram?.	IV	U	10
		(OR)			
	B	List out mechanical tachometers and explain slipping clutch tachometers and electrical tachometer?	IV	R	10
21	**A**	Explain the block diagram of automatic control system and it types in details?	V	U	10
		(OR)			
	B	i. Comparison of hydraulic and pneumatic system? ii. Explain the application of measurements and control for setup for boilers and air conditioners?	V	U/R	5 5

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%

MEC-632 ROBOTICS

Course	Instruction		Examination			
Robotics	Hours/Week	Hours/Semester	Marks			Duration
	5	75	Internal Assessment	Semester End Examination	Total	3Hrs
			25	75	100	

Topics and Allocation of Hours

Unit	Topics	Hours
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	13
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS	13
III	SENSORS AND MACHINE VISION	13
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	12
V	ROBOT APPLICATIONS IN MANUFACTURING	12
	REVISION AND TEST	12
		75

COURSE DESCRIPTION:

Rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to mplement flexible manufacturing systems where Robotic technology plays major role. Hence study of robotic technology is very essential.

OBJECTIVES:

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

COURSE OUTCOMES:

MEC – 632 ROBOTICS	
After successful completion of this course, the students should be able to	
C632.1	Define fundamentals of Robot.
C632.2	Impart knowledge on structure and elements of robot
C632.3	Describe about various drives used in robot.
C632.4	Develop knowledge on role of sensors and vision system
C632.5	Describe the application of industrial robots.

MEC-632 ROBOTICS

UNIT-I

UNDAMENTALS OF ROBOT TECHNOLOGY [13Hrs]

ntroduction – **History of robot** - Definitions-Robot Anatomy – [2Hrs]

Basic configuration of Robotics – Robot Components – Manipulator [2Hrs]

nd effecter, Driving system, Controller and Sensors. Mechanical [2Hrs]

rm –Degrees of freedom –Links and joints –Types of joints –Joint [2Hrs]

otation scheme –Pitch, Yaw, Roll –Classification of robots –Work [2Hrs]

nvelope, Work Volume – Effect of structure on Control ,Work [2Hrs]

nvelop and Work volume. Introduction to PUMA robot. [1Hr]

UNIT -II]13 Hrs]

OT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS

Robot controller –Configuration - Four types of controls –Open loop [2Hrs]

and closed loop controls –Speed of response and stability – [2Hrs]

Precision of movements: Spatial resolutions, accuracy and

repeatability. Pneumatic drives – Hydraulic drives – Mechanical [2Hrs]

drives –Electrical drives –Stepper motors, DC Servo motors and AC [1Hr]

Servo motors – Salient features – Applications and Comparisons of [2Hrs]

Drives. End effecters – Grippers – Mechanical Grippers, Magnetic

Grippers, Vacuum Grippers, Two fingered and [2Hrs]

Three fingered Grippers, Internal and External Grippers –End Of

Arm Tooling (EOAT)- Selection and Design considerations [2Hrs]

UNIT-III

SENSORS AND MACHINE VISION [13 Hrs]

Requirements of Sensors –**Sensor devices used in robot work**

cell - Principles and applications of the following types of sensors – [2Hrs]

encoders and Pneumatic position sensors – Range sensors – [2Hrs]

Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical [2Hrs]

proximity sensors – Touch sensors: Binary sensors, Analog

sensors –Wrist sensors –Slip sensors. Machine vision system – [2Hrs]

Camera –Frame grabber –Sensing and digitizing image data – [1Hr]

Signal conversion –Image storage –Lighting techniques –Image [2Hrs]

processing and analysis –Data reduction: Edge detection, Feature

extraction and object recognition – Applications – Inspection, [2Hrs]

Identification, Visual serving and navigation

UNIT-IV [12Hrs]

ROBOT KINEMATICS AND ROBOT PROGRAMMING

Forward kinematics, Inverse kinematics and differences –Forward [2Hrs]

kinematics and Reverse kinematics of manipulators with Two and [2Hrs]

Three degrees of freedom –Deviations. –Robot dynamics –Static [2Hrs]

analysis - Robot programming –Teach pendant programming – [2Hrs]

Lead through programming –Robot programming languages –VAL [2Hrs]

Programming – Motion commands, Sensor commands, End

effecter commands and Simple programs. [2Hrs]

UNIT-V

ROBOT APPLICATIONS IN MANUFACTURING [12Hrs]

Robot applications – Material handling – Press loading and

unloading –Die casting –Machine tool loading and unloading [2Hrs]

Spot welding – Arc welding – Spray painting – Assembling [2Hrs]

Finishing – Automatic Guided Vehicle – Adopting robots to [2Hrs]

workstations – Requisite robot characteristics and Non requisite [2Hrs]

robot characteristics – Stages in selecting robots for industrial [2Hrs]

applications –Safety considerations for robot operations –Robotics

in the future and characteristics task– Economical analysis of [2Hrs]

obots –Social implications.

