1. COURSE DETAILS

Programme: Mechanical Engineering	**Semester: V**
Course: # Inplant Training	**Group: A***
Course Code: IPT190228	**Duration: 26 Weeks**

2. EXAMINATION SCHEME

Sr No	Course Name	Training Duration	Credits		Weekly Report	Quiz Test	Dissertation (Report)	Oral/ Viva	Total	Group (Gr)
1	# Inplant Training (IPT190228)	26 Weeks **	20	**Maximum Marks**	50	50	50	50	200	A*
				Minimum Marks	20	20	20	20	80	

****Total Inplant Training Duration 26 weeks equal to 24 weeks actual training plus 2 weeks examination and processing**

*Compulsory, # Award Winning, Weekly Report and Quiz Test are assessed by Internal Examiner Only, Dissertation and Oral/Viva are Assessed by Internal and External Examiner Jointly

Gr- Group, B - Basic, C - Core, A - Application, M – Management

3. COURSE OBJECTIVE

The inplant training facilitates students to understand the various domains of mechanical industry along with work environment and the students are exposed to the latest developments in technologies. By exposing and interacting with the real-life mechanical industry, student will appreciate and understand the actual working and best practices adopted in the industry to make the student conversant with industrial activities, organizational behaviour and ethics and to understand various industrial aspects viz. manufacturing processes, industrial design, productivity improvement, value engineering, quality control. Students can analyse and solve engineering problems from industry.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- **Soft Skill including Communication, Presentation and liaising etc.**
- **Life skills including Time management, Safety, Innovation, Entrepreneurship, Team building etc.**
- **Hands-on including Reading Drawings and Design, Implementation and Quality Assurance aspects etc.**
- **Industry specific tools including Value Engineering, Concurrent Engineering etc.**

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's LEVEL
CO1	Communicate effectively (verbal as well as written) the work carried out.	Apply
CO2	Prepare and present the report of the work carried out.	Apply
CO3	Exercise time management and safety in the work environment.	Apply
CO4	Work in a team.	Apply
CO5	Demonstrate various quality assurance.	Apply
CO6	Interpret and solve routine technical problems through the application of engineering principles.	Apply

6. IMPLEMENTATION STRATEGY (PLANNING)

Students shall be sent for 24 weeks inplant training in the V semester. Students understand basic working of industry and its work culture. Students are made aware about industrial safety norms. Before the training begins, the students are addressed by the Principal about rules, safety precautions and discipline to be maintained in the company during the training. The same is reminded by the institute supervisor on every visit. The company supervisor also takes care about students' safety

In the initial weeks company personnel train, the students about their manufacturing process and products. The students are involved in project implementation for onsite execution, design and drawings, use of software and similar work.

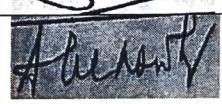
Each company is visited by the institute supervisor on regular basis till the end of in plant training. Each student is monitored for performance, any difficulty, grievances and absenteeism. Accordingly corrective and preventive actions are taken.

7. EVALUATION CRITERIA

Each student performance is assessed by a company supervisor and is recorded in weekly report. The same record is maintained and assessed by the institute supervisor. Depending on the grades given by the company supervisor and also by examining the performance in the weekly report, marks are given out of 50 by the institute supervisor. Considering their work profile in the company, institute supervisor gives 5 quiz tests each of 10 marks to the students. The same are assessed by institute supervisor. The training report submitted by a student is assessed together by internal and external examiner and accordingly marks are

given out of 50. Students presents the work done by them in the company and are examined by internal and external examiner together for 50 marks, constituting total 200 marks. These marks are converted out of 100 marks for final evaluation (Award of Diploma). The external examiner appointed for in-plant training examination is from industry.

8. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Mr. G. J. Badwe	
2	Internal	Mr. G. B. Deshpande	
3	Internal	Mr. A. S. Shukla	
4	External	Mr. A. K. Chaudhary - Director (Total Tools Pvt. Ltd.)	

1. COURSE DETAILS

Programme: Mechanical Engineering	**Semester:VI**
Course: # Metrology and Quality Control	**Group: A***
Course Code: MQC 190219	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D +T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
03	02	-----	-----	05	03	70	20	10	70	50	50	---	200

3. COURSE OBJECTIVE

Metrology is the science of measurement. Measurement activities are given prime importance in industry as the success of any industry depends upon quality of product. Technician working in industries often come across various instruments, gauges and system of limits, fits, tolerances used for measuring different parameters of machined components.

The Quality system & total quality management is an effective system of integrating quality development, quality maintenance and quality improvement efforts of the various groups in industry, so as to enable production and services at most economical level which tends towards full customer satisfaction. Therefore, this course attempts to impart the necessary knowledge and develop the required abilities so that he / she can perform his / her job efficiently and effectively in modern industry.

4. SKILL COMPETENCY :

The aim of this course is to help the students to develop required knowledge and skills to attain the following industry identified competency through various teaching learning experiences.

- **Use relevant instruments to measure various parameters of machine components.**
- **Apply Quality Control techniques for assuring quality of products and services.**

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to

CO No.	Course Outcome	Bloom's level
CO 1	Use relevant measuring standards and instrument for measurement.	Understanding Apply
CO 2	Use different types of comparators	Understanding Apply
CO 3	Select gauges, fits and tolerances for machine components.	Understanding Apply
CO 4	Interpret the data obtained from the different measurement processes and Quality control techniques.	Understanding Apply
CO 5	Draw & Interpret control charts for variable and attribute data.	Understanding Apply

6. COURSE CONTENTS

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
1	**Introduction to metrology and Standard of measurements** 1.1 Definition of metrology, objectives of metrology, categories of metrology – Scientific, Industrial metrology, legal metrology. 1.2 Need of inspection - Concept of precision, Accuracy, Sensitivity, Readability, Traceability, and Reproducibility. 1.3 Sources of errors, factors affecting accuracy. 1.4 Selection of instruments, Precaution while using instruments for getting higher precision and accuracy, Concept of least count of measuring Instrument. 1.5 Definition and introduction and comparison-Line standard, End Standard and Wavelength Standard.	04	04	CO 1
2	**Comparators** 2.1 Introduction and application of Slip gauge. 2.2 Definition and requirement of good comparator, classification, use of comparators. 2.3 Construction and Working principle of comparators – Dial indicator, Sigma Comparator, Pneumatic comparator- high pressure. 2.4 Advantages and Disadvantages	04	06	CO 2
3	**Measurements** **3.1 Angular Measurement** 3.1.1 Concept of angular measurement and Instruments for angular measurements. 3.1.2 Use and working of universal bevel protractor, sine bar. 3.1.3 Working Principle of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges), Angle dekkor as an angular comparator. **3.2 Screw Thread Measurement** 3.2.1 Screw thread Terminology, Errors in threads and pitch. 3.2.2 Measurement of elements such as major diameter, Minor diameter, Effective diameter, Pitch diameter, Two wire method, Best size of wire, thread gauge micrometer. 3.2.3 Construction and working principle of floating carriage micrometer. 3.2.4 Construction, working principle and applications of - Tool Maker's Microscope, Profile Projector. **3.3 Gear Measurement** 3.3.1 Analytical and functional inspection of Gear, Measurement of tooth thickness by constant chord method. 3.3.2 Method by Gear Rolling tester Parkinson's Gear Tester. 3.3.3 Measurement of tooth thickness by Gear tooth Vernier. 3.3.4 Errors in gears such as backlash, run out. **3.4 Measurement of Geometrical features** 3.4.1 Parallelism, Straightness, Squareness testing.	13	22	CO 1

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
	3.4.2 Flatness testing using monochromatic light source optical flat. **3.5 Measurement of Surface Finish** 3.5.1 Primary and secondary texture, sampling length, Lay, CLA, Ra, RMS, Rz, values and their interpretation. 3.5.2 Working principle of stylus probe instruments such as Tomlinson surface meter. 3.5.3 Introduction to CMM.			
4	**Limits, Fits, Tolerances and Gauges** 4.1 Concept of Limits, Fits, Tolerances. 4.2 Concept of interchangeability and Selective Assembly. 4.3 Gauges – Limit gauges, Plug gauge, Snap gauge and ring gauge. 4.4 Taylor's principle- Design of plug and snap.	03	04	CO 3
5	**Quality Control** 5.1 Definitions and meaning of - Quality, Quality Control, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost of Quality, Quality assurance, Cost of rework and repair, Quality and Inspection, Quality Circle. 5.2 Inspection stages, comparison between inspection and quality, factors affecting on them. 5.3 Quality Economics: Cost of Quality, Value of Quality, Economics of Quality confirmation, Cost of Quality Appraisal, Prevention, external and internal failure. 5.4 Various QC tools: Cause-and-effect diagram (fishbone or Ishikawa diagram), Check sheet, Histogram, Pareto chart and Scatter diagram. 5.5 **Total Quality Management** - Principles and concept of total quantity management. a) Quality Audit: Concept of. b) Six sigma: Statistical meaning, methodology of system Improvement	12	16	CO 4
6	**Statistical Quality Control** 6.1 Meaning and importance of SQC. 6.2 Variable and attribute measurement, chance and assignable causes of variation. 6.3 Normal distribution curve characteristics, uses, process capability, capable and incapable process, possible relations of process in control with USL and LSL, Cp, Cpk. 6.4 Control chart for variablesX and R chart (calculations of trial control limits, revised control limits, interpretation and conclusion. 6.5 Control Chart for attributes P chart, np Chart c chart (calculations of trial control limits, revised control limits, interpretation and conclusion). 6.6 Acceptance Sampling Concept, Comparison with 100% inspection, Operating Characteristics Curve, Different types of sampling plans, sampling methods, merits and demerits of acceptance sampling.	12	18	CO 5
Total		**48**	**70**	

7. LIST OF PRACTICALS

Term work consists of Journal containing a judicial mix of minimum 10 experiments.

Sr. No.	Title of Experiment	Approx. Hrs required	COs
1	Measure various dimensions of a given components using, Vernier Caliper and Screw micrometer	02	CO 1
2	Measure various dimensions of a given components using, Vernier Height Gauge and depth micrometer.	02	CO 1
3	Measure various dimensions of a given components using, Inside Micrometer	02	CO 1
4	Measure bore dimension of a give sample using dial bore indicators.	02	CO 1
5	Measure gear tooth elements using gear tooth Vernier caliper.	02	CO 1
6	Measure the effective diameter of the screw thread using profile projector.	02	CO 1
7	Use floating carriage micrometer to measure minor, major and effective diameter of screw thread.	02	CO 1
8	Measure unknown angle of a given tapered component using sine bar in combination with slip gauges.	02	CO 1
9	Use Bevel Protractor to measure an angle and taper of the given component.	02	CO 1
10	Compare the dimension of given work piece with dimension on drawing using mechanical comparator (Dial indicator) and slip gauges.	02	CO 2
11	Basic design of Plug gauge / Snap gauge	02	CO 3
12	Draw the frequency histogram, frequency polygon for the samples and calculate mean, mode and median for same.	02	CO 4
13	Prepare and analyze steps to solve the given problem in institute/industry using quality circle concept.	02	CO 4
14	Draw the normal distribution curve and curve and calculate deviation, Variance, range and determine the process capability.	02	CO 5
15	Draw and interpret the control charts (X bar and R chart) for given data.	02	CO 5
16	Draw and interpret the control charts (P-chart and C-chart) for given data.	02	CO 5
Total		**32**	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. PPT

9. LEARNING RESOURCES

Sr. No.	Title of book	Author	Publication
1.	Engineering Metrology	R.K. Jain	Khanna Publishers, 2B-Nath Market, Delhi-06
2.	Engineering Metrology	I.C. Gupta	Dhanpatrai& Sons 1682, NaiSarak, Delhi
3.	Statistical Quality Control	M.S. Mahajan	Dhanpatrai& Sons 1682, NaiSarak, Delhi
4	Statistical Quality Control	Grant Leavenworth	Tata McGraw Hill Book Co. Singapore
5	Quality Planning & Analysis	J.M. Juran	Tata McGraw Hill, 4/12 Asat Ali RoadNew Delhi-02
6	Total Quality Management	Besterfield, Dale H.	Prentice Hall, New Delhi

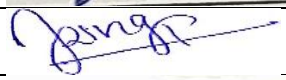
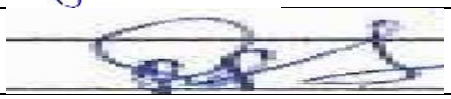
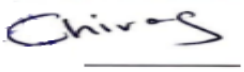
10. WEB REFERENCES

a. http://nptel.ac.in/courses/112106138
b. https://cosmolearning.org/video-lectures/pyrometry-cont
c. Tangram Software for CMM
d. Dong-Do software for Electronic comparator
e. https://www.youtube.com/watch?v=DxdFiIDrFBc
f. https://www.youtube.com/watch?v=7WQzT13u1us
g. https://www.youtube.com/watch?v=QH5UoTDwqVM
h. https://www.youtube.com/watch?v=sLZeR7RMGFA
i. https://www.youtube.com/watch?v=QGBRwXwxnuU
j. https://www.youtube.com/watch?v=YB8tGAPqbNA
k. https://www.youtube.com/watch?v=jTbRMMgbnNU
l. https://www.youtube.com/watch?v=80sNyYPTXPA

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	Topic	Distribution of theory marks			
		R level	U level	A level	TOTAL Marks
1	Introduction to metrology and Standard of measurements	04	---	---	04
2	Comparators	--	02	04	06
3	Measurements	04	10	08	22
4	Limits, Fits, Tolerances and Gauges		04		04
5	Quality Control	04	04	08	16
6	Statistical Quality Control	04	04	10	18
	Total	16	24	30	70

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		Name	Signature
1	Internal	Mr. Girish B. Deshpande	
2	Internal	Mr. Virag A. Timbadia	
3	Internal	Mr. Pratik P. Sawant	
4	External	Mr. Chirag Kachadiya - Director Mihir Industries	

1. COURSE DETAILS

Program: Mechanical Engineering	**Semester: VI**
Course: #Design of Machine Elements	**Group: A***
Course Code: DME190220	**Duration: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instruction & Period per week					Theory Paper duration & Marks		Scheme of Examination And Maximum Marks						
L	P	D	T	Cr	Hrs	Mks	SSL	TA	TH	TW	PR	OR	TOT
3	3	-	-	6	04	70	20	10	70	50	--	50	200

3. COURSE OBJECTIVE

Design department of industry is one of the major job areas for diploma technicians. Fundamental knowledge of Applied Mechanics, Strength of Materials, Engineering Mathematics, Engineering Materials, Theory of Machines & CADD is essential. To enable students to work there they should know how to design simple machine elements. They should also be aware of usual design procedure, selection procedures, codes, norms, standards & guidelines for selection of appropriate materials. This subject aims at developing analytical & selection abilities in the students to give solutions to simple engineering design problems using standard procedure.

4. SKILL COMPETANCY

The aim of this course is to help the students to attain following industry identified competency through various teaching learning experiences. The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Design simple machine components.**

5. COURSE OUTCOMES:

CO No.	COURSE OUTCOME	Bloom's LEVEL
CO1	Select suitable material for machine elements.	Understanding
CO2	Design joints & levers for various applications.	Applying
CO3	Design power transmission elements like shaft, keys, Couplings and gears.	Applying
CO4	Recommend the power screws & suitable fastener for different applications.	Applying
CO5	Choose springs for various applications.	Applying
CO6	Select standard components with their specifications from manufacturers catalogues.	Applying

6. COURSE CONTENTS:

Sr.	TOPIC/Sub-topic	Hrs	Marks	COs
1	**Introduction to Design of machine Elements:** 1.1 Selection of proper materials for engineering applications, designation of steel and cast iron as per I.S. 1.2 **Stress concentration**: causes and remedies. 1.3 **Factor of safety:** proper selection of factor of safety. Factors on which good factor of safety depends. 1.4 **Standardization:** objective of standardization. 1.5 Preferred numbers and significance in Mechanical engineering design.	**04**	**06**	**CO1**
2	**Design of joints & Levers.** **Design Of Joints:** 2.1 Design of Socket & Spigot cotter & knuckle joint. **Design of Levers:** 2.2 Design of hand ,foot ,bell crank levers.	**06** **04**	**10** **06**	**CO2**
3	**Design of Shafts, Keys & Couplings:** **Design of Shaft:** Materials type standard sizes stresses in shafts under loading condition as follows:- 3.1 Design of shaft Course to:- • Bending , • Twisting. 3.2 Probability of saving materials by using hollow shaft in place of solid shaft with reasons. 3.3 Design of shaft Coursed to combine bending and twisting shaft supported on two bearing with one or two pulleys mounted on it with sides either vertical or horizontal. **3.4 Design of Keys:** 3.5 Keys, types and applications. Design analysis of square and rectangular sunk keys. Design of shear pins. **3.6 Design of Couplings:** 3.7 Couplings types and application of shaft couplings; Rigid couplings: • Design of solid muff coupling. Design of flanged coupling.	**08** **04** **06**	**12** **04** **08**	**CO3** **CO3** **CO3**

4	**Design of Power screw:** **Design of Power Screw:** 4.1 Torque required to raise the load by square threaded screw. 4.2 Torque required to lower the load by square threaded screw. 4.3 Design of **Bottle Neck Type** screw jack.	**04**	**06**	**CO4**
5	**Spring Design:** 5.1 Classification, application and function of springs, material used for springs. 5.2 Closed coil helical spring (CCHS) of circular section-parameter required to specify a CCHS.	**06**	**08**	**CO5**
6	**Design of Gear & Bearings:** **Gear Design:** 6.1Gear terminology, materials and design consideration of gears, 6.2Standard proportions of gear system .strength of gear teeth, and design of elements. Design procedure for spur gear, Lewis equation and permissible working stress, Static & dynamic tooth load. **Bearings:(No design only Theory)** Sliding bearing and rolling contact bearing (RBC) and their comparison	**06**	**10**	**CO6**
	TOTAL	**48**	**70**	

7. LIST OF ASSIGNMENTS/EXERCISES/TUTORIALS/DRAWINGS:

*Each experiment comprises minimum 3 to 4 drawing sheets.

Sr. No.	Title of Experiment /Drawing	Approx. Hrs required	COs
1	Design of socket & spigot type cotter joint.	12	CO1,CO2
2	Design of Shaft	03	CO1,CO3, CO6
3	Design of Flange coupling	12	CO1,CO3
4	Design of Bottle Neck type Screw Jack	12	CO1,CO4
5	Design of Spring	03	CO1,CO5
6	Design of Spur Gear Drive	06	CO1,CO3
	Total	**48**	

8. IMPLEMENTATION STRATEGY (PLANNING):

In depth study and understanding of the Course will be implemented by adopting the Following strategy.(Teaching plan)

1. Lesson plan.
2. Use of charts, models.
3. Use of actual devices.

9. LEARNING RESOURCES

Sr. No.	Title of book	Author	Publication
1	Machine design	R.S Khurmi & Gupta	Eurasia Publishing House New, 2001
1	PSG/Design Data Book	-	PSG College of Technology, 1978
2	Design of Machine Elements	Sharma	New Delhi Philearing, 2010
3	Design Of Machine Elements	V.B. Bhandari	Tata McGraw Hills, 2007
4	Machine design	Pandya & Shah	Charotar Publishers, 1973

9. WEB REFERENCES

1. http://www.mhhe.com/bhandari/dome2e
2. http://youtu.be/CLeLFUrvO2g
3. http://youtu.be/Y-JziMbt3Gs
4. http://youtu.be/gMoKpoBQUXU
5. http://youtu.be/pJMCxnRrNyw
6. http://youtu.be/13x3IJgxMj8
7. http://youtu.be/bAh1yRzrYJs
8. http://youtu.be/GfbcxJmjn9s
9. http://youtu.be/y2PADZeNByY

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	Topic	Distribution of theory marks			
		R level	**U level**	**A level**	**TOTAL Marks**
1	Introduction to design of machine elements	03	03	----	06
2	Design of Joints and Levers	03	03	10	16
3	Design of shafts, keys and couplings	----	06	18	24
4	Design of power screw	----	-----	06	06
5	Spring design	----	03	05	08
6	Design of gears and bearings	03	-----	07	10
	Total	**09**	**15**	**46**	**70**

12. QUESTION PAPER PATTERN

Que. No.	End Semester Examination		Periodical Test	
	Bits	Marks	Bits	Marks
1.	Any three out of 4 (3 marks each)	09	Any four out of 5 (2 marks each)	08
2.	Any two out of 3 (6 marks each)	12	Any one out of 2 (6 marks each)	06
3.	Any one out of 2 (16 marks each)	16	Any one out of 2 (6 marks each)	06
4.	Any three out of 4 (3 marks each)	09		
5.	Any two out of 3 (6 marks each)	12		
6.	Any one out of 2 (12 marks each)	12		
Total		70		20

13. COURSE EXPERT COMMITTEE MEMBERS:

Sr. No.	**Examiners**	**NAME**	**SIGNATURE**
1	Internal	Mr. Amol D. Bele	
2	Internal	Mr. Gajanan J. Badwe	
3	Internal	Mr. Suhas B. Wasnik	
4	External	Dr. Megha Nagrale - Professor S.P College of Engineering, Mumbai	

1. COURSE DETAILS

Programme: Mechanical Engineering	**Semester: VI**
Course: Modern Production Processes	**Group: A***
Course Code: MPP190221	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
02	02	--	--	04	03	70	20	10	70	25	-	25	150

3. COURSE OBJECTIVE

This course centers upon improving the performance of manufacturing industry through the innovative applications of processes such as unconventional machining processes, additive manufacturing, CNC machines etc. which differentiates companies in a unique ability to create and sustain in a competitive advantage by processing difficult to machine materials and complex shapes and profiles.

4. SKILL COMPETENCY

The course is to acquire understanding, working and applications of the advanced manufacturing processes to develop following skills

- **Perform the job of a competent machine operator and supervisor.**

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's LEVEL
CO1	Choose the machining processes for finishing and superfinishing operations.	Remember Understand Apply
CO2	Describe the working and applications of unconventional machining process to produce complex and hard to machine components.	Remember Understand Apply
CO3	Prepare CNC part programming for CNC milling machineand describe and select gear manufacturing process.	Remember Understand, Apply
CO4	Illustrate the construction, working and applications of plastic moulding and creation of objects with precise geometric shapes built layer by layer	Remember Understand

6.COURSE CONTENTS

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
1	**Metal FinishingProcess** 1.1 Grinding Process: Introduction to Grinding Process, Types of Grinding Machines, Grinding Wheel, Bonds & Bonding Process, Grit, Grade & structure of Grinding Wheel, Shape & Sizes,Selection and Standard marking system of Grinding Wheel, Mounting and Balancing of Grinding Wheel, Truing & Dressing of Grinding Wheel 1.2 Superfinishing Processes Principal, Working, Advantages, limitationsand applications of Metal spraying, Oxidizing, Tumbling, Honing, Lapping, Burnishing, Polishing	07	15	CO1
2	**Unconventional Machining Methods** 2.1Introduction, Advantages, Limitations, Difference between conventional andunconventional machining methods 2.2 Introduction, Principle, Advantages,Limitations & Application of Electrochemical machining / Grinding, Electrical Discharge Machining, Ultrasonic Machining Process,Laser Beam machining Process, Electron Beam machining process, Plasma Arc Machining andAbrasive Jet Machining	07	15	CO2
3	**CNC Milling** 3.1 Introduction to NC, CNC & its components, Difference, Characteristics, Advantages, Limitations, Applications 3.2 Position Control: Position & Motion control in NC machines, NC system, Tool positioning modes. 3.3 NC/CNC System: Open loop System/ Close Loop System, Linear Interpolation, Single Quadrant Circular Interpolation, Multiple Quadrant Circular Interpolation 3.4 Machining cycle: Pocket Milling Cycle, Drilling Canned Cycle, Milling Canned Cycle **3.5** NC/CNC Programming: NC part programming,Writing/ Preparing Part Programming using G-code and M code, Elementary exercise on part programming	05	12	CO3
4	**Gear Manufacturing** 4.1 Introduction to gears, Gear Nomenclature, Classification of gear manufacturing process, Gear Cutting on Milling machine. 4.2 Gear Generating: Working, construction, advantages, limitations and applications of Gear Hobbing and Gear Planing. 4.3 Gear Shaping: Rack cutter and pinion cutter generating process, advantages and limitations	05	12	CO3

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
	4.4 Gear Finishing: Gear Shaving, Gear Grinding and Gear lapping 4.5 Indexing: Dividing head & Indexing methods, Simple Indexing, Compound Indexing			
5	**Plastic Moulding** 5.1 Plastics: Introduction and classification of plastics, Difference between thermo and thermosetting plastics, Classification of plastic moulding processes 5.2 Introduction, Principle, Working, Applications of Compression, Blow, Injection and Extrusion moulding	04	08	CO4
6	**Additive manufacturing** 6.1 Introduction and overview of Additive Manufacturing Process, 3-D Printing Vs CNCmachining 6.2 Advantages, Types and Selection of 3-D printing process, Supports in 3-D printing 6.3 Material Consideration: PLA, ABS, PET, Nylon, TPU (Flexible), PC and Resin	04	08	CO4
Total		**32**	**70**	

7. LIST OF PRACTICALS/ASSIGNMENTS

Term Work consists of Journal containing minimum 06 nos of Assignments and minimum 01 no of practical job in group.

Sr. No.	Topic	Practical exercises	Hrs. Required	CO
01	**Unconventional Machining Process**	Observe the preparation/processing of job on ECM in Industry in a group of students	02*	CO2
		Observe the preparation/processing of job on EDM or Wire cut EDM in Industry in a group of students	02	CO2
02	**Gear Manufacturing**	Demonstration of Making a Gear Blank on lathe in a group of students	02	CO3
		Demonstration of Gear cutting on milling machine by using dividing head in a group of students	04	CO3
03	**CNC Milling**	Understanding construction of CNC Millingand function of various parts	02*	CO3
		Setting of Tool and Job in the Fixture	02	CO3
		Preparing/Feeding CNC programme	02	CO3
		Demonstration of Job consisting of operations such as Facing, Slotting, Drilling, Circular/Rectangular pocket milling	02	CO3
		Preparing CNC part programme for two jobsfor individual students consisting of Part Drawing Sequence of Operations Programming using G and M code	10*	CO3
04	**Plastic Moulding**	Understanding Construction of Injection Moulding Machine	02	CO4
		Demonstration for manufacturing a component on Injection Moulding Machine in a group of students	02*	CO4
		Understanding Construction of Blow Moulding Machine or Extrusion Moulding Machine	02	CO4
		Demonstration for manufacturing acomponent on Blow Moulding Machine or Extrusion Machine in a group of students	02	CO4
05	**Additive manufacturing**	Introduction to additive manufacturing/3D printing machine and its various components	02	CO4
		Introduction of Software for additive manufacturing and making part ready for 3D printing	02*	CO4
		Demonstration for Manufacturing simple component in a group of students	02	CO4
06	**Metal Finishing Process**	Assignment on Metal finishing processes	02	CO1
	Total		42	

Note: A judicial mix of minimum 24 or more practical need to be performed, the practical's marked as ***** are compulsory.

1] The instructor shall give demonstration to the students by preparing a specimen job as per the job drawing.

2] The workshop diary/journal shall be maintained by each student duly signed by instructor of respective shop and certified by chargeman/foreman in-charge

3] Workshop diary/Journal should contain

a) Safety precautions in workshop.

b) Part Drawings/Designs of the job and procedure/methodology adopted for making respective jobs

4] Journal consisting of study assignments should be certified by the lecturer in-charge.