Text Books:

Sl.No	Subject	Author	Publisher/Edition
1	Robotics	R.Radhakrishnan, S.Subramanian	New Age International Pvt. Ltd. Edition.Latest
2	Robotics and Industrial Applicatons	Mikell P.Groover, Emory Zimmers	Jr.Prentice Hall of India Pvt., Ltd. Edition.Latest

LEARNING WEBSITES:

https://nptel.ac.in/courses/112102103/16
https://nptel.ac.in/courses/112104228/31
https://www.youtube.com/watch?v=tiarT1YS-lM
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
C620.1	2	-	-	2	-	-	3	3	-	3
C620.2	2	-	-	2	-	-	3	3	-	2
C620.3	2	-	-	2	-	-	3	3	-	3
C620.4	2	-	2	2	-	-	3	2	-	2
C620.5	2	-	-	2	-	-	3	2	-	3
Total	2	-	2	2	-	-	15	13	-	13
Correlation Level	2	-	2	2	-	-	3	2.6	-	2.6

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%

****

MEC – 632 ROBOTICS

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	Define the term 'Robotics'.	I	R
2.	Classify the Robots?	I	R
3.	What is meant by Work envelope?	II	R
4.	Define End effectors.	II	R
5.	What is meant by open loop control system?	III	R
6.	Mention any two applications of industrial robots.	V	R
7.	What is meant by gripper?	IV	R
8.	What is meant by accuracy of Robot?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	What is a Piezo-electric sensor?	I	R
10.	What is a proximity sensor?	I	R
11.	What is frame grabber?	II	R
12.	State any two techniques in image processing and analysis.	II	R
13.	What is meant by Reverse Kinematics?	III	R
14.	What is Lead through programming?	IV	R
15.	Give any two Robot programming Languages.	V	R
16.	What is teaching pendant?	V	R

PART – A (5 X 2 = 10 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	Explain the basic configuration of Robot with a neat sketch.	I	U	10
		(OR)			
	B	(i) Explain the structural characteristics of Robot. (ii) (ii)Explain the types of links with neat sketches.	I	U/U	5/5
18.	**A**	(i) Explain the types of drive system used in Robots. (ii) Explain the types of Electromagnetic Grippers	II	U/U	5/5
		(OR)			
	B	(i) Illustrate the various types of stepper motors with neat sketches. (ii)Explain the factors to be considered for selection and design of Grippers.	II	U/U	5/5
19	**A**	(i) Explain the machine vision Applications in Robots. (ii) Explain the operation of Ultrasonic sensor with a neat sketch.	III	U/U	5/5
		(OR)			
	B	(i) Describe the types of optical encoders with neat sketches. (ii)Explain the various techniques in image processing and analysis.	III	U/U	5/5
20	**A**	(i) Explain Forward Transformation of manipulator with two degrees of freedom. (ii) Explain the generations of Robot Programming languages.	IV	U/U	5/5
		(OR)			
	B	(i) Explain Reverse kinematics of manipulator with two degrees of freedom. (ii) Explain motion commands and sensor commands with an example.	IV	U/U	5/5
21	**A**	Explain the Robot applications in the field of machine tool loading and unloading operations.	V	U	10
		(OR)			
	B	(i) Explain the various social considerations for implementing the Robots. (ii) Describe the various types of workstations & Adopting the Robots.	V	U/U	5/5

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%

MEC – 630 REFRIGERATION AND AIR-CONDITIONING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Semester End Examination	Total	
Air-Conditioning	5	75	25	75	100	3 Hrs

Topics and Allocation of Hours:

Unit	Topics	Hours
I	REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS	13
II	VAPOUR COMPRESSION & ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS	13
III	REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION	13
IV	PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS	12
V	COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES	12
	REVISION AND TEST	12
	Total	**75**

COURSE DESCRIPTION:

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 633 REFRIGERATION AND AIR-CONDITIONING	
After successful completion of this course, the students should be able to	
C633.1	Define the law of heat transfer, explain the open and closed air system of refrigeration and details about compressor and evaporators.
C633.2	Explain about vapour compression refrigeration system, vapour absorption refrigeration system and cryogenic refrigeration system
C633.3	Explain the various functions and applications of refrigeration system.
C633.4	Define the psychometric properties and processes and use of psychometric chart.
C633.5	Determine the cooling load of various refrigeration systems.

MEC – 633 REFRIGERATION AND AIR-CONDITIONING

UNIT-I

REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS [13Hrs]

Thermodynamic state of a pure substance, modes of heat transfer – [2Hrs]
laws of heat transfer - mechanisms of production of cold - unit of
refrigeration –types of refrigeration - reversed Carnot cycle - C.O.P of [2Hrs]
heat engine-heat pump- refrigerating machine – principle of working of
open and closed air system of refrigeration – advantages and [2Hrs]
disadvantages – and its application of air cycle-problems -
application and control of refrigeration system
Compressor – principle of working and constructional details of [2Hrs]
reciprocating and rotary compressors, hermetically and semi
hermetically sealed compressors- condensers-principle of working and [1Hr]
constructional details of air cooled and water cooled condensers,
evaporative condensers- advantages and disadvantages - natural and [2Hrs]
forced draught cooling towers.
Evaporators- natural circulation and forced circulation type – principle [2Hrs]
of working constructional details.