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Demonstration
3. Industrial Visit

9. LEARNING RESOURSES

Sr. No.	Title Of Book	Author	Publication
1.	Production Technology	R. K. Jain	Khanna Publishers, New Delhi
2.	A Text Book OF Production	P. C. Sharma	S Chand & Co., New Delhi
3.	Production Technology	H.M.T.	Tata McGraw Hill Publishers, New Delhi
4.	Workshop Technology Vol I and II	S.K. Hajara Chaudhary	Media Promotors and Publishers,New Delhi
5.	Workshop Technology	H.S. Bawa	Tata McGraw Hill Publishers, New Delhi

10. WEB REFERENCES

1. https://nptel.ac.in/courses/112105126/36
2. https://nptel.ac.in/courses/112106137/pdf/2_5.pdf
3. https://nptel.ac.in/courses/112105127/pdf/LM-32.pdf
4. https://www.engr.uvic.ca/~mech410/CAM_references/CNC_Computer_Numerical_Control_Pro grammig_Basics.pdf
5. http://home.iitk.ac.in/~jrkumar/download/Computer%20Numerical%20Control_2018.pdf
6. https://www.pds.gov.in/downloads/PLASTIC_PROCESSING_TECHNIQUE.pdf
7. ttps://www.3dhubs.com/knowledge-base/additive-manufacturing-technologies-overview
8. http://home.iitk.ac.in/~nsinha/Additive_Manufacturing%20I.pdf

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1.	Metal Finishing Process	06	06	03	15
2.	Unconventional Machining Methods	04	08	03	15
3.	Numerical Control/ Computerized Numerical Control	02	02	08	12
4.	Gear Manufacturing	03	05	04	12
5.	Plastic Moulding	04	04	--	08
6.	Additive manufacturing	04	04	--	08
TOTAL		23	29	18	70

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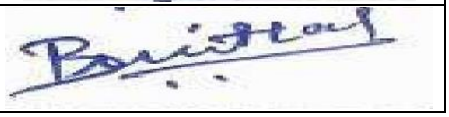
12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Mr. Pravin R. Parate	
2	Internal	Mr. Shankar C. Kolekar	
3	Internal	Mr. Pratik P. Sawant	
4	External	Mr. Mahendra Bhor Organisation- MCGM- Sub Engineer	

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1. COURSE DETAILS

Programme: Mechanical engineering	**Semester: VI**
Course: # Production Management	**Group: M***
Course Code: PMT190222	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
03	02	--	--	05	03	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

Students get familiarize with the theory and practice of production management, which discuss concepts, basic problems in manufacturing industry and provides the methods, strategies and applications of various economical and mathematical tools to solve production and operation related problems by following safe practice.

4. SKILL COMPETENCY

The course is to acquire a working understanding of the roles and functions of production management in the context of manufacturing industry to develop skills in solving production management problem by making them to recognize, appreciate, and perform the job of a competent production or operation manager, which covers the two major areas of production and operations management:

- **Design and management of the Production System, Operation and Control of the System.**

5.COURSE OUTCOMES(COs)

At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME	Bloom's LEVEL
CO1	Distinguish and interpret the relationship between different departments of manufacturing industry with different components of production system by following safe practices.	Remembering Understanding Apply
CO2	Determine the best method of performing operation by eliminating wastages and determine the standard time that a qualified worker should take to perform the operation.	Remembering Understanding Apply
CO3	Calculate total project duration, product mix and assign the resources.	Understanding Apply
CO4	Design inventory control system.	Remembering Understanding Apply

6.COURSE CONTENTS

Sr.No.	Topic / Sub-topic	Hours	Marks	COs
1	**General Workingof ManufacturingIndustry**	03	05	CO1
1.1	Introduction to Production and Productivity, Types of Industry			
1.2	Different Departments of manufacturing industry and their functions, Inter-relationship of different departments			
1.3	General working of Job type and Mass type production industry			
2	**Production System**	09	15	CO1
2.1	Introduction, Production System with feedback control loop			
2.2	Types of production: Batch, Job, Mass with advantages, limitations and applications			
2.3	Plant location: Introduction, Factors for selection of plant location			
2.4	Plant layout: Introduction, Objective, Principles, Types with advantages, limitations and applications, Tools & techniques for improving plant layout, Factors considered for Workstation Design			
2.5	Product design and development: Introduction,			

Sr.No.	Topic / Sub-topic	Hours	Marks	COs
	Product Life Cycle, Stages and different aspects considered for Product design and development			
3 3.1 3.2 3.3	**Work Study** Definition and objectives of work study Brief discussion on Eight-steps basic procedureof work study Method Study: Introduction, Brief description of Steps, Recording techniques such as Operation process chart, Flow diagram, String diagram, Two handed flow process chart,Multiple activity chart with examples Time Study: Introduction, Brief description of Steps, Elements, Allowances, Performance rating, Calculation of Standard Time	08	12	CO2
4 4.1 4.2 4.3 4.4	**Industrial Safety** Introduction, Objective Accidents, Losses of accidents Personal Protective Equipment's for Body, Eyes, Hands, Legs etc Occupational Health and Safety Management System	04	06	CO1
5 5.1 5.2 5.3 5.4 5.5 5.6	**Production, Planning andControl** Introduction, Objective and functions of PPC Sales Forecasting, Methods of sales forecasting PERT and CPM: Introduction, Difference between PERT and CPM, Activity and its types, Events, Slack Construction of network and numbering the events, Calculation of Total Project Duration, Critical Path, Total, Free and Independent Float, Three-time estimate, Standard Deviation, Probability of completion of project in given duration Linear Programming: Introduction, Application, Product Mix, Formulation of problem and finding product mix by graphical method only. Assignment Problems: Introduction, Application, Maximization and Minimization problems Sequencing Models: Introduction, Application, Finding Sequence, Total elapsed time and idle time for N jobs on two and three machines	16	20	CO3

Sr.No.	Topic / Sub-topic	Hours	Marks	COs
6	**Inventory Control**	08	12	CO4
6.1	Introduction, Objective, Advantages, Types and various cost associated with inventory			
6.2	Economic Order Quantity (EOQ) for basic model (lead time and safety stock zero), Finding EOQ, No of Orders and Average			
6.3	Inventory Carrying Cost Inventory Control System (P and Q System), Safety Stock, Make or Buy decision			
6.4	Techniques of Inventory Control: Just in time (JIT) and ABC analysis			
		48	**70**	

7.LIST OF PRACTICALS/ASSIGNMENTS/EXERCISES/TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum 10 no of assignment.

Sr. No.	Title of Assignment	Approx.Hrs required	COs
1	Assignment on Working of a company	04*	CO1
2	Assignment on Production system	02	CO1
3	Assignment on Plant layout	02	CO1
4	Assignment on Product design and development	02	CO1
5	Assignment on Work-study	04*	CO2
6	Assignment on Industrial Safety	02	CO1
7	Assignment on Production, planning and control	02	CO3
8	Assignment on PERT & CPM	04*	CO3
9	Assignment on Linear programming	04*	CO3
10	Assignment on Assignment Models	02	CO3
11	Assignment on Sequencing models	02	CO3
12	Assignment on Inventory control system	02	CO4
	Total	**32**	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of assignments.
3. Cast Studies
4. PPT/ Online learning Resources

9. LEARNING RESOURSES

Sr. No.	Title Of Book	Author	Publication
1.	Production Technology	R. K. Jain	Khanna Publishers, New Delhi
2.	Production Technology	H. M. T.	Tata McGraw Hill Publishers, New Delhi
3.	Elements of Production Planning & Control	Eilon Samuel	Universal Pub. 534, Kalbadevi Rd Mumbai-400 002
4.	Operation Research	V. K. Kapoor	Sultan Chand & Sons, 23, Daryaganj New Delhi-110 002
5.	Industrial Engineering & Production Management	Martand Telsang	Chand & Co. 7361, Ram Nagar, New Delhi 110055

10. WEB REFERENCES

1. http://www.universalteacherpublications.com/univ/ebooks/or/index1.htm
2. http://www.nptelvideos.in/2012/12/project-and-production-management.html
3. http://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf
4. http://www.nitc.ac.in/app/webroot/img/upload/Production%20Management%20Module%201%20Course%20notes.pdf
5. https://nptel.ac.in/courses/110105094/
6. https://nptel.ac.in/courses/112107143/25
7. https://nptel.ac.in/courses/112104222/33
8. https://nscpolteksby.ac.id/ebook/files/Ebook/Hospitality/Production%20and%20Operations%20Management%20(2008)/8.%20Chapter%207%20%20WORK%20STUDY%20%28TIME%20AND%20MOTION%20STUDY%29.pdf
9. https://www.wisdomjobs.com/e-university/production-and-operations-management-tutorial-295/production-and-operation-management-introduction-9433.html
10. http://elearning.nokomis.in/uploaddocuments/Operations%20Research/chap%2010%20Project%20Management%20PERT%20CPM/PPT/Chapter%2010%20PERT-CPM%20PPT.pdf

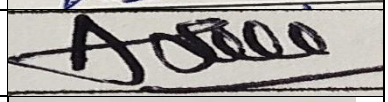
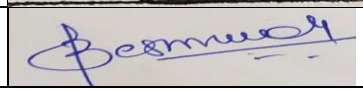
11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1.	General Working of Manufacturing Industry	02	03	-	05
2.	Production System	07	08	-	15
3.	Work Study	03	03	06	12
4.	Industrial Safety	03	03	-	06
5.	Production, Planning and Control	02	02	16	20
6.	Inventory Control	03	04	05	12
TOTAL		**20**	**23**	**27**	**70**

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs.The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Dr. Pravin R. Parate	
2	Internal	Mr. Girish B. Deshpande	
3	Internal	Mr. Ashutosh S. Shukla	
4	External	Dr. Ashish J. Deshmukh - Professor Organization : MPSTME, Mumbai	

1. COURSE DETAILS:

Programme	**: Mechanical Engineering**	**Semester**	**: VI**
Course	**: # Project**	**Group**	**: A***
Course Code	**: PRO190223**	**Duration**	**: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D +T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
-	6	-----	-----	06	-	-	-	-	-	50	--	50	100

3. COURSE OBJECTIVE

Project develops the ability to visualize the problems related to design and drawing, assembly testing, they have to develop a prototype or model of a project etc. It can be an advance analysis. The group project develops skills and attitude to work in teams specially when the nature of work is project based.

4. SKILL COMPETANCY

The aim of this course is to help the students to attain following industry identified competency through various teaching-learning experiences:

- **Develop project proposals to launch small scale enterprises**

5. COURSE OURCOMES (CO's): at the end of course, student will be able to: -

CO. No	COURSE OUTCOMES	Blooms Level
CO 1	Select most contemporary subject for the project work	R, U, A
CO 2	Prepare project proposal with action plan and time duration scientifically before the beginning of the project	U, A
CO 3	Apply their practical skill and choose the techno economical solution to theproblem identified.	U, A
CO 4	Develop team work and leadership and consider ethical and environmental issues related to project.	U, A
CO 5	Prepare and present technical report along with project demonstration	R, U, A

6. ACTIVITY PLAN:

Activity No.	Activities	Week No
1	Formation of Group	1
2	Selection of Project: Individual/Group discussions	
3	Define Problem statement for project work	2
5	Decide Strategies/Methodology to carry out project	
6	Literature Survey/data survey	
7	Submission of synopsis: by each group	
8	Project activity plan-Defining activities, strategy, duration	3
9	Allocation of work responsibility to individual/team	4
10	Visits to Industries / Institutions / Market/field work/sites	5
11	Collection of Data /Survey/Analysis	6
12	Design of Components, preparation of drawing, estimates	7
13	Fabrication, Assembling, Model/Prototype development, Testing as per project requirements	8
14	Progressive presentation of work and recording in diary	9-10
15	Consolidation of work allotted to individual or team	11-12
16	Presentation of initial draft: pre submission draft	13
17	Final Project Report: Printed: Submission: soft & Hard copy	14
18	Group presentation of project work at the time of final evaluation	15-16

N.B:

- The group / student shall prepare Project Diary with Name of Project, Name of Students in group, their attendance and progress and get assessed from guide from time to time during project hours.
- The activities mentioned above shall be monitored and guided by Project Guide every week during the contact hours provided for the same.
- The Project is also included with Seminar with the aim to develop certain set communication skills (preparation of report, writing survey report writing Lab. experiment results writing conclusions of the work done and physical phenomenon observed, participating in group discussions, verbally defending the project in the form of Seminar etc.

7. TERM WORK

The term-work shall comprise of one mechanical or inter disciplinary group project (maximum 4 students). Students shall note there is presentation for project work at three levels based on following points such as:

Leadership, Understanding, Observation &Accuracy, Contribution and Timely Completion

- **Phase –I – 15 Marks**
- **Phase –II- 15 Marks and**
- **Final Presentation – 20 Marks**
- **Total = 50 Marks**

TW to be assessed by internal examiners.

➢ GUIDELINE FOR PREPARATION OF PROJECT REPORT:

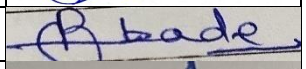
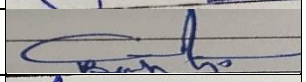
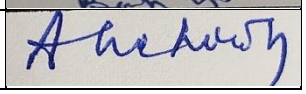
1. The student shall get the initial draft copy of the project approved from the Project guide.
2. Structure: It shall be as follows :
   - Title page, Inner title page (white), Certificate, Certificate from Industry,

Synopsis, Acknowledgment, Table of Contents, List of table & figures (optional), Introduction, Objectives of the Project, Methodology used, Design, Drawing of the part and assembly, Testing, Costing, Result, Conclusions & Scope for future, Merits, Demerits, Applications, Bibliography

- Annexure consists of various designed parts and assembly drawings, photographs, charts, statistical data
- CD of video clips /Power Point presentation

3. Each group has to submit one copy of project report to the library and one soft and hard copy to the department apart from the individual copy.
4. The project report will be of 40 to 50, A4 Size pages with 1.5 line spacing. Font: NewTimes Roman, left margin 3 cm, right margin 1.5 cm, top margin 2.5 cm, bottom margin 1.5 cm, header & footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified.
5. Chapters (to be numbered in Arabic) containing Introduction-which usually specifies scope of work and the present developments. Main body of the report divided appropriately into chapters, sections and subsections. The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc. and subsections as 2.2.3, 2.5.1 etc.
6. The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 12.
7. The figures and tables must be numbered chapter wise.
8. The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.
9. Each student from group shall have one copy with individual certificate only.
10. The project report and progressive assessment sheets are to be submitted before the end of term declared in the Academic Calendar of the institute.

8. COURSE EXPERT COMMITTEE MEMBERS:

Sr. No.	Expert	NAME	SIGNATURE
1	Internal	Shri A.K CHORE	
2	Internal	Shri R.R AMBADE	
3	Internal	Shri G.J BADWE	
4	External	Shri A K Chaudhary - Director Organization: Total Tools Pvt. Ltd.	

1. COURSE DETAILS

Programme	**: Mechanical Engineering**	**Semester**	**: VI**
Course	**: #World Class Manufacturing System**	**Group**	**: A***
Course Code	**: WCM190224**	**Duration**	**: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions & Periods per Week					Examination Scheme and Maximum Marks							
Theory Hrs. L	Practical Hrs. P	Drawing Hrs. D	Tutorial Hrs. T	Credit (L+ P+ D+ T)	Theory Paper Duration and		SSL	TA	TH	TW	PR	OR	TOTAL
					Hrs	Marks							
03	02	--	--	05	03	70	20	10	70	50	--	50	200

3. COURSE OBJECTIVE

The world class manufacturing systems will help to understand the concept of excellence in manufacturing traditional & current concepts to build up organization strength through customer focus, overcoming impediments and also to learn how to achieve stability and sustain excellent manufacturing practices.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the productivity of an organization by implementing various principles of World Class.
- Use lean manufacturing tools for overall improvement of working environment.
- Overcome various barriers of manufacturing systems with improved security, cost reduction, improved functionality etc.

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to: -

CO No.	Course Outcome	Bloom's Level
CO1	Identify the factors, aspects, principles and techniques which makes a system world class manufacturing system.	Remember Understand
CO2	Apply TQM, DOE, SCM, DM and Clustering methods.	Understand Apply
CO3	Use various tools related to lean manufacturing.	Understand Apply
CO4	Apply Principles of Human resources management.	Understand Apply
CO5	Identify challenges, factors and characteristics of E-commerce and globalization.	Understand

6. COURSE CONTENTS

Sr. no.	Title	Hours	Marks	Cos
1.	**Introduction to World Class Manufacturing** 1.1 Meaning of World Class 1.2 WCM Techniques, Pillars of WCMS 1.3 Characteristics, Aspects & Principles of WCM 1.4 WCM Schonberger Model, Gunn's Model & WCM Framework 1.5 Manufacturing Strategy structure: Competitive advantage concept, Competitive Priorities & Decision Categories, Manufacturing capabilities, Manufacturing Performance: Quality Performance, Delivery Performance, Flexibility Performance & Cost Performance	04	10	CO1
2.	**Principles and Practices of WCM** 2.1 Introduction to Total Quality Management (TQM) and its Pillars 2.2 Process Control; Bench Marking 2.3 Design of Experiment: Introduction, Background & Overview 2.4 Supply Chain Management, Failure Mode and Effect Analysis 2.5 Introduction: Digital Manufacturing and Multiple Criteria Decision-Making Techniques 2.6 Rank order Clustering & network diagram by Hollier methods (Simple Numerical)	03	08	CO2
3.	**Lean Manufacturing System** 3.1 Objectives of lean manufacturing, traditional Vs lean manufacturing 3.2 key principles and implications of lean manufacturing 3.3 Value creation and Seven wastes, Just in time 3.4 Team establishment, transformation process, Project Management 3.5 Introduction to Value Engineering, Concurrent Engineering and Reverse Engineering with examples and its other applications	08	16	CO3
4.	**Tools of Lean Manufacturing System** 4.1 Improving Product & Process Design 4.2 Manufacturing Planning Control, Material Requirement Planning and Manufacturing Resource Planning 4.3 5S'Principles, Poke-Yoke, Continuous Improvement/Kaizen, Work Involvement, Kanban 4.4 Rapid Prototyping Techniques, Multiple Criteria Decision Making 4.5 Total waste Elimination & its various methods	08	16	CO3
5.	**Human Resource Management** 5.1 Human Resource Dimensions in WCM 5.2 Morale and Teamwork 5.3 High Employee Involvement	03	06	CO4

Sr. no.	Title	Hours	Marks	Cos
	5.4 Cross Functional Teams 5.5 Human Integration Management			
6.	**Globalization & WCM Through E-Commerce** 6.1 E-business models based on the relationship of transaction parties- B2C, B2B, C2C, C2B 6.2 E-Marketing & E-Marketing Trends 6.3 E-Payment System Overview 6.4 E-customer Relationship Management 6.5 Introduction to E-Supply Chain Management 6.6 E- Strategy, Legal & Ethical issues in E-commerce 6.7 Design and Developing Business Model 6.8 Role of IoT in improving manufacturing systems	06	14	CO5
		32	**70**	

7. LIST OF PRACTICALS/ ASSIGNMENT

* Term work consists of Journal containing a judicial mix of minimum 10 experiments.

Sr. No.	Title of Experiment/ Assignment/ Exercise/ Tutorial/ Drawings	Approximate Hrs. Required	COs
1.	Assignment on simple numerical on rank order clustering and network diagram using Hollier methods.	03	CO2
2.	Identify various mapping tools used in various manufacturing industries for product/ process improvement.	03	CO3
3.	Collect the information on various applications of design of Experiment in manufacturing industry.	03	CO2
4.	Identify the gaps that can be covered by using digital manufacturing techniques over traditional manufacturing.	03	CO2
5.	Case studies on E-Commerce, E-Marketing, E-Payments and E-security.	03	CO5
6.	Preparation of Product and process-based case study related to mechanical industry.	03	CO3
7.	Identify new trends and factors in manufacturing systems to improvise the process through optimization.	03	CO2
8.	*Presentation based on various WCM system & tools, features of WCM, Principles of WCM and Recent trends. Student will submit brief report on the same.	06	CO1 CO3
9.	Case studies on real life application of rapid prototyping techniques.	03	CO3
10.	Group discussion/ Role Play/ Project or problem-based learning on HRM in WCM.	03	CO4
11.	*Preparation of business proposal and report of the same along with presentation (Group of maximum 3 students)	09	CO5
12.	Group discussion based on various techniques to improvise overall system productivity and its report.	03	CO2 CO3

13.	*Mini project/ Model/ Charts on product/ process design and development based on at least one of the following (group of at least 3 students) Value Engineering, Concurrent Engineering, Reverse Engineering Digital Manufacturing, Rapid Prototyping, Any other relevant field.	09	CO1 CO2 CO3 CO5
	Total	**48**	

Note: Practical marked with * are compulsory.

8. IMPLEMENTATION STRATEGY (PLANNING)

1.Teaching Plan
2. Slides
3. Online Resources

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	World-class Manufacturing	Jim Todd	McGraw Hill, London, 1995
2	World Class Manufacturing - The Lesson of Simplicity	Schonberger R.J.	Free Press, 1986
3	Management strategy: achieving sustained competitive advantage	Marcus, A. A.	New-York: McGraw-Hill/Irwin, 2011.
4	Manufacturing Strategy: Process and Content	Voss C. A.	Chapman & Hall, London, 1992
5	Lean production simplified	Pascal, D.	2nd Edition, Productivity Press, 2007
6	Introduction to Total Productive Maintenance	Nakajima, S.	Productivity Press, 1988
7	Advanced Operations Management	Mohanty R. P. and Deshmukh S. G.	Pearson Education, 2003
8	Total Quality Management	Besterfield D. H.	Pearson Education, 1999
9	Inspection Quality Control and Reliability	Sharma S. C.	Khanna Publishers, 1998
10	Manufacturing & Operations Strategy	Danny Samson	Prentice Hall, 1991
11	Introduction to Statistical quality control	Douglas C. Montgomery	John wiley 4th edition2001
12	Total quality control	A. V. Feigenbaum	Mcgraw hill int.edition USA
13	TQM & ISO 14000	Dr. K. C. Arora	S. K. Kataria & Sons, 1998

10. WEB REFERENCES

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- https://www.youtube.com/watch?v=lZPO5RclZEo
- https://www.slideshare.net/vat2512/digital-manufacturing-part-2
- https://nptel.ac.in/courses/112/104/112104188/
- https://nptel.ac.in/courses/110/107/110107130/
- https://nptel.ac.in/courses/112/107/112107282/
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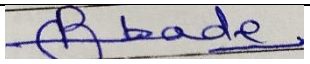
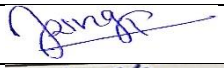
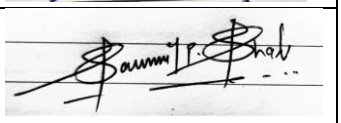
- https://www.youtube.com/watch?v=i6tiLQhP4OM
- https://www.youtube.com/watch?v=UrwbeOIlc68
- https://www.youtube.com/watch?v=xuAltdNpvC0

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to World Class Manufacturing	4	6	-	10
2	Principles and Practices of WCM	-	4	4	8
3	Lean Manufacturing System	4	4	8	16
4	Tools of Lean Manufacturing System	4	4	8	16
5	Human Resource Management	2	-	4	6
6	Globalization & WCM Through E-Commerce	2	4	8	14
	Total	**16**	**22**	**32**	**70**

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Mr. Roshan R. Ambade	
2	Internal	Mr. Virag A. Timbadia	
3	Internal	Mr. Girish B. Deshpande	
4	External	Mr. Saumil Shah – Assistant Manager Organization: RenewSys, Mumbai	

1. COURSE DETAILS

Programme	**: Mechanical Engineering**	**Semester**	**: VI**
Course	**: # Computer Aided Design / Computer Aided Manufacturing / Computer Aided Engineering**	**Group**	**: A***
Course Code	**: CAD190225**	**Duration**	**: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D +T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
02	03	-----	-----	05	03	70	20	10	70	50	--	50	200

3. COURSE OBJECTIVE

Exposure to CAD tools for use in mechanical Engineering design conceptualization, geometrical modeling, communication and optimization, further use in CAD, CAM, CAE. Impart knowledge related to principals, methods and techniques of 3 D modelling in parametric cad software. Undertake project works in use CAD geometric modeling software for design analysis, evaluation and optimization of mass properties, static-stresses, thermal deformations, etc. using professional software. To provide an experiential learning environment, while applying CAD, CAE tools to design of simple parts, assemblies, mechanisms and structures.

4. SKILL COMPETENCY

The aim of this course is to help the students to develop required knowledge and skills to attain the following industry identified competency through various teaching learning experiences:

- **Use relevant concepts to draw 3D model.**
- **Analyze 3D Model.**
- **Develop assembly.**
- **Apply techniques to prepare part programming.**

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to: -

CO No.	Course Outcome	Bloom's level
CO1	Apply concepts of CAD.	II – Understand, III - Apply
CO2	Develop part program for given application.	II – Understand, III – Apply
CO3	Apply concepts of FEA.	II – Understand, III – Apply
CO4	Construct and analyze 3D modeling using software.	II – Understand, III – Apply

6. COURSE CONTENTS

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
1	**Computer graphics** 1.1 Definition and applications of computer graphics. 1.2 Two dimensional geometric transformations-Formulations, Translation, Rotation, scaling, reflection, shear. 1.3 Coordinate systems- MCS, UCS, Screen. 1.4 Mapping of geometric models. comparison between geometrical transformations and geometrical mapping. 1.5 Two dimensional geometric mappings- Translation, Rotational. .	4	10	CO1
2	**Geometrical modeling: Curves** Representation of curves – parametric and non-parametric. 2.1 Types of curves-Analytical and non-analytical. 2.2 Parametric equation of line, circle and ellipse, analytical problems. 2.3 Parametric equation of parabola and hyperbola. 2.4 Synthetic curves- Cubic, Bezier, B-spline.	4	10	CO1
3	**Geometrical modeling: Surfaces and solids** 3.1 Geometic modeling- salient features, methods. **3.2** Wire frame- Types, advantages and limitation. **3.3** Surface modeling-advantages, limitations, analytical surfaces, synthetic surfaces. **3.4** Solid Modeling- Geometry and Topology, advantages, limitations, constructive solid geometry, boundary representation, sweeping, parametric solid modeling, feature based modeling, constraint-based modeling, applications.	5	12	CO1
4	**Computer aided manufacturing** 4.1 NC machine tools- Elements, classification, steps, advantages, limitations, applications. 4.2 CNC machine tools- Elements, classification, Advantages, Limitations, applications. 4.3 General constituents of NC/CNC machine tools. 4.4 DNC machine tools- Elements, functions, classification, Advantages, Limitations. 4.5 Steps in part programming, Terminology used in part programming, Input data in part programming, Formats in part programming. 4.6 Manual part programming for turning applications -Turning center.	8	18	CO2
5	**Finite Element Analysis -Fundamental concepts** 5.1 Introduction. 5.2 Boundary conditions, Displacements, strains and stresses in body. 5.3 Types of finite element, coordinate systems used in FEA. 5.4 Advantages, limitations, applications of Finite element method.	5	9	CO3

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
	5.5 Basic concepts-Forces acting on body, Discretization of body, Load and nodal displacement vectors, Node numbering and Element connectivity. 5.6 Force nodal displacement relationship for 1 D element. 5.7 Assemblage of Two one- Dimensional Elements.			CO4
6	**Finite Element analysis: One-Dimensional Problems** 6.1 Basic steps in Finite Element Method. 6.2 Problem solving by FEA packages. 6.3 Problem on two springs. 6.4 Problem on stepped metallic bar.	6	11	CO3 CO4
Total		**32**	**70**	

7 LIST OF PRACTICALS

Term work consists of Journal containing a judicial mix of minimum 8 experiments.

Sr. No.	Title of Experiment	Hrs. required	COs
1	Develop geometrical models. (3 nos.)	6 hrs. each	CO1 CO4
2	Develop assembly. (2 nos.)	12	CO1 CO4
3	Understand and do finite element analysis. (3 nos.)	6 hrs. each	CO3 CO4
4	Prepare part programs. (2 nos.)	12	CO2
Total		**48**	

8 IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan.
2. PPT.

9 LEARNING RESOURCES

Sr. No.	Title of book	Author	Publication
1.	CAD/CAM/CIM	P Radhakrishnan	Willey eastern limited, New Delhi.
2.	CAD/CAM	Mikell Grover	Pearson publications, New Delhi.
3.	CAM	P N Rao	Tata McGraw Hill 4/12 Asat Ali Road, New Delhi-02.
4.	CAD	Michael Fitzpatrick	Tata McGraw Hill Book Co., New Delhi.
5.	CAD/CAM	J. Srinivas	Oxford university press.

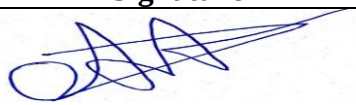
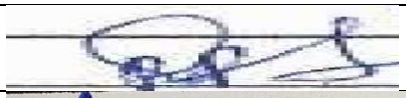
10 WEB REFERENCE

1 https://en.wikipedia.org
2 https://www.inc.com
3 https://www.plm.com
4 https://www.coursera.org
5 https://www.mastercam.com
6 https://onlinecourses.swayam2.ac.in

11 SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	Topic	Distribution of theory marks			
		R level	U level	A level	TOTAL Marks
1	Computer graphics	03	03	04	10
2	Geometrical modeling: Curves	03	03	04	10
3	Geometrical modeling: Surfaces and solids	04	04	04	12
4	Computer aided manufacturing	06	04	08	18
5	Finite Element analysis - Fundamental concepts	-	03	06	09
6	Finite Element analysis: One-Dimensional Problems	-	03	08	11
	Total	**16**	**20**	**34**	**70**

12 COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		Name	Signature
1	Internal	Mr. A. K. Chore	
2	Internal	Mr. G. B. Deshpande	
3	Internal	Mr. P. P. Sawant	
4	External	Mr. A. K. Chaudhary - Director Total Tools Pvt. Ltd.	