UNIT -II

VAPOUR COMPRESSION REFRIGERATION SYSTEM ,
VAPOURABSORPTION REFRIGERATION SYSTEM AND
CRYOGENICREFRIGERATION SYSTEMS [13Hrs]

Principle of working of vapour compression system – analysis of [2Hrs]
vapour compression cycle using T-s diagram and p-H diagram
refrigerating effect- compression work - C.O.P - effect of superheating [2Hrs]
and under cooling – effect of evaporative pressure and condenser
pressure-problems – liquid vapour refrigeration heat exchangers [2Hrs]
advantages and disadvantages of superheating and under cooling –
use of flash chamber and accumulator. Simple absorption system [2Hrs]
– Electrolux system - solar absorption refrigeration system- absorption [1Hr]
system comparison with mechanical refrigeration system. [2Hrs]
Refrigerators for above 2 K- Philips Refrigerator—Giffered McMohan [2Hrs]
refrigerator- refrigerators for below 2 K - Magnetic refrigeration systems

UNIT – III

REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION [13Hrs]

Capillary tube-automatic expansion valve-thermostatic expansion valve- [2Hrs]

lectronic expansion valve-solenoid valve-evaporator pressure regulator [2Hrs]

–suction pressure regulator-classification of refrigerants-selection of a

refrigerant-properties and applications of following refrigerants SO_2 , CH_4 ,F_{22} [2Hrs]

nd NH_3 –CFCs refrigerants- equivalent of CFCs refrigerants (R-123a,R- [2Hrs]

143a,

R-69S)- blends of refrigerants(R400 and R500 Series) - lubricants

used in refrigeration and their applications. Slow freezing –quick freezing [2Hrs]

cold storage-frozen storage-freeze drying –dairy refrigeration –ice cream [1Hr]

abinets-ice making – water cooler, milk cooler, bottle cooler-frost free [2Hrs]

refrigeration

UNIT-IV

PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS [12Hrs]

Psychrometry properties - adiabatic saturation of air by evaporation [2Hrs]

of water-psychometric chart and its uses – psychometric processes –

sensible heating

and cooling - humidifying and heating - dehumidifying and cooling - adiabatic

cooling with humidification - total heating or cooling processes -sensible heat [2Hrs]

factor - by pass factor – adiabatic mixing – evaporative cooling - problems

– governing optimum effective temperature – comfort [2Hrs]

chart-design consideration. Equipment for air conditioning and insulation

factors – air purification – temperature control – humidity control – dry and [2Hrs]

wet filters- centrifugal dust collector – air washer humidifier – dehumidifier [2Hrs]

fans and blowers– grills and registers – summer and winter air conditioning, [2Hrs]

window and split air conditioners — properties of ideal insulator, types of

I insulating materials .

UNIT –V

COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES [12Hrs]

Different heat sources – conduction heat load – radiation load of sun – occupants load – equipment load - infiltration air load – miscellaneous heat sources –fresh air load – problems Classification of duct systems – Duct design – equal friction method Classification of duct systems - Duct design – equal friction method – velocity reduction method – problems Chilled water Systems -Air handling Units Energy conservation and design decisions - heat reclaim – thermal storage – ice builder – ice harvester – variable refrigerant flow (VRF) – variable primary flow (VPF).

[2Hrs]

[2Hrs]

[2Hrs]

[2Hrs]

[2Hrs]

[2Hrs]

Text Books :

Sl.No	Subject	Author	Publisher
1	Refrigeration and air conditioning	P.L . Ballaney,	Khanna Publishers Edition.Latest
3	Refrigeration and air conditioning	V.K.Jain	Industrial refrigeration and Hand book/Revised edition

Reference Books:

Sl.No	Subject	Author	Publisher
1	A course in refrigeration and air conditioning	Domkundwar	Tata McGraw-Hill Education Latest Edition
2	Home refrigeration and air conditioning	Audels	Theo.Audel & Co. publisher Latest Edition
3	Refrigeration and air conditioning	C.P Arora	Cengage Learning; 7th edition

LEARNING WEBSITES:

https://nptel.ac.in/courses/112105128/
https://nptel.ac.in/courses/112107208/
https://nptel.ac.in/courses/112105128/38
http://www.nptelvideos.in/2012/12/refrigeration-and-airconditioning.html
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

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C633.1	2	2	2	2	-	2	3	3	2	3
C633.2	2	2	2	2	-	2	3	3	2	3
C633.3	2	2	2	2	-	2	3	3	2	3
C633.4	2	2	2	2	-	2	3	3	2	3
C633.5	2	2	2	2	-	2	3	3	2	3
Total	10	10	10	10	-	10	15	15	10	15
Correlation Level	2	2	2	2	-	2	3	3	2	3

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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MEC – 630 REFRIGERATION AND AIR-CONDITIONING

Time: 3 Hrs Max.Marks:75

PART – A (5 X 2 = 10 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
1.	What is pure substance?	I	R
2.	Define a ton of refrigeration.	I	R
3.	What is cryogenics?	II	R
4.	Define cryocooler.	II	R
5.	Write about capillary tube.	III	R
6.	What is solenoid valve?	III	R
7.	State the Avogadro's law.	IV	R
8.	What is fresh air load?	V	R
PART – B (5 X 3 = 15 MARKS)			
Answer any FIVE Questions			
Sl.No		**Unit**	**Bloom's Level**
9.	Compare the air-cooled and water condensers.	I	R
10.	Differentiate between sealed and semi-sealed compressors.	I	U
11.	What are the advantages of stirling refrigerator?	II	R
12.	List out the major components of cryogenic refrigeration.	II	R
13.	Explain the properties of Ammonia as a refrigerant.	III	U
14.	Explain about the lubricants used in refrigeration.	III	U
15.	Briefly explain the various insulation factors to be considered in air conditioning system.	IV	R
16.	What are the different heat sources to be considered in designing of air conditioning system?	IV	R