1. COURSE DETAILS

Programme: Mechanical Engineering	**Semester: VI**
Course: #Tool Design and Process Planning	**Group: A***
Course Code: TDP190226	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per					Examination Scheme and Maximum							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D +T)	Theory paper duration and marks(ese)		SSL	TA	TH	TW	PR	OR	Total
					Hours	Marks							
02	03	-----	-----	05	03	70	20	10	70	50	---	50	200

3. COURSE OBJECTIVE

Tool Design and Process Planning is basic component of manufacturing industry. The quality and efficiency of manufacturing process depends upon selection of proper tools and machines. Productivity and quality of manufacturing process may be further enhanced by proper and quick mounting of tools and jobs on machines using suitable Jigs and Fixtures. This course attempts to develop ability in students to develop basic design of jig, fixture, press tools, to prepare sequence of operation, select suitable tool and machines, plastics dies are also dealt with this course.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- **Interpret Plastics die elements, prepare Process Planning Sheet, design and draw basic drawings of jigs, fixtures and press tool dies for a given component.**

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to: -

CO No.	Course Outcome	Bloom's level
CO 1	Interpret geometries of various cutting tools, plastics die elements.	Remembering Understanding
CO 2	Prepare Process planning Sheet of an industrial component	Understanding Apply
CO 3	Use relevant Jig and Fixture design principles and elements for different operations on industrial components such as machining, welding for a simple component	Understanding Apply
CO 4	Design conceptual Jig and Fixture for different machining operations such as facing, turning, face milling, slot milling and drilling for a simple component.	Understanding Apply
CO 5	Design conceptual Press tools for different operations such as blanking, punching, drawing for a simple component.	Understanding

6. COURSE CONTENTS

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
1	**Theory of Metal cutting** 1.1 Principles in tool engineering. 1.2 Mechanics of Metal cutting: requirements of tools. Types of chips. 1.3 Introduction to Cutting tool Geometry - Single point cutting tool, Multipoint cutting tool (face Milling and Drill)	03	06	CO1
2	**Process Planning** 2.1 Introduction. 2.2 Role of process planning engineer. 2.3 Content of process plan, process operations 2.4 Steps of process planning. Factors influencing on process selection 2.5 Prepare Process planning Sheet. (maximum 6 operations)	03	06	CO2
3	**Jig Fixture Elements and Design Principles** 3.1 Concept, definition of locating, supporting and clamping. 3.2 Use of locating and clamping principles on shop floor. 3.3 Degree of freedom concept and importance. 3.4 Types of locator – construction, working and applications. 3.5 Clamping devices – construction, working and applications. 3.6 Design principles for drill bush, Drill bushes – Press fit, plain/headless, flanged/headed, renewable, slip, and liner. 3.7 Fool proofing and ejecting techniques.	05	12	CO3
4	**Jig and Fixture design** 4.1 Concept, definition of jigs and fixtures. 4.2 Difference between jigs and fixtures. Jigs- Types, construction, working and application. 4.3 Fixtures- Types construction, working. 4.4 Design considerations and procedure for Jigs (Drilling) and Fixtures.	05	11	CO4
5	**Press Tool Design** 5.1 Press working operations- Blanking, punching, drawing, and bending. 5.2 Press tools: types, working, components and their Functions. 5.3 Concept, meaning, definitions and calculations of press tonnage and shut height of press tool. 5.4 Shear action in cutting die – Metal cutting principle. 5.5 Die clearance: Concept, meaning, definition, Reasons, effects 5.6 Scrap strip layout - Concept, importance, types, and determining percentage stock utilization. 5.7 Centre of pressure: Concept, meaning, definition. 5.8 Types, working, and applications of stock stop, pilots, strippers	10	20	CO5

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
	and knockouts. 5.9 Cutting dies-types and applications. 5.10 Design of progressive cutting die: a. Sketch the component. b. Prepare scrap strip layout. c. Calculate tonnage. d. Determine centre of pressure. e. Determine dimensions of punches, die block and die shoe. f. Prepare sketch of stripper plate. g. General assembly sketch of punches arrangement, die block, die shoe and stripper plate.			
6	**Bending Dies, Drawing Dies, Plastic Moulds** 6.1 **Bending Dies** 6.1.1 Types, Parts and functions of bending die. 6.1.2 Definition, and factors affecting bend radii, bend allowance and spring back. 6.1.3 Calculation of Bend allowance, Blank size and Bending pressure 6.2 **Drawing dies** 6.2.1 Parts and functions of drawing die. 6.2.2 Determine blank size for drawing operation (single draw without flange). 6.2.3 Determine punch and die dimensions. 6.2.4 Calculation of drawing pressure. 6.3 **Introduction to Plastics Mould** 6.3.1 Construction and Functions of Basic Elements – Injection mould, Two plate, Three Plate mould, Blow mould.	02 02 02	05 05 05	CO5 CO5 CO1
Total		**32**	**70**	

7. LIST OF PRACTICALS

Term work consists of Journal containing a judicial mix of minimum 10 experiments.

Sr. No.	Title of Experiment	Approx.Hrs required	COs
1	Identify the use of different types of tools and their designation systems.	03	CO 1
2	Draw the cutting tool with nomenclature Single point, Multipoint.	03	CO 1
3	Prepare a process planning sheet for a given simple component. Maximum 6 operations.	03	CO 2
4	Design a jig for drilling operation of a given simple component	03	CO 3 CO 4
5	Draw basic assembly drawing of designed jig	03	CO 3 CO 4
6	Draw basic assembly drawing of designed jig	03	CO 3 CO 4
7	Design a Fixture for machining of a given simple component.	03	CO 3 CO 4

Sr. No.	Title of Experiment	Approx.Hrs required	COs
8	Draw basic assembly drawing of designed fixture.	03	CO 3 CO 4
9	Prepare Strip layout for given simple component.	03	CO 5
10	Design a Progressive cutting die for a given simple component.	03	CO 5
11	Draw basic assembly drawing of designed progressive die for a given simple component.	03	CO 5
12	Design bending die for a given simple component.	03	CO 5
13	Draw basic assembly drawing of designed bending die for a given simple component.	03	CO 5
14	Design a drawing die for a given simple component.	03	CO 5
15	Draw basic assembly drawing of designed bending die for a given simple component.	03	CO 5
16	Identify and Draw Injection mould and blow mould and show its parts.	03	CO 1
	TOTAL	48	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. PPT

9. LEARNING RESOURCES

Sr. No.	Title Of Book	Author	Publication
1.	Tool Design	Donaldson Anglin	Mcgraw Hill Education, 2000 ISBN: 9780070153929, 0070153922
2.	Production Engineering	Sharma P. C	S.Chand Publishing, 2012 SBN: 9788121923620
3.	Tool Engineering and Design	Nagpal G. H.	Khanna Publication, 2003 ISBN : 817409203X
4	Tool Engineering, Jigs and Fixture	Atkins Albert	McGraw-Hill, 1922 ISBN/ASIN: 1151454966
5	Fundamentals of Tool Engineering Design	Basu S. K.	Oxford Ibh, 1979 ISBN 812040016X, 9788120400160
6	Fundamentals of Electrical Networks	Gupta, B.R, and Singhal Vandana	S.Chand and Co., New Delhi, 2005 ISBN: 978-81-219-2318-7
7	Jigs and Fixtures	P. H. Joshi	Tata Mc Graw Hill
8	Press Tools	P. H. Joshi	Tata Mc Graw Hill
	Machine tool and Tool Design	Sharma P. C.	S.Chand Publishing, 2012 SBN: 9788121923620,

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2. https://www.youtube.com/watch?v=bUrp8JMRwx4andvl=en
3. https://www.youtube.com/watch?v=qaG_vxsfLUg
4. https://www.youtube.com/watch?v=EgTzD_8dUFc
5. https://www.youtube.com/watch?v=WJ_VlWd0EsA
6. https://www.youtube.com/watch?v=i5ZGSMXw5nU
7. https://www.youtube.com/watch?v=wulJZzORm3wandpbjreload=10
8. https://www.youtube.com/watch?v=I71YrXafg0o
9. https://www.youtube.com/watch?v=S9qzJat3Mzk
10. https://www.youtube.com/watch?v=Us7kjBmRL-Q
11. https://www.youtube.com/watch?v=yoUxqeAN0So
12. https://www.youtube.com/watch?v=eqKa2gv9Kx0
13. https://www.youtube.com/watch?v=MtNTFvP0uAI
14. https://www.youtube.com/watch?v=93-VH01ACB4

11 SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	Topic	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Theory of Metal cutting	02	02	02	06
2	Process Planning	--	02	04	06
3	Jig Fixture Elements	02	06	04	12
4	Jig Fixture design	01	02	08	11
5	Press Tool Design	04	08	08	20
6	Bending Dies, Drawing Dies, Plastic Moulds	02	07	06	15
Total		**12**	**26**	**32**	**70**

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		Name	Signature
1	Internal	Mr. G. B. Deshpande	
2	Internal	Mr. P. P. Sawant	
3	Internal	Dr. P. R. Parate	
4	External	Mr. Mahendra Bhor – Sub Engineer MCGM	

1. COURSE DETAILS

Programme	**: Mechanical Engineering**	**Semester**	**: VI**
Course	**: #Power Plant Engineering**	**Group**	**: A***
Course Code	**: PPE190227**	**Duration**	**: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions & Periods per Week					**Examination Scheme and Maximum Marks**							
Theory Hrs. L	**Practical Hrs. P**	**Drawing Hrs. D**	**Tutorial Hrs. T**	**Credit (L+ P+ D+ T)**	**Theory Paper Duration and Marks**		**SSL**	**TA**	**TH**	**TW**	**PR**	**OR**	**TOTAL**
					Hrs	**Marks**							
02	03	--	--	05	03	70	20	10	70	50	--	50	200

3. COURSE OBJECTIVE

Power Plant Engineering basically focuses on power generation principles for real world applications. It helps in creating and adopting modern solutions for power generation. It also helps to understand the various factors for selection of site, working of components of different kind of power plants and also helps to improvise on power generation economics.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Build new technologies based on power generation systems.
- Use modern tools in order to solve real life problems related to power plant components and its economic aspects.
- Maintain power generation systems related to mechanical engineering

5. COURSE OUTCOMES(COs) At the end of the semester student will be able to: -

CO No.	Course Outcome	Bloom's Level
CO1	Identify various environmental aspects of power generation, factors for site selection and causes and remedies to overcome pollutions produced by different types of power plants.	Understand
CO2	Describe components, systems of steam/ thermal power plant, Nuclear Physics and components of Nuclear Power Plant.	Understand Apply
CO3	Describe various components of Hydro, Diesel, Gas Turbine Power Plants & various non-conventional power plants. State the use of waste heat.	Understand Apply
CO4	Estimate economic and other parameters of power plants, Select appropriate energy storage method.	Understand, Apply

6. COURSE CONTENTS

Sr. no.	Title	Hours	Marks	Cos
1.	**Energy Fundamentals and Environmental Aspects of Power Plant** 1.1 Introduction - Present Power position in India 1.2 Classification of Energy, Energy Sources and Power Plants 1.3 Conventional and Non-conventional Energy Resources 1.4 Environmental aspects of Power Generation, Global Environmental Issues, Effect of Greenhouse gases, Acid Rain and Carbon Foot-print 1.5 Various types of pollutions produced by power plants and its Prevention	03	04	CO1

2.	**Thermal Power Plant** 2.1 General layout of modern Coal fired Thermal Power Plant 2.2 Site selection for Coal fired Thermal Power Plant 2.3 Classification of coal, Coal Handling and Storage, In-plant Handling of Coal, Coal Preparation Plant, Transfer of Coal and related equipment, pulverized coal handling systems. 2.4 Coal Burning [Firing] methods, factors for selection of firing method, Overfeed and Under-feed supply of coal, classification of stokers, Multi-retort stoker, pulverized fuel firing – Unit & Central system, Introduction to fuel burners. 2.5 Ash Handling System – Mechanical, Hydraulic, Pneumatic and Steam Jet system, Uses of fly-ash 2.6 Power station Design	06	14	CO2
3.	**Nuclear Power Plant** 3.1 Introduction, Advantages and Limitations of Nuclear Power Plant 3.2 Site selection of Nuclear Power Plant 3.4 Detailed classification of Nuclear Reactors, Main parts of a Heterogeneous Nuclear Reactor: Core, Moderator, Control Rods, Reflector, Coolant, Radiation Shielding, Reactor Vessel 3.5 Basic Reactor Systems: Pressurized Water Reactor [PWR] and Boiling Water Reactor [BWR] 3.6 Nuclear fuels, desirable properties of various element materials of reactor like structure, coolant, control rod, shielding etc. 3.7 Types of Nuclear Wastes, effects of nuclear radiation, methods of nuclear waste disposal	07	16	CO2

4.	**Hydro-Electric Power Plant** 4.1 Introduction, Advantages and Limitations of Hydroelectric Power Plant 4.2 Site selection of hydroelectric power plant 4.3 Essential features of hydroelectric power plant: catchment area, reservoir, dam and intake house, inlet waterway, power house, tail race 4.4 Classification of hydro-electric power plants, factors considered for selection of turbine 4.5 Hydrology, Runoff, Hydrograph and Flow Duration Curve [simple numerical on calculation of Power, Discharge, hydrograph and flow duration curve] 4.6 Introduction to Diesel Engine Power Plant and Gas turbine Power Plant [only introduction – advantages, limitations, applications and list of components]	04	08	CO3 CO4
5.	**Non-Conventional Power Generation and Waste Heat Recovery** 5.1 Introduction to Power from Renewables 5.2 Solar Power Plants – Solar photovoltaic system, Solar cell, classification of photovoltaic technology 5.3 Tidal Power Plants – factors affecting the suitability of the site, classification, working of single basin and double basin system 5.4 Geothermal & Wind Power Plants - forms of geothermal energy, types of wind power plants, Fuel cells 5.5 Bio-Energy Systems, Biomass Power Plants – biogas plants (only basics), Introduction to Hybrid Systems and its power output 5.6 Advantages and limitations of various types of non-conventional power plants 5.7 Direct and indirect benefits of Waste Heat Recover, Uses of wasteheat, Heat Recovery and Waste Heat Boilers	05	12	CO3

6.	**Power Station Economics and Energy Storage** 6.1 Introduction 6.2 Cost Analysis – Fixed cost, Operating Cost, Terms and definitions related to Electrical load – Connected load, Maximum demand, Demand factor, Diversity factor, Load curve, Load Duration Curve: Base load power plant, Peak load power plant, Intermediate load power plant, Load factor, Plant Operating factor, Utility or Utilization factor, Reserve factor, Plant Capacity factor, Plant Use factor [simple numerical on this topic] 6.3 Plant Design, Operation and Economics 6.4 Need of energy storage, classification of energy storage 6.5 Mechanical Energy Storage – pumped storage, compressed air storage, flywheel storage 6.6 Chemical Energy Storage – Battery Storage, Thermal Energy Storage	07	16	CO4
	Total	**32**	**70**	

7. LIST OF PRACTICALS/ ASSIGNMENTS

* Term work consists of Journal containing a judicial mix of minimum 10 experiments.