PART – C(5 X 10 = 50 MARKS)					
Answer any FIVE Questions					
Sl.No			**Unit**	**Blooms Level**	**Max Marks**
17.	**A**	With a neat sketch, explain the construction and working principle of a reciprocating compressor.	I	R	10
		(OR)			
	B	Explain the construction & working principle of a water cooled condenser.	I	U	10
18.	**A**	Briefly analyze the T-S and P-V diagram of vapour compression system.	II	R	10
		(OR)			
	B	With a neat sketch, explain the working principle of vapour absorption refrigeration system.	II	R	10
19	**A**	. i. List out the effects caused by using various refrigerants to the environment. ii. Explain the working of slow freezing and quick freezing system.	III	R/U	5 5
		(OR)			
	B	Explain the properties and applications of Sulphur Di-oxide & methane.	III	U	10
20	**A**	Sketch and explain the heating and humidifying process on psychometric chart.	IV	R	10
		(OR)			
	B	Explain the working of window type air conditioning with the sketch.	IV	R	10
21	**A**	Explain in details the different heat sources to be considered in designing of air conditioning system.	V	U	10
		(OR)			
	B	Explain variable refrigerant flow with neat sketch.	V	U	10

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%

MEC-640-COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

- □ Study of parametric modeling.
- □ Understand the part modeling and assembly of parts
- □ Create the views of the solid model and parts list.
- □ Study the working principle of CNC machines
- □ Study the datum points and offsets.
- □ Differentiate incremental System with absolute system
- □ Study the simulation software package.
- □ Write program and simulate in the Lathe software and Milling software.

- □ Prepare a part program, edit and execute in CNC Turning centre.
- □ Prepare a part program, edit and execute in CNC Machining centre.
- □ Produce components in the CNC Turning centre and CNC Machining
- □ Centre

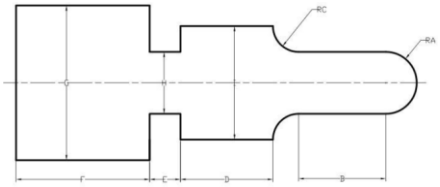
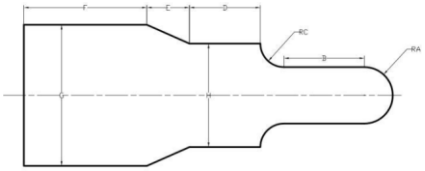
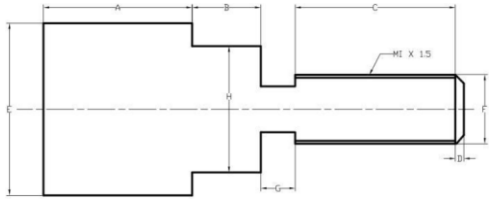
COURSE OUTCOMES

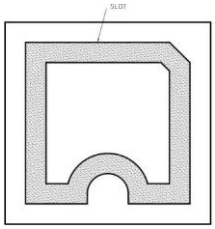
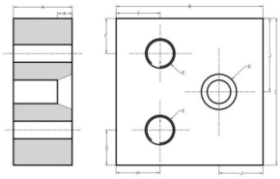
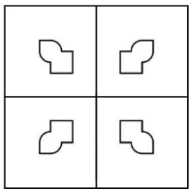
After successful completion of this course, the students should be able to	
C640.1	Summarize 3D commands of Auto CAD
C640.2	Relate the part model and assembly of parts using Auto CAD.
C640.3	Define the working principles of CNC machines.
C640.4	Determine to prepare, edit and execute part program in CNC machines.
C640.5	Develop components as per drawings using CNC machines.

EQUIPMENTS REQUIRED

LATHE		
S.No	**Name of the equipment**	**Required Nos.**
1	Personal computer	30 Nos.
2	CNC programming software (Lathe and Milling)	Sufficient to the strength
3	Modeling package	Sufficient to the strength
4	CNC Turning Machine	1 No.
5	CNC Milling Machine	1 No.
6	Laser Printer	1 No.
7	Consumables	Sufficient quantity

MEC-640-COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL

Sl.No	Name of the exercise	Course Outcome
PART- A **SOLID MODELLING**		
Ex.1	Geneva Wheel	C640.1, C640.2
Ex.2	Bearing Block	C640.1, C640.2
Ex.3	Bushed bearing	C640.1, C640.2
Ex.4	Gib and Cotter joint	C640.1, C640.2
Ex.5	Screw Jack	C640.1, C640.2
Ex.6	Connecting Rod	C640.1, C640.2
Ex.7	Sleeve and cotter joint	C640.1, C640.2
Ex.8	Spigot and cotter joint	C640.1, C640.2
CNC Turning machine		
Sl.No	**Name of the exercise**	**Course Outcome**
Ex.9	Using Linear and Circular interpolation - Create a part program and produce component in the Machine. 	C640.3, C640.4, C640.5
Ex.10	Using Stock removal cycle –Create a part program for multiple turning operations and produce component in the Machine. 	C640.3, C640.4, C640.5
Ex.11	Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine. 	C640.5 C640.3, C640.4, C640.5

CNC Milling machine		
Ex.12	Using Linear interpolation and Circular interpolation –Create a part program for grooving and produce component in the Machine. 	C640.3, C640.4, C640.5
Ex.13	Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine. 	C640.3, C640.4, C640.5
Ex.14	Using subprogram - Create a part program and produce component in the Machine. 	C640.3, C640.4, C640.5

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

https://nptel.ac.in/courses/112105211/

https://nptel.ac.in/courses/112103248/19

https://www.digimat.in/nptel/courses/video/112105211/L01.html

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
C640.1	3	2	3	3	-	2	3	3	2	-
C640.2	3	2	3	3	-	2	3	3	2	-
C640.3	3	2	2	3	-	2	3	3	-	3
C640.4	3	2	1	3	-	2	3	3	-	2
C640.5	3	2	1	3	-	2	3	3	-	3
Total	15	10	10	15	-	10	15	15	4	8
Correlation Level	3	2	2	3	-	2	3	3	2	2.7

MEC- 650 -MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

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

COURSE OUTCOMES

After successful completion of this course, the students should be able to	
C650.1	Plan instruments for machine tool testing.
C650.2	Evaluate geometrical tests on machines such as lathe, shaping, drilling, surface grinding, milling and slotting machine with permissible deviations.
C650.3	Interpret the machine tool alignment and results.
C650.4	Define the maintenance of the machine components.
C650.5	Create the record of work for all the exercises.

EQUIPMENTS REQUIRED

LATHE		
S.No	**Name of the equipment**	**Required Nos.**
1	Lathe machine	01
2	Shaping machine	01
3	Drilling machine	01
4	Surface grinding machine	01
5	Milling machine	01
6	Slotting machine	01
7	Lathe machine	01
8	Shaping machine	01
9	Drilling machine	01
10	Dial gauge	05
11	Magnetic stand	05
12	Surface gauges	05
13	Spirit level	05
14	Spanners (DE/Ring/Box)	Sufficient quantity
15	Screw drivers	Sufficient quantity
16	Allen screw sets	Sufficient quantity
17	Hammer	Sufficient quantity
18	Test mandrels	Sufficient quantity
19	Squares / Blocks	Sufficient quantity
20	Lead screw and nut	01
21	Tailstock	01
22	Bench vice	01
23	Three jaw chuck	01
24	Four jaw chuck	01
25	Drill chuck	01

MEC- 650 -MACHINE TOOL TESTING AND MAINTENANCEPRACTICAL

PART – A		
Sl.No	**Name of the Exercise**	**Course Outcome**
Ex.1	Conduct the following test for the lathe machine and prepare a test chart. Check the level of slide ways. Check the straightness of carriage movement. Check the parallelism of tailstock movement to carriage movements. Check the run-out of the spindle. Check the parallelism of the axis of the outside of tailstock sleeve to carriage movement.	C650.1,C650.2, C650.3, C650.5
Ex.2	Conduct the following test for the shaping machine and prepare a test chart. Check the flatness of table top face. Check the parallelism of table top face to its transverse movement. Check the parallelism of table top face to the ram movement. Check the parallelism of T-slot of top face to the ram movement. Check the squareness of table side face to its transverse movement.	C650.1,C650.2, C650.3, C650.5
Ex.3	Conduct the following test for the drilling machine and prepare a test chart. Check the level of the machine. Check the flatness of the table surface. Check the run-out of the internal taper of the spindle. Check the straightness of the pillar and squareness of the spindle axis. Check the squareness of the table surface to the vertical movement of the spindle housing	C650.1,C650.2, C650.3, C650.5
Ex.4	Conduct the following test for the surface grinding machine and prepare a test chart. Verify the leveling of slide ways. Verify the straightness of slide ways in a horizontal plane. Verify the flatness of the table surface. Verify the parallelism of the table surface. Check the run-out of the wheel spindle nose.	C650.1,C650.2, C650.3, C650.5
Ex.5	Conduct the following test for the milling machine and prepare a test chart. Check the straightness of the vertical movement of the knee. Check the squareness of the table surface to the	C650.1,C650.2, C650.3, C650.5

	column ways for knee. Check the flatness of the table surface. Check the parallelism of the table surface to its movement. Check the run-out of the internal taper of the spindle.	
Ex.6	Conduct the following test for the slotting machine and prepare a test chart. Check the flatness of the table top face. Check the run-out of the central locating bore. Check the parallelism of table surface to its movement in longitudinal direction. Check the squareness of the longitudinal and transverse movements of table. Check the squareness of ram movement to the table surface in the transverse direction.	C650.1,C650.2, C650.3, C650.5
Dismantle, inspect and assemble the following machine components.		
Ex.7	Lead screw and nut	C650.4, C650.5
Ex.8	Tail stock	C650.4, C650.5
Ex.9	Bench vice	C650.4, C650.5
Ex.10	Three jaw chuck	C650.4, C650.5
Ex.11	Four jaw chuck	C650.4, C650.5
Ex.12	Drill chuck	C650.4, C650.5

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

https://nptel.ac.in/courses/112106179/35

https://nptel.ac.in/courses/112105232/5

https://www.youtube.com/watch?v=BolIbqYiJtM

https://www.google.com/search?q=three+jaw+chuck+disassembly&sa=X&ved=2ahUKEwiSyJecpITkAhW0guYKHcNyDwEQ1QIoAHoECAsQAQ&biw=1366&bih=608

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C650.1	2	2	-	3	-	2	3	2	-	3
C650.2	2	2	-	3	-	2	3	2	-	3
C650.3	2	2	-	3	-	2	3	2	-	3
C650.4	2	2	-	3	-	2	3	2	-	3
C650.5	2	2	-	3	-	2	3	2	-	3
Total	10	10	-	15	-	10	15	10	-	15
Correlation Level	2	2	-	3	-	2	3	2	-	3

MEC- 661 MECHANICAL INSTRUMENTATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

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

COURSE OUTCOMES

After successful completion of this course, the students should be able to	
C661.1	Plan for various instruments.
C661.2	Evaluate the result of calibration.
C661.3	Interpret calibration curve.
C661.4	Measure various parameters
C661.5	Study the specification of measuring instruments.