Sr. No.	**Title of Experiment/ Assignment/ Exercise/ Tutorial/ Drawings**	**Approximate Hrs. Required**	**COs**
1.	Collect information about various types of materials and fuel used for different kind of power plants, Location of power plants in India.	03	CO1
2.	Study of various types of stokers and dust collectors.	03	CO2
3.	Simple numerical on hydrology: hydro-graph and flow duration curve.	03	CO3
4.	Simple numerical on operational aspects and economics of power plants.	03	CO4
5.	*Detailed plant design, operation & economics for any one type of power plant.	06	ALL CO

Sr. No.	Title of Experiment/ Assignment/ Exercise/ Tutorial/ Drawings	Approximate Hrs. Required	COs
6.	*Individual Presentation on recent trends in energy generation/ waste heat recovery and its uses/ energy storage and environmental aspects of power generation/ renewable energy sources/ Diesel and Gas Turbine plants etc. Student shall submit a brief report of the same.	06	CO1 CO3 CO4
7.	*Case studies or develop mini projects/ model/ layouts/ group discussions/ Maintenance procedure etc. on various types of power plants. (In a group of maximum 3 students)	06	ALL CO
8.	*Collect information & Technical details on (any one of the following) • Thermal power plant. • Nuclear power plant. • Hydro-Electric power plant. • Non-conventional power plant. • Gas turbine power plant. • Diesel engine power plant.	03	CO2 CO3
9.	Study of combined cycle power generation (Co-generation).	03	CO2
10.	Study of energy conservation – management and energy from biomass.	03	CO3
11.	Study of Electro-Chemical energy storage, Compressed Air Energy Storage and hydrogen energy.	03	CO4
12.	Calculate cost of electricity consumption of any one laboratory/ class room or library.	06	CO4
13.	If possible, one Industrial visit to any power plant. Student shall submit a brief technical report of the visit. (As per Availability)	One Day Visit	ALL CO
Total		**48**	

NOTE: Practical marked with * are compulsory.

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Slides
3. Online Resources

9. LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1.	Power Plant Engineering	Manoj Kumar Gupta	PHI Learning
2.	Energy Conservation Management	Suresh Kumar Soni, Manoj Nair	Satya Prakashan
3.	Power Plant Engineering	A K Raja, Amit Praksh Shrivastava, Manish Dwivedi	New Age International Publishers
4.	Power Plant Familiarization	Manual of Central Training Resources Unit	NTPC India, 1991
5.	Power Plant Engineering	P.K. Nag, 2nd Edition	TMH, New Delhi
6.	A Text Book of Power Plant Engineering	R.K. Rajput	Laxmi Publications
7.	Hydro-Electric and Pumped Storage Plants	M G Jog	New Age International Publishers
8.	A Course in Power Plant Engineering	Arora, Domkundwar	DhanpatRai & Co
9.	Power Plant Engineering	P.C. Sharma	S.K. Kataria & Sons
10.	Power Plant Engineering	G.R. Nagpal	Khanna Publishers
11.	Power station Engineering and Economy	Bernhardt G.A. Skrotzki and William A. Vopat	TMH, New Delhi
12.	Nuclear Power Plant Engineering	James Rust	Haralson Publishing Company
13.	Nuclear Power Plants	Edited by Soon Heung Chang,	InTech Publishers

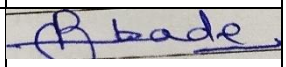
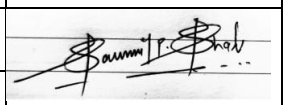
10. WEB REFERENCES

- https://nptel.ac.in/courses/108105058/
- https://nptel.ac.in/courses/112105221/
- https://aits-tpt.edu.in/wp-content/uploads/2018/08/PS1-Lecture-notes.pdf
- https://nptel.ac.in/courses/105105110/pdf/m5l01.pdf
- http://www.ivt.ntnu.no/ept/fag/tep4195/innhold/Forelesninger/forelesninger%202006/5%20-%20Hydro%20Power%20Plants.pdf
- https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education/Teachers_Manual/Teachers_manual_diploma_hydropower_engineering.pdf
- https://www.youtube.com/watch?v=fM6RVJwdVUM
- https://www.youtube.com/watch?v=MGj_aJz7cTs
- https://www.youtube.com/watch?v=_AdA5d_8Hm0
- https://www.youtube.com/watch?v=yx_XoqXNtRM
- https://www.youtube.com/watch?v=Z5-KT8E4dwk
- https://www.youtube.com/watch?v=gp4pWAVzPJI

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Energy Fundamentals and Environmental Aspects of Power Plant	04	--	--	04
2	Thermal Power Plant	02	06	06	14
3	Nuclear Power Plant	04	08	04	16
4	Hydro-Electric Power Plant	--	02	06	08
5	Non-Conventional Power Generation and Waste Heat Recovery	04	08	--	12
6	Power Station Economics and Energy Storage	--	04	12	16
	Total	**14**	**28**	**28**	**70**

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Mr. Virag A. Timbadia	
2	Internal	Mr. Roshan R. Ambade	
3	Internal	Mr. Suhas B. Wasnik	
4	External	Mr. Saumil Shah – Assistant Manager Organization: RenewSys, Mumbai	

1. COURSE DETAILS

Programme: Mechanical Engineering	**Semester: VI**
Course: Entrepreneurship Development	**Group: M**
Course Code: (EDP190018)	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks (ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
02	02	--	--	04	03	70	20	10	70	50	--	--	150

3. COURSE OBJECTIVE:

Students get familiarize with the theory Entrepreneurship Development, which discuss concepts, basic problems in entrepreneurship and provides the methods, strategies and procedure to start an enterprise.

4. SKILL COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences

- **Develop project proposal to launch the small-scale enterprise**

5. COURSE OUTCOMES (COs) at the end of the semester student will be able to:

CO No.	COURSE OUTCOME	Bloom's LEVEL
CO1	Identify your Entreprenural traits	Remembering
CO2	Acquire entrepreneurial value and attitude	Understanding
CO 3	Identify the business opportunity that suits them	Understanding
CO 4	Use the information to prepare project report for business venture	Remembering, Applying
CO 5	Develop Comprehensive business plan	Applying
CO6	Prepare Plan to manage Enterprise Effectively	Applying

6. COURSE CONTENTS

Sr.No.	Topics/Sub-Topics	Hours	Marks	COs
1	**1. Venture Development:** 1.1 Introduction of entrepreneurship 1.2 Small Scale industries 1.3 Business structure	4	10	CO1
2	2. **Finance For Enterprise & Financial Statement** 2.1Source of finance 2.2Fixed capital & working capital 2.3Short term and long term source 2.4Balance sheet 2.5Profit & Loss Account	6	15	CO3 CO6
3	3. **Product/ service Development** 3.1Selection of product /services 3.2Innovation management 3.3APQP(advanced product quality planning) 3.4FMEA(Failure Mode effective analysis)	6	15	CO4 CO2
4	4.**Support System** 4.1. Support system – Government agencies: MCED, NI – MSME, 4.2 Support agencies for entrepreneurship guidance, Training, Registration, Technology and Quality control 4.3 Breakeven point, Return on Investment and return on sales.	8	15	CO2 CO6
5	**5.**Marketig Strategy 5.1Importance of marketing 5.2 marketing management 5.3 soft skill 5.4 pricing and costing 5.5 marketing mix 5.6 Distribution channel	8	15	CO1 CO2 CO5
	TOTAL	32	70	

7. LIST OF PRACTICALS/ASSIGNMENTS/EXERCISES/TUTORIALS/DRAWINGS

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	COs
1	Introduction of Entrepreneurship Development	04	CO1
2	Study of MSME Project Report	04	CO3
3	Proprietorship Loan Procedure	04	CO5
4	Study of Balance Sheet	04	CO5
5	Selection of Product/ Services	08	CO2
6	Preparation of Project Report	08	CO4, CO6
		32	

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Minimum no of practical/assignments/drawings etc.
2. Industry visit
3. Guest/Expert lectures
4. Demonstrations/Simulations
5. Group discussions
6. Seminar
7. Case Study

9. LEARNING RESOURSES

Sr. No.	Title Of Book	Author	Publication
1.	Dynamics of Entrepreneurial Development and Management	Shri Vasant Desai	Himalaya Publication Mumbai
2.	Entrepreneurship Development	Shri S S Khanna	S. Chand And Company
3.	Small Scale Industries and	Shri Vasant Desai	Himalaya Publication
4.	Entrepreneurship	Shri J. Saboo	Himalaya Publication

10. WEB REFERENCES

i) https://www.toppr.com/guides/business-studies/entrepreneurship-development/process-of-entrepreneurship-development/

ii) https://my.msme.gov.in/MyMsmeMob/MsmeProjectProfile/Home.htm

iii) https://www.ediindia.org/

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Venture Development	2	3	5	10
2	Finance for Enterprise & Financial Statement	2	8	5	15
3	Product/ service Development	4	6	5	15
4	Support System	5	8	2	15
5	Marketing Strategy	-	8	7	15
TOTAL		13	33	24	70

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Mr.Ashutosh S. Shukla	
2	Internal	Mr.Sachin Kamble	
3	Internal	Mr.Pratik P. Sawant	
4	External	Mr. S. N. Mahajan	
		Organisation: Professor,Vartak Polytechic Vasai	

Annexure:-I

Committees

I.1 Managing Council (MC)

Representatives of Shri Vile ParleKelavani Mandal		Shri Amit Balwant Sheth, Chairman Shri Nayan Patel Shri Hiten V.Parekh Shri Asoke Basak Dr.Madhav N.Welling Dr.Sharad Mhaiskar Dr.D.J.Shah
Member,Industry Representative		Mr, Hemant Minocha ,MD,Rajiv Plastics,Mumbai
Representatives of Government		
Representative of the State Government		Dr.Abhay Wagh Director, Directorate of Technical Education, Maharashtra State,
Representative of the Maharashtra State Board of Technical Education		Dr.Vinod Mohitkar Director, Maharashtra State Board of Tech.Education
Representative of Central Government		Shri P.N.Jumle Director, Board of Apprenticeship Training (W.R.)
Representative of the All India Council for Technical Education		Dr. Ajeet Singh, Regional Officer& Assistant Director,All India Council for Technical Education (WesternRegion)
Expert Members nominated by the State Government/AICTE		----------
Ex-Officio –Secretary-Principal		Dr.M.Z.Shaikh

I.2 Board of Studies (BOS)

Sr. No.	Name	Designation & Organisation	BOS Designation
1.	Dr.(Mrs) Shubha Pandit	Principal,K.J.Somaiya Engg.College,Mumbai	Chairman
2.	Dr.Vinod Mohitkar	Director, MSBTE	Member
3.	Dr. M.Z.Shaikh	Principal, S.B.M.Polytechnic	Member
4.	Mrs.Neeta Kadukar	Vice Principal and Head, Information Technology Department,SBM Polytechnic	Member
5.	Shri Dhirajkumar Pandirkar	Chief Engineer, MHADA, Mumbai	Member
6.	Shri B.R.Patel,	Director, Procem Consultant (Alumni), Mumbai	Member
7.	Dr. A.V.Bhonsale	Rtd. Principal, Vidyavardhini College of Engineering, Vasai	Member
8.	Shri Sunil Kangane,	Director, Invotech, (Alumni), Mumbai	Member
9.	Shri Ricky Uchil,	Vice President, Adani Electricity Mumbai	Member
10.	Shri Apurva Patel	Director, Exult Industries Ltd. Mumbai	Member
11.	Shri V.M.Joshi,	Adjunct Faculty. Swami Vivekananda Institute of Technology, Mumbai	Member
12.	Shri Paresh Haria,	General Manager PCS Technology, Mumbai	Member
13.	Shri Hemant Minocha	Managing Director, Rajiv Plastics, Mumbai	Member
14.	Prof.E.Narayanan	Ex-Faculty DJSCOE, Mumbai	Member
15.	Shri Ramesh Vulavala	Rtd, HOD DJSCOE, Mumbai	Member
16.	Dr.D.J.Shah	Ex-Principal SBMP	Member
17.	Shri Milind Kamat	General Manager, Toyo Engg. Ltd., Mumbai	Member
18.	Shri Harinder Salwan	Managing Director, Tircom Multimedia Pvt. Ltd. Mumbai	Member
19.	Shi Ashih Tapiawala	Trainer, Vibrant Bootcamp, (Alumni) Mumbai	Member

20.	Shri Ashok Mehta	Ex-Principal SBM Polytechnic	Invitee
21.	Shri Vinod B.Vanvari,	Head, Civil Engg.Dept. SBM Polytechnic	Member
22.	ShriA.K.Chore	Head, Mechanical Engg.Deptt. SBM Polytechnic	Member
23.	Shri N.D.Adate	I/c. Head, Electrical Engg.Deptt. SBM Polytechnic	Member
24.	Mrs.A.A.Kulkarni	Head, Electronics Deptt. SBM Polytechnic	Member
25.	Shri D.M.Karad	Head, Plastics Engg.Deptt. SBM Polytechnic	Member
26.	Shri R.D.Shimpi	Head, Chemical Engg. Deptt. SBM Polytechnic	Member
27.	Shri J.S.Kulkarni	Head, Computer Engg.Deptt. SBM Polytechnic	Member
28.	Shri Abhijit Dongaonkar	Lecturer, IT SBM Polytechnic	Member
29.	Shri S.T.Khelkar	Controller of Exam. SBM Polytechnic	Member
30.	Shri Gajanan Badwe	Lecturer, Mechanical (TPO) SBM Polytechnic	Member
31.	Shri L.B.Deshpnade	Lecturer, Electronics SBM Polytechnic	Convenor