EQUIPMENTS REQUIRED

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

MEC- 661 MECHANICAL INSTRUMENTATION PRACTICAL

PART – A		
Sl.No	**Name of the Exercise**	**Course Outcome**
1	Find the static characteristics of instruments with demonstration of any one measuring instrument.	C661.2, C661.3
2	Measure displacement by using inductive transducer. (Linear variable displacementtransducer i.e. LVDT) and verify its characteristics.	C661.1, C661.2, C661.3C661.4,C661.5
3	Measure negative pressure or vacuum using McLeod gauge / Bourdon tube pressure gauge.	C661.1, C661.2, C661.4,C661.5
4	Measure temperature by thermocouple and verifying by thermometer.	C661.1, C661.2, C661.4,C661.5
5	Measure flow of liquid by rotameter.	C661.1, C661.2, C661.4,C661.5
6	Measure liquid level by capacitive transducer system.	C661.1, C661.2, C661.4,C661.5
7	Measure speed of rotating shaft by stroboscope / magnetic / inductive pick up.	C661.1, C661.2, C661.4,C661.5
8	Measure force or weight by load cell.	C661.1, C661.2, C661.4,C661.5
9	Measure strain by using basic strain gauge and verify the stress induced.	C661.1, C661.2, C661.4,C661.5
10	Measurement of Torque.	C661.1, C661.2, C661.4,C661.5

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

https://nptel.ac.in/courses/112107242/5

https://www.youtube.com/watch?v=lc4dsNvm2Ks

https://www.youtube.com/watch?v=qbKnW42ZM5c

https://nptel.ac.in/courses/112105232/26

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C661.1	-	-	2	3	1	-	3	3	1	3
C661.2	-	-	2	3	1	-	3	3	1	3
C661.3	-	-	2	3	1	-	3	3	1	3
C661.4	-	-	2	3	1	-	3	3	1	3
C661.5	-	-	2	3	1	-	3	3	1	3
Total	-	-	10	15	5	-	15	15	5	15
Correlation Level	-	-	2	3	1	-	3	3	1	3

MEC662 - ROBOTICS PRACTICAL

TEACHING AND SCHEME OFEXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

MARKS ALLOCATION:

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

Objectives

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

COURSE OUTCOMES

After successful completion of this course, the students should be able to	
C662.1	Study of Robot.
C662.2	Define the techniques of programming.
C662.3	Various methods of positioning and placing objects
C662.4	Command and practice
C662.5	Prepare a record of work done.

EQUIPMENTS REQUIRED

LATHE		
Sl.No	**Name of the equipment**	**Required Nos.**
1	Computer with Accessories	15 Nos.
2	Compatible Software	Sufficient quantity
3	Hardware	6 axis Robot

MEC 662- ROBOTICS PRACTICAL

PART – A		
Sl.No	**Name of the Exercise**	**Course Outcome**
1	Position recording using Cartesian co-ordinate system - (No. of positions to be specified - 9)	C662.1,C662.2, C662.3,C662.4, C662.5
2	Position recording using Polar co-ordinate system - (No. of positions to be specified- 9)	C662.1,C662.2, C662.3,C662.4, C662.5
3	Pick and place the objects - No. of objects to be specified- 6)	C662.1,C662.2, C662.3,C662.4, C662.5
4	Pick and stack the objects - (No. of objects to be specified- 6)	C662.1,C662.2, C662.3,C662.4, C662.5
5	Spray painting practice - (Area to be specified - 300mm x 300mm)	C662.1,C662.2, C662.3,C662.4, C662.5
6	Spot welding practice - (No. of spots to be specified - 9)	C662.1,C662.2, C662.3,C662.4, C662.5
7	Arc welding practice –(Length of weld to be specified)	C662.1,C662.2, C662.3,C662.4, C662.5
8	Assembling practice - (Simple assembling)	C662.1,C662.2, C662.3,C662.4, C662.5
9	Profile cutting practice - (Complicated profile – combination of lines and arcs)	C662.1,C662.2, C662.3,C662.4, C662.5
10	Machine loading and unloading practice with time delay - (No. of times to be specified)	C662.1,C662.2, C662.3,C662.4, C662.5

Continuous Internal Assessment

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

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

b) Procedure/ observation and tabulation/ Other Practical related work : 10 marks

c) Record writing : 10 marks

Total **25 marks**

LEARNING WEBSITES:

https://www.youtube.com/watch?v=0yD3uBshJB0

https://nptel.ac.in/courses/112105249/

https://www.youtube.com/watch?v=DaWMvEY3Qgc

https://nptel.ac.in/courses/112101099/32

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C662.1	-	-	-	3	-	-	3	2	-	2
C662.2	-	-	-	3	-	-	3	3	-	2
C662.3	-	-	-	3	-	-	3	2	-	2
C622.4	-	-	-	3	-	-	3	2	-	3
C662.5	-	-	-	3	-	-	3	2	-	3
Total	-	-	-	15	-	-	15	11	-	12
Correlation Level	-	-	-	3	-	-	3	2.2	-	2.4

MEC – 663 REFRIGERATION AND AIRCONDITIONING PRACTICAL

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

ALLOCATION OF MARKS

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

OBJECTIVES:

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

COURSE OUTCOMES

MEC – 663 REFRIGERATION AND AIR CONDITIONING PRACTICAL	
After successful completion of this course, the students should be able to	
C663.1	Define about basic refrigeration operations.
C663.2	Demonstrate knowledge about water coolers and split type air conditioners.
C663.3	List about the various methods of setting and adjustment of thermostat and expansion valves.
C663.4	Illustrate the electrical circuits of air conditioning systems.
C663.5	Outline the various service procedures of refrigeration and air conditioning system.

EQUIPMENTS REQUIRED

Sl.No	Name of the equipment	Required Nos.
1	Refrigerator with test rig	
2	Water cooler	
3	Window A/C with test rig	
4	Split A/C	
5	Cooling tower	
6	Thermostat units	
7	Cut off units	
8	Thermostatic expansion valve unit	
9	Automatic expansion valve unit	
10	Sealed compressor with experimental setup	
11	Mechanics tool set	
12	Tube cutter	
13	Tube bender type	
14	Tube bender spring	
15	Swaging tool	
16	Flaring block	
17	Flaring nut	
18	Pinching tool	
19	Capillary tube testing gauge	
20	Blow lamp	
21	Gas cylinder with receiver valve and key	
22	Charging system	
23	Blow lamp	
24	Stem key	
25	Spring remover	

26 Service valve

27 “T” connector

28 High pressure gauge

29 Compound gauge

30 Leak detector

31 Soldering and brazing kit

MEC – 663 REFRIGERATION AND AIRCONDITIONING PRACTICAL

Sl.No	Name of the exercise	Course Outcome
PART- A		
1. BASIC REFRIGERATION WORKSHOP OPERATION		
	(a) Copper and steel tubing - To study the various sizes of copper and steel tubing, to study the various tools used for operations, To become familiar with various operations on copper and steel tubing–Flaring, Swaging	C663.1
	(b) Soldering methods used in R& A.C	C663.3
2. TO STUDY THE CONSTRUCTION FEATURES OF THE FOLLOWING:		
	(a) Domestic refrigerators (b) Water coolers (c) Window Air Conditioner (d) Split Type Air-Conditioner	C663.1, C663.2
3. PROPER METHODS OF SETTING AND ADJUSTING OF		
	(a) Thermostats (b) Low pressure and high pressure cut-outs (c) Thermostatic expansion valve (d) Automatic Expansion Valve	C663.3
PART-B TEST PROCEDURES		
Ex.1	To determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with Thermostatic expansion valve, Capillary tube, Automatic Expansion Valve	C663.4
Ex.2	To determine the C.O.P of sealed system by using electrical measurements	C663.4
Ex.3	To determine the capacity of a window air conditioner.	C663.4
Ex.4	Wiring of refrigerator, water cooler, desert cooler, room air conditioner – packaged air conditioner, panel board etc	C663.4
SERVICE PROCEDURES		
	1. To change refrigerant into service cylinder from storage cylinder. 2. To evaluate the entire system 3. To Pump down the system 4. To Purge air from the system 5. To locate the leaks in a system.	C663.5

	6. To charge the system 7. To check the oil level in the compressor. 8. Tracing the common faults in R& A.C units and their remedies.	

Continuous Internal Assessment

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

a)	Attendance	: 5 marks – (Award of marks same as theory subjects)
b)	Procedure/ observation and tabulation/ Other Practical related work	: 10 marks
c)	Record writing	: 10 marks
	Total	**25 marks**

LEARNING WEBSITES:

http://mgcl.iitr.ac.in/49200-nptel-video-lecture-topics.pdf

https://www.youtube.com/watch?v=nlsNmhilD74

https://nptel.ac.in/courses/112105128/10

https://nptel.ac.in/courses/112105128/

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C663.1	3	2	-	2	2	2	3	2	1	2
C663.2	3	2	-	2	2	2	3	2	1	2
C663.3	3	2	-	2	2	2	3	2	1	2
C663.4	3	2	-	2	2	2	3	2	1	3
C663.5	3	2	-	2	2	2	3	2	1	3
Total	15	10	-	10	10	10	15	10	5	12
Correlation Level	3	2	-	2	2	2	3	2	1	2.4

MEC- 670 PROJECT WORK

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

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

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

MARKS ALLOCATION:

INTERNAL ASSESSMENT:

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

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

EVALUATION FOR BOARD EXAMINATION:

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

OBJECTIVES:

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

COURSE OUTCOMES:

MEC – 670 PROJECT WORK	
After successful completion of this course, the students should be able to	
C670.1	Plan and identify materials, processes and other resources optimally.
C670.2	Develop innovative and creative ideas.
C670.3	Develop leadership, interpersonal skill and team work.
C670.4	Purchase raw material/standard parts.
C670.5	Interpret the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.