I.3 Programme wise committee (PBOS)

Sr.No	Name	Designation & Organisation	PBOS Designation
1	Dr. A.V Bhonsale,	Rtd. Principal, Vidyavardhini College of Engineering, Vasai	Chairman
2	Shri P.K Shah	Ex Deputy General Manager , L&T LTD	Industry Expert
3	Shri A.K Chaudhary	Director, Total Tools Pvt Ltd, Andheri East	Industry Expert
4	Shri Ashit Lathia	Director, Lathia Rubbers Pvt Ltd	Industry Expert
5	Shri Sunil Kangane	Director, Invotech, (Alumni), Mumbai	Alumina
6	Dr. M.Z.Shaikh,Principal	Principal, S.B.M.Polytechnic	Member
7	Mrs. Neeta Kadukar,	Vice Principal and Head, Information Technology Department,SBM Polytechnic	Member
8	Shri L.B. Deshpande, Curriculum Coordinator	Lecturer, Electronics SBM Polytechnic	Member
9	Mr. G.J Badwe. Training and placement Officer	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
10	Shri Sudhir Khelkar , CEO	Controller of Exam. SBM Polytechnic	Member
11	Shri A.K Chore, Head of the department	Head of The Department, Mechanical Engineering	Member
12	Shri R.R Ambade	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
13	Shri A.D Bele	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
14	Shri S.B Wasnik	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
15	Shri P.R Parate	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
16	Shri G.B Deshpande	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
17	Shri A.S Shukla	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
18	Shri V.A Timbadia	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
19	Shri S.C Kolekar	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member
20	Shri P.P Sawant	Lecturer, Mechanical Engineering Department, SBM Polytechnic	Member

I.4 PROGRAMME CURRICULUM DEVELOPMENT COMMITTEE

Institute Level Curriculum Development Cell

Sr. No.	Name of the Faculty	Designation
1	Dr. M.Z.Shaikh,Principal	Chairman
2	Mrs. Neeta Kadukar, Vice-Principal and Head, IT Dept.	Member
3	Shri V.B.Vanvari, Head, Civil Engg.Dept.	Member
4	Shri A.K.Chore, Head, Mechanical Engg.Dept.	Member
5	Shri N.D.Adate,I/C Head, Electrical Engg.Dept.	Member
6	Mrs. A.A.Kulkarni, Head, Industrial and Digital Elex.Dept.	Member
7	Shri D.M.Karad, Head, Plastics Engg.Dept.	Member
8	Shri R.D.Shimpi, Head, Chemical Engg.Dept.	Member
9	Shri J.S.Kulkarni, Head, Computer Engg.Dept.	Member
10	Shri A.B.Dongaonkar, Lecturer, IT Dept.	Member
11	Mrs.K.P.Bhave,Lecturer,Chemistry Dept.	Member
12	Shri G.J.Badwe,Training and Placement Officer	Member
13	Shri S.T.Khelkar,Controller of Examinations	Member
14	Shri L.B.Deshpande,Lecturer,Electronics Dept.	Member Secretary

DEPARTMENT LEVEL COMMITTEE (DEPARTMENT CO-ORDINATORS)

Sr. No.	Name of the Faculty	Designation
1	Shri S. N. Ranshur	Lecturer, Civil Engineering
2	Shri A. S. Shukla	Lecturer, Mechanical Engineering
3	Shri D. G. Rajmandai	Lecturer, Electrical Engineering
4	Ms. P. J. Nikhade	Lecturer, Industrial/Digital Electronics
6	Shri S. A. Kamble	Lecturer, Plastics Engineering
5	Shri M. M. Belwalkar	Lecturer, Chemical Engineering
7	Shri P. H. Shah	Lecturer, Computer Engineering
8	Shri P. D. Rathod	Lecturer, Information Technology

Course-wise Curriculum Development Committee - SCHEME 2019

Department of MECHANICAL ENGINEERING

SEMESTER I

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	BMTI90001	Basic Mathematics	K K Dange	R R Ambade	U J Patel	Meena Gawas
2	ACH190002	Applied Chemistry	S V Suvarna	K P Bhave	R D Shimpi	Dr.S Unni
3	EVS190003	Environmental studies	S V Suvarna	K P Bhave	R D Shimpi	Dr.S Unni
4	DLS190004	Development of Life skills	B M Pande	A A Kulkarni	K P Bhave	Archana Lalla
5	APM190005	Applied Mechanics	N N Petkar	A K Singh	K P Jayateerth	D S Pandikar
6	EDGI90201	Engineering Drawing	N M Pathak	N M Patil	G B Deshpande	C Kachadia
7	WSP190008	Workshop Practice	P R Parate	S C Kolekar	P P Sawant	M V Bhore

SEMESTER II

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	EMT1 90009	Engineering Mathematics	K K Dange	R R Ambade	U J Patel	Meena Gawas
2	APHI 90010	Applied Physics	G R Waghmare	S S Salve	L B Deshpande	M B Jaiswal
3	CMS19001I	Communication skills	B M Pande	A A Kulkarni	K P Bhave	Archana Lalla
4	ENG190202	Engineering Graphics	N M Pathak	N M Patil	G B Deshpande	C Kachadia
5	MPM190203	Manufacturing Processes and Materials	P R Parate	S C Kolekar	P P Sawant	M V Bhore
6	PICI 90204	Programming in C++	A K Chore	P P Sawant	A S Shukla	P Kashikar
7	STM190012	Stress Management	N M Pathak	R D Shimpi	S A Kamble	C Kachadia

SEMESTER III

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	AMTI90013	Applied Mathematics	K K Dange	R R Ambade	U J Patel	Meena Gawas
2	FMH190205	Fluid Mechanics & Hydraulic Machines	A D Bele	A S Shukla	V A Timbadia	M V Bhor
3	MED190206	Mechanical Engineering Drawing	N M Pathak	P R Parate	G B Deshpande	M V Bhor
4	THEI90207	Thermal engineering	R R Ambade	A D Bele	S B Wasnik	S Kamble
5	SOM190015	Strength of materials	S A Kamble	A S shukla	V A Timbadia	E Narayanan
6	BEEI90016	Basics of electrical & electronics	D G Rajmandai	N G Farkade	N R Nagose	C R Biral

SEMESTER IV

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	AUTI90208	Automation	A K Chore	G B Deshpande	P P Sawant	A K Chaudhary
2	TOMI90209	Theory of machines	G J Badwe	A D Bele	S B Wasnik	M Mohan
3	IFP190210	Industrial Fluid Power	V A Timbadia	R R Ambade	A S shukla	A Khulli
4	PER190211	Power Engineering & Refrigeration	R R Ambade	S B Wasnik	A D Bele	Dr B Bhasme
5	MPRI90212	Machining processes	P R Parate	S C Kolekar	P P Sawant	M V Bhore
6		**Elective-I**				
6.1	AEG190213	Automobile Engineering	R R Ambade	G B Deshpande	A S shukla	N Shid
6.2	MEC190214	Mechatronics	V A Timbadia	P P Sawant	G B Deshpande	C Kachadia
6.3	MHSI90215	Material Handling Systems System	A S shukla	P R Parate	G B Deshpande	A Khulli
6.4	ECA190216	Energy Conservation and Audit	P P Sawant	R R Ambade	S B Wasnik	S Dalvi
7	MMC190217	Mechanical Measurements & Control	A D Bele	S B Wasnik	A S Shukla	M Mohan
8	HVA190218	Heating, Ventilation & Air conditioning	S B Wasnik	P P Sawant	R R Ambade	Dr B Bhasme

SEMESTER V

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	(IPT190324)	Inplant Training	G J Badwe	G B Deshpande	A S Shukla	A K Chaudhary

SEMESTER VI

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	MQC190219	Metrology & Quality Control	G B Deshpande	V A Timbadia	P P Sawant	C Kachadia
2	DME190220	Design of Machine Elements	A D Bele	G J Badwe	S B Wasnik	Dr. M Nagrale
3	MPP190221	Modern Production Processes	P R Parate	S C Kolekar	P P Sawant	M V Bhore
4	PMT190222	Production Management	P R Parate	G B Deshpande	A S Shukla	Dr. A Deshmukh
5	PRO190223	Project	A K Chore	R R Ambade	G J Badwe	A K Chore
6	**# Elective –II (Any one)**					
6.1	(WCM 190224)	World Class Manufacturing Systems	R R Ambade	V A Timbadia	G B Deshpande	S Shah
6.2	(CAD 190225)	Computer Aided Design / Computer Aided Manufacturing / Computer Aided Engineering	A K Chore	G B Deshpande	P P Sawant	A K Chore
6.3	(TDP 190226)	Tool Design & Process Planning	G B Deshpande	P P Sawant	P R Parate	M V Bhore
6.4	(PPE 190227)	Power Plant Engineering	V A Timbadia	R R Ambade	S B Wasnik	S Shah
7	(EDP 190018)	Entrepreneurship Development	A S Shukla	S A Kamble	P P Sawant	S N Mahajan

CDC Co-Ordinator

(Department)

Head of the Department

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC * MUMBAI 400 056.

Certificate

The curriculum of the **Mechanical Engineering** has been modified in the year 2019, as per the provisions made in the curriculum development process of Shri Bhagubhai Mafatlal Polytechnic, Mumbai.

This is the **outcome based Curriculum of Diploma in Mechanical Engineering programme,** which shall be implemented from academic year 2019-20

Verified by

Department Level CDC Representative

S.B.M.Polytechnic, Mumbai.

Head of Department

Mechanical Engineering

S.B.M.Polytechnic, Mumbai.

Incharge, Curriculum Development Cell

S.B.M.Polytechnic, Mumbai.

Principal

S.B.M.Polytechnic, Mumbai.

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC * MUMBAI 400 056.

APPENDIX – I

CERTIFICATE OF BENCHMARKING OF CURRICULUM

MIHIR INDUSTRIES

Mfr. Of : Precision Turn Components on Swiss Automat Machines,
Press & Fabrication components.

Mittal Industrial Estate No.2, 2nd Floor, Unit No. 204, A.K.Road, Marol Naka, Mumbai-59.

Tel Factory : 28506240/28501307 Res : 26150075 Email : [redacted]

Date: 23rd Dec. 2021

CERTIFICATE

This is to certify that the curriculum of Mechanical Engineering at Shri Bhagubhai Mafatlal Polytechnic is in line with the industrial requirements.

The curriculum of Scheme-2019 is well designed incorporating core engineering applications, emerging technologies and basic management skills.

The inplant training conducted in the 5th semester provides a clear understanding about industry standards, different products and processes.

Further the practice of reviewing the outcome based curriculum frequently ensures that the program keeps pace with the changing needs of industries.

FOR MIHIR INDUSTRIES

CHIRAG [redacted]
PARTNER

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC MUMBAI 400 056.

卐

CERTIFICATE

This is to certify that the curriculum of Mechanical Engineering at Shri Bhagubhai Mafatlal Polytechnic is in line with the industrial requirements.

The curriculum of Scheme-2019 is well designed incorporating core engineering applications, emerging technologies and basic management skills.

The inplant training conducted in the 5th semester provides a clear understanding about industry standards, different products and processes.

Further the practice of reviving the curriculum frequently which enables curriculum to keep pace with industry and industrial requirements.

Shop No. 15, Cheena Nagar, Markour Link Road, Chembur, Mumbai-400089
Mob: 9869514231

WHOMSOEVER IT MAY CONCERN

This is to certify that the curriculum of 2019 scheme of Mechanical Engineering at Shri Bhagubhai Mafatlal Polytechnic is in line with the current requirement of industry.

We also confirm that the industrial training of 24 weeks for every student gives appropriate exposure to current industrial requirement/standard/product/process.

We assure to be associated with Shri Bhagubhai Mafatlal Polytechnic for updating the curriculum as per norms from time to time.

This is for your information only.

Regards

For **PERFECT GEARS**

PERFECT GEARS MUMBAI 400 093

RITESH CHOKSI (CEO)

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC MUMBAI 400 056.

www.choksienergy.com

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Tel.: +91 22 2834 3887 / 2823 6455 Fax: +91 22 2836 6598 / 2823 6404
E-mail: perfectgears@choksi-india.com

APPENDIX-II

PROGRAMME - MECHANICAL ENGINEERING

MAPPING MATRIX OF PO'S, PSO's AND CO'S:

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Basic Mathematics BMTI90001	C101.1	3	1	1		1		2		1
	C1O1.2	3	2	2	2	1	2	2	1	1
	C1O1.3	3	1	1		1		2	1	1
	C1O1.4	3	1			1	2	2		1
	Avg (C101)	**3.00**	**1.25**	**1.33**	**2.00**	**1.00**	**2.00**	**2.00**	**1.00**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Applied Chemistry ACH190002	C102.1	3								
	C102.2	3								
	C102.3	3	2	2	1	2		1	1	
	C102.4	2	2	2		2		1	1	
	C102.5	2	1	2		1			1	
	Avg. (C102)	**2.60**	**1.67**	**2.00**	**1.00**	**1.67**		**1.00**	**1.00**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Environmental studies EVS190003	C103.1	3	3	1	1	3	2	2	2	3
	C103.2	3	3	1	1	3	2	2	1	1
	C103.3	2	1	1	1	3	2	2	1	2
	C103.4	2	1	1	1	3	2	2	1	2
	C103.5	2	1	1	1	3	2	2	1	2
	Avg. (C103)	**2.40**	**1.80**	**1.00**	**1.00**	**3.00**	**2.00**	**2.00**	**1.20**	**2.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Development of Life skills DLS190004	C104.1			1		2	3	1		
	C104.2	1	1	1	1	1	3	2	2	1
	C104.3	1	2	2	1	2	3	2	2	1
	C104.4			1		2	3	2	1	
	Avg. (C104)	**1.00**	**1.50**	**1.25**	**1.00**	**1.75**	**3.00**	**1.75**	**1.67**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Applied Mechanics APM190005	C105.1	3			2		1		2	
	C105.2	3			2		1		2	
	C105.3	3			2		1		2	
	C105.4	3			2		1		2	
	C105.5	3			2		1		2	
	Avg. (C105)	**3.00**			**2.00**		**1.00**		**2.00**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Engineering Drawing EDG190201	C106.1	3	3	3	2	-	3	3	3	2
	C106.2	3	1	2	2	-	2	2	2	2
	C106.3	2	-	2	-	-	-	2	2	2
	C106.4	2	-	2	-	-	-	2	2	1
	Avg. (C106)	**2.5**	**2**	**2.25**	**2**	**-**	**2.5**	**2.25**	**2.25**	**1.75**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Workshop Practice WSP190008	C107.1	2		1	3		2	2	3	1
	C107.2	3	1	1	2	1	1	2	3	1
	C107.3	3		1	3	1	3	2	3	1
	C107.4	3	2	1	1	2	2	3	3	2
	Avg. (C107)	**2.75**	**1.50**	**1.00**	**2.25**	**1.33**	**2.00**	**2.25**	**3.00**	**1.25**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Engineering Mathematics EMT 190009	C108.1	3	2	2	1	1	1	2	1	2
	C108.2	3		1	1	1	1	2	1	1
	C108.3	3	1	1	1	1	1	2	1	2
	C108.4	3	2	2	2	1	2	2	1	2
	Avg. (C108)	**3.00**	**1.67**	**1.50**	**1.25**	**1.00**	**1.25**	**2.00**	**1.00**	**1.75**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Applied Physics APH I90010	C109.1	3	2	1	3	1	1	1	2	1
	C109.2	3	2	1	2	1	1	1	2	1
	C109.3	3	2	2	1	2	2	1	1	3
	C109.4	3	2	2	1	2	2	1	1	1
	Avg. (C109)	**3.00**	**2.00**	**1.50**	**1.75**	**1.50**	**1.50**	**1.00**	**1.50**	**1.50**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Communication skills CMS19001I	C110.1	1	2	2		2	3	1	1	1
	C110.2		1	1	1	1	3	1	1	1
	C110.3	2	1	1			3	1		
	C110.4		1	1	1	1	3	2	1	1
	Avg. (C110)	**1.50**	**1.25**	**1.25**	**1**	**1.33**	**3**	**1.25**	**1**	**1**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Engineering Graphics ENG190202	C111.1	3	1	2	-	-	2	1	3	3
	C111.2	2	-	1	-	-	-	1	1	1
	C111.3	2	-	1	-	-	-	1	1	1
	C111.4	2	-	1	-	-	-	2	2	2
	C111.5	2	-	2	1	1	2	3	3	3
	Avg. (C111)	**2.20**	**1.00**	**1.40**	**1.00**	**1.00**	**2.00**	**1.60**	**2.00**	**2.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Manufacturing Processes and Materials MPM190203	C112.1	3		2	2	1	2	3	3	2
	C112.2	3	1		2	1	1	2	2	2
	C112.3	2	1		1		1	2	2	1
	C112.4	3	1		2	1	1	2	2	2
	Avg. (C112)	**2.75**	**1**	**2**	**1.75**	**1**	**1.25**	**2.25**	**2.25**	**1.75**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Programming in C++ PIC 190204	C113.1	2	2	2				1		
	C113.2	2	3	3				1		
	C113.3	2	3	3	2			1	1	1
	Avg. (C113)	**2**	**2.67**	**2.67**	**2**			**1**	**1**	**1**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Stress Management **SMT190012**	C114.1						2	3	1	
	C114.2						2	3	1	
	C114.3						2	3	1	
	C114.4						2	3	1	
	Avg. (C114)						**2.00**	**3.00**	**1.00**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Applied Mathematics AMTI90013	C201.1	3	3	3	2	1	2	2		2
	C201.2	3	3	3	2	2	2	2	1	2
	C201.3	3	3	3	2	1	1	2		
	C201.4	3	3	3	2	1	2	2	1	2
	Avg. (C201)	**3.00**	**3.00**	**3.00**	**2.00**	**1.25**	**1.75**	**2.00**	**1.00**	**2.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Fluid Mechanics & Hydraulic Machines FMH190205	C202.1	3	2		2				1	3
	C202.2	2	2		2				1	1
	C202.3	2	2		2				1	1
	C202.4	2	2	2	2				1	2
	C202.5	2	2	2	2				1	2
	Avg. (C202)	**2.00**	**2.00**	**2.00**	**2.00**				**1.00**	**1.80**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Mechanical Engineering Drawing MED190206	C203.1	3	2	1	1		1	1	3	2
	C203.2	3	2	1	1		1	1	3	2
	C203.3	3	2	1	1				3	2
	C203.4	3	2	1					2	2
	C203.5	3	2	1					2	2
	Avg. (C203)	3	2	1	1		1		2.6	2

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Thermal engineering THEI90207	C204.1	3	3	1	0	1	0	0	0	3
	C204.2	3	3	1	0	1	0	0	0	3
	C204.3	3	2	1	1	0	0	1	1	3
	C204.4	3	2	1	1	0	1	1	1	3
	C204.5	3	2	1	1	0	1	1	1	2
	Avg. (C204)	**3.00**	**2.40**	**1.00**	**0.60**	**0.40**	**0.40**	**0.60**	**0.60**	**2.80**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Strength of Materials SOM190015	C205.1	3	-	1	2	-	-	1	3	1
	C205.2	2	2	3	1	-	-	-	2	-
	C205.3	3	2	2	2	-	-	-	3	-
	C205.4	1	3	2	2	-	-	-	2	-
	C205.5	2	-	-	2	-	-	-	2	-
	Avg.(C205)	**2.2**	**2.3**	**2**	**1.8**	**-**	**-**	**1**	**2.4**	**1**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Basics of electrical & electronics BEEI90016	C206.1	3	1		1				1	1
	C206.2	3	2	2	2	2		2	1	1
	C206.3	3	3		2				1	1
	C206.4	3							1	1
	C206.5	2		2	2				1	1
	C206.6	1	2			1		1	1	1
	Avg. (C206)	**2.50**	**2.00**	**2.00**	**1.75**	**1.50**		**1.50**	**1.00**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Automation AUTI90208	C207.1	2	1	3				1	2	
	C207.2	2	2	3	1			1	2	
	C207.3	2	1	3				1	2	
	C207.4	3	1	3	2			1	2	
	Avg. (C207)	**2.25**	**1.25**	**3.00**	**1.50**			**1.00**	**2.00**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Theory of machines TOMI90209	C208.1	3	3	2					3	1
	C208.2	3	2	2					3	1
	C208.3	3	2	2					3	1
	C208.4	3	2	2					3	
	Avg. (C208)	**3.00**	**2.25**	**2.00**					**3.00**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Industrial Fluid Power **IFP190210**	C209.1	3		2				1		
	C209.2	2	1	2				1		
	C209.3	2	1	2				1		
	C209.4	2	1	2				1		
	C209.5	3	3	3	3	1	2	1	3	2
	C209.6	3	3	3	3	1	2	1	3	2
	Avg. (C209)	**2.50**	**1.80**	**2.33**	**3.00**	**1.00**	**2.00**	**1.00**	**3.00**	**2.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Power Engineering & Refrigeration PER190211	C210.1	3								3
	C210.2	3			3	3				3
	C210.3	3			3					3
	C210.4	3							3	3
	C210.5	3		3					3	3
	Avg. (C210)	**3.00**		**3.00**	**3.00**	**3.00**			**3.00**	**3.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Machining processes MPRI90212	C211.1	3			2		1	1	1	
	C211.2	2			2		1		1	
	C211.3	2			1	1		1		
	C211.4	1			1		1	1		
	Avg. (C211)	**2**			**1.50**	**1**	**1**	**1**	**1**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Automobile Engineering AEG190213	C212.1	3	1	-	-	-	-	-	2	2
	C212.2	3	3	2	2	-	-	-	3	2
	C212.3	3	2	-	1	-	-	-	2	
	C212.4	3	2	-	1	-	-	-	1	
	C212.5	3	2	-	1	-	2	1	2	2
	Avg. (C212)	**3.0**	**2.0**	**2.0**	**1.25**	**-**	**2.0**	**1.0**	**2.0**	**2.0**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Mechatronics MEC190214	C213.1	3		1					1	1
	C213.2	3	2	2	1				2	2
	C213.3	3	2	3	1		1		3	2
	C213.4	3	2	1	1				1	1
	Avg.(C213)	**3.00**	**2.00**	**1.75**	**1.00**		**1.00**		**1.75**	**1.50**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Material Handling Systems MHSI90215	C214.1	3	3	2	2	1		1	3	
	C214.2	2	3	2	2			1	3	
	C214.3	2	2	2	2			1	2	
	C214.4	2	2	2	2		1	1	2	
	Avg.(C214)	**2.25**	**2.50**	**2**	**2.00**	**1.00**	**1.00**	**1.00**	**2.50**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Energy Conservation and Audit ECA190216	C215.1	2	2	2		2		1	2	
	C215.2	3	3	3	3			1	3	
	C215.3	3	3	2		3		1	3	
	C215.4	3	3	2		3		1	3	
	C215.5						2	1		
	Avg. (C215)	**2.75**	**2.75**	**2.25**	**3**	**2.67**	**2**	**1**	**2.75**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Measurements & Control MMC190217	C216.1	3	1		2			1	3	1
	C216.2	2	2	2	2			1	2	1
	C216.3	2	2	2	2			1	2	1
	C216.4	2	2	2	2			1	2	1
	C216.5	2	2	2	2			1	2	1
	C216.6	2	2	2	2			1	2	1
	Avg.(C216)	**2.17**	**1.83**	**2.00**	**2.00**			**1.00**	**1.83**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Heating, Ventilation & Air conditioning HVA190218	C217.1	3			3				3	3
	C217.2	3		2	3	3			3	
	C217.3	3							3	
	C217.4	3		3	3				3	3
	C217.5	3								3
	Avg.(C217)	**3.00**		**2.5**	**3.00**	**3.00**			**3.00**	**3.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Inplant Training IPT190228	C301.1	1				3		2	2	2
	C301.2	3		2		2			3	2
	C301.3	2		1			3	2	2	3
	C301.4	1		2		3		2	3	2
	C301.5	2	2	2	2		3	1	3	2
	C301.6	2	2	3	1	1	1		3	2
	Avg.(C301)	**1.83**	**2.00**	**2.00**	**1.50**	**2.25**	**2.33**	**1.75**	**2.67**	**2.17**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Metrology & Quality Control MQC190219	C302.1	3	2	2			1	1	2	2
	C302.2	3	2	1			1		2	1
	C302.3	3	2	1					2	1
	C302.4	3	3	3	3		2	2	3	3
	C302.5	3	3	3	3		2	2	3	3
	Avg. (C302)	3.00	2.20	2.00	3.00		1.50	1.67	2.40	2.00

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Design of machine elements DME190220	C303.1	2	2	3	2	1		1	3	1
	C303.2	2	2	3	2	1		1	3	1
	C303.3	2	2	3	2	1		1	3	1
	C303.4	2	2	3	2	1		1	3	1
	C303.5	2	2	3	2	1		1	3	1
	C303.6	2	2	3	2	1		1	3	1
	Avg.(C303)	**2.00**	**2.00**	**3.00**	**2.00**	**1.00**		**1.00**	**3.00**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Modern Production Processes MPP190221	C304.1	2	3	2	2	1	1	1	3	
	C304.2	3	3	2	2	1	1	1	2	
	C304.3	2	2	1	1				2	
	C304.4	2	2	1	2	1	1	1	2	
	Avg. (C304)	**2.25**	**2.5**	**1.5**	**1.75**	**1.00**	**1.00**	**1.00**	**2.25**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Production Management PMT190222	C305.1	3	1		1	1	2	2	3	1
	C305.2	2	1	1	2	1	1	1	2	1
	C305.3	2	3	2	3		3	2	3	1
	C305.4	2	2	1	1	1	1	2	3	2
	Avg. (C305)	**2.25**	**1.75**	**1.33**	**1.75**	**1.00**	**1.75**	**1.75**	**2.75**	**1.25**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Project PRO190223	C306.1	2	2	2	2	1	1	1	2	2
	C306.2	2	2	2	2	1	2	1	2	2
	C306.3	2	2	2	2	1	2	1	2	2
	C306.4	2	2	2	2	3	3	1	2	2
	C306.5						3	2	2	2
	Avg. (C306)	**2.00**	**2.00**	**2.00**	**2.00**	**1.50**	**2.2**	**1.20**	**2.00**	**2.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
World Class Manufacturing System WCM190224	C307.1	3	3	2	2	2	1	2	3	
	C307.2	3	2	2	2	2	1	2	3	
	C307.3	3	3	2	2	2	1	2	3	
	C307.4	3	2	2	2	2	1	2	3	
	C307.5	3	2	2	2	2	1	2	3	
	Avg. (C307)	**3.00**	**2.40**	**2.00**	**2.00**	**2.00**	**1.00**	**2.00**	**3.00**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Computer Aided Design / Computer Aided Manufacturing / Computer Aided Engineering CAD190225	C308.1	3	2	2	2			1	3	
	C308.2	3	2	2	2			1	3	
	C308.3	3	2	2	2			1	3	
	C308.4	3	2	2	2			1	3	
	Avg. (C308)	**3.00**	**2.00**	**2.00**	**2.00**			**1.00**	**3.00**	

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Tool Design and Process Planning TDP190226	C309.1	3	1	1					1	
	C309.2	3	3	2	2				3	2
	C309.3	3	3	2	2		1	1	3	1
	C309.4	3	3	2	2	1	1	1	3	1
	C309.5	3	3	2	2	1	1	1	2	
	Avg. (C309)	3	2.6	1.8	2	1	1	1	2.4	1.33

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Power Plant Engineering PPE190227	C310.1	3	1	1		2			3	1
	C310.2	3				1			3	2
	C310.3	3				1			1	1
	C310.4	3	2	2	2			1	3	2
	Avg. (C310)	**3.00**	**1.50**	**1.50**	**2.00**	**1.33**		**1.00**	**2.50**	**2.50**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Entrepreneurship Development EDP190018	C311.1	2							2	2
	C311.2			2			2		3	2
	C311.3	3	2				3	1	2	2
	C311.4		2		2				2	2
	C311.5		3			2		1	2	2
	C311.6		2			3		1	2	2
	Avg. (C311)	**2.50**	**2.25**	**2.00**	**2.00**	**2.50**	**2.50**	**1**	**2.17**	**2.00**