MEC- 670 PROJECT WORK

DETAILED SYLLABUS

ENVIRONMENTAL & DISASTER MANAGEMENT

1. ENVIRONMENTAL MANAGEMENT

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

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

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

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

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

2. DISASTER MANAGEMENT

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

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

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

MEC- 670 PROJECT WORK

LIST OF QUESTIONS

1. ENVIRONMENTRAL MANAGEMENT

1. What is the responsibility of an Engineer-in-charge of an Industry with respect to Public Health?
2. Define Environmental Ethic.
3. How Industries play their role in polluting the environment?
4. What is the necessity of pollution control? What are all the different organizations you know, which deal with pollution control?
5. List out the different types of pollutions caused by a Chemical / Textile / Leather / Automobile / Cement factory.
6. What is meant by Hazardous waste?
7. Define Industrial waste management.
8. Differentiate between garbage, rubbish, refuse and trash based on their composition and source.
9. Explain briefly how the quantity of solid waste generated in an industry could be reduced.
10. What are the objectives of treatments of solid wastes before disposal?
11. What are the different methods of disposal of solid wastes?
12. Explain how the principle of recycling could be applied in the process of waste minimization.
13. Define the term 'Environmental Waste Audit'.
14. List and discuss the factors pertinent to the selection of landfill site.
15. Explain the purpose of daily cover in a sanitary landfill and state the minimum desirable depth of daily cover.
16. Describe any two methods of converting waste into energy.
17. What actions, a local body such as a municipality could take when the agency appointed for collecting and disposing the solid wastes fails to do the work continuously for number of days?
18. Write a note on Characteristics of hazardous waste.
19. What is the difference between municipal and industrial effluent ?
20. List few of the undesirable parameters / pollutants anticipated in the effluents from oil refinery industry / thermal power plants / textile industries / woolen mills / dye industries / electroplating industries / cement plants / leather industries(any two may be asked)
21. Explain briefly the process of Equalization and Neutralization of waste water of varying characteristics discharged from an Industry.

22. Explain briefly the Physical treatments "Set the waste water treatment.

23. Explain briefly when and how chemical / biological treatments are given to the waste water.

24. List the four common advanced waste water treatment processes and the pollutants they remove.

25. Describe refractory organics and the method used to remove them from the effluent.

26. Explain biological nitrification and de-nitrification.

27. Describe the basic approaches to land treatment of Industrial Effluent.

28. Describe the locations for the ultimate disposal of sludge and the treatment steps needed prior to ultimate disposal.

29. List any five Industries, which act as the major sources for Hazardous Air Pollutants.

30. List out the names of any three hazardous air pollutants and their effects on human health.

31. Explain the influence of moisture, temperature and sunlight on the severity of air pollution effects on materials.

32. Differentiate between acute and chronic health effects from Air pollution.

33. Define the term Acid rain and explain how it occurs.

34. Discuss briefly the causes for global warming and its consequences

35. Suggest suitable Air pollution control devices for a few pollutants and sources.

36. Explain how evaporative emissions and exhaust emissions are commonly controlled.

37. What are the harmful elements present in the automobile smokes? How their presence could be controlled?

38. What is the Advantage of Ozone layer in the atmosphere? State few reasons for its destruction.

39. Explain the mechanism by which hearing damage occurs.

40. List any five effects of noise other than hearing damage.

41. Explain why impulsive noise is more dangerous than steady state noise.

42. Explain briefly the Source –Path –Receiver concept of Noise control.

43. Where silencers or mufflers are used ? Explain how they reduce the noise.

44. Describe two techniques to protect the receiver from hearing loss when design / redress for noise control fail.

45. What are the problems faced by the people residing along the side of a railway track and near to an Airport? What provisions could be made in their houses to reduce the problem?

2. DISASTER MANAGEMENT

1. What is meant by Disaster Management? What are the different stages of Disaster management?

2. Differentiate Natural Disasters and Manmade Disasters with examples.

3. Describe the necessity of Risk identification and Assessment Surveys while planning a project.

4. What is Disasters recovery and what does it mean to an Industry?
5. What are the factors to be considered while planning the rebuilding works after a major disaster due to flood / cyclone / earthquake? (Any one may be asked)
6. List out the public emergency services available in the state, which could be approached for help during a natural disaster.
7. Specify the role played by an Engineer in the process of Disaster management.
8. What is the cause for Earthquakes? How they are measured? Which parts of India are more vulnerable for frequent earthquakes?
9. What was the cause for the Tsunami 2004 which inflicted heavy loss to life and property along the coast of Tamilnadu? Specify its epicenter and magnitude.
10. Specify the Earthquake Hazard Zones in which the following towns of Tamilnadu lie:
    (a) Chennai (b) Nagapattinam (c) Coimbatore (d) Madurai (e) Salem.
11. Which parts of India are experiencing frequent natural calamities such as (a) heavy rain fall (b) huge losses due to floods (c) severe cyclones
12. Define basic wind speed. What will be the peak wind speed in (a) Very high damage risk zone –A, (b) High damage risk zone, (c) Low damage risk zone.
13. Specify the minimum distance from the Sea shore and minimum height above the mean sea level, desirable for the location of buildings.
14. Explain how the topography of the site plays a role in the disasters caused by floods and cyclones.
15. Explain how the shape and orientation of buildings could reduce the damages due to cyclones.
16. What is a cyclone shelter? When and where it is provided? What are its requirements?
17. What Precautionary measures have to be taken by the authorities before opening a dam for discharging the excess water into a canal/river?
18. What are the causes for fire accidents? Specify the remedial measures to be taken in buildings to avoid fire accidents.
19. What is a fire escape in multistoried buildings? What are its requirements?
20. How the imamates of a multistory building are to be evacuated in the event of a fire/Chemical spill/Toxic Air Situation/ Terrorist attack, (any one may be asked).
21. Describe different fire fighting arrangements to be provided in an Industry.

CO – PO & PSO's Mapping Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C670.1	2	3	2	3	3	3	3	3	3	3
C670.2	3	2	3	2	2	3	3	3	3	3
C670.3	3	3	3	3	3	3	3	3	3	3
C670.4	2	3	3	3	3	3	3	3	3	3
C670.5	3	2	2	2	2	3	3	3	3	3
Total	13	13	13	13	13	15	15	15	15	15
Correlation Level	2.6	2.6	2.6	2.6	2.6	3	3	3	3	3