GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN
JODHPUR

SEMESTER SCHEME-2020-21

(SESSION 2021-2022 & ONWARDS)

TEACHING AND EXAMINATION SCHEME AND SYLLABUS

MECHANICAL (PRODUCTION) ENGINEERING

(MP)

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Curriculum Development Cell
Board of Technical Education, Rajasthan
W-6 Residency Road,
Jodhpur

GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR

TEACHING AND EXAMINATION SCHEME

(SEMESTER SCHEME-2020-21)

FOR DIPLOMA **III SEMESTER MECHANICAL (PRODUCTION) ENGINEERING (MP)**

SESSION 2021-2022& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assign	PR(S)		
PC	$MP 3001	Basic Mechanical Engineering	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	MP 3002	Metrology & Measurments	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	$MP 3003	Fluid Mechanics & Hydraulic Machinery	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	MP 3004	Industrial Production Technology -I	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	MP 3005	Heat Power Engineering	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	MP 3006	Computer Aided Machine Drawing Lab	0	0	4	4	-	-	40	3	-	-	60	100	2
PC	MP 3007	Production Drawing Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	MP 3008	Industrial Production Technology **-I** Lab	0	0	3	3	-	-	40	3	-	-	60	100	1.5
PC	MP 3009	Precision Metrology Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	MP 3010	Heat Power Engineering lab	0	0	3	3	-	-	40	3	-	-	60	100	1.5
SI	MP 3011	Summer Internship-I(4 weeks after II Sem.)	0	0	0	0	-	-	100	-	-	-	-	100	2
VS	+MP 3333	Anandam (Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**12**	**3**	**18**	**33**	**300**	**15**	**300**	**--**	**100**	**100**	**400**	**1200**	**26**
													Grand Total :	**1200**	**26**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +MP 3333 is same in all branches of Engineering

2. $MP 3001 and $MP 3003 are same MA/ME 3001 and as MA/ME 3003 respectively

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR

TEACHING AND EXAMINATION SCHEME

(SEMESTER SCHEME-2020-21)

FOR DIPLOMA **IV SEMESTER MECHANICAL (PRODUCTION) ENGINEERING (MP)**

SESSION 2021-2022& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	MP 4001	Industrial Production Technology -II	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	***MP 4002	Strength of Materials	2	1	0	3	60	3	-	-	20	20	-	100	3
PC	MP 4003	Theory of Machines and Mechanisms	2	1	0	3	60	3	-	-	20	20	-	100	3
PE	MP 4004	**Programme Elective-I** **MP 40041-** Material Science & Heat Treatment *__MP 40042-__ Material Handling Systems	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	MP 4005	**Programme Elective-II** **MP 40051-** Quality & Environmental Engineering **MP 40052-** Advanced Manufacturing Processes	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	MP 4006	Strength of Materials & Hydraulic Mechinery Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	MP 4007	CAD/CAM Lab	0	0	2	2	-	-	40	3	-	-	60	100	1
PC	MP 4008	Industrial Production Technology II - Lab	0	0	2	2	-	-	40	3		-	60	100	1
PR	MP 4009	Minor Project	0	0	4	4	-	-	40	3	-	-	60	100	2
AU	+MP 4222	Essence of Indian Knowledge and Tradition	2	0	0	2	--	--	--	--	--	--	--	--	--
VS	+MP 4444	Anandam (Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**15**	**2**	**14**	**31**	**300**	**--**	**160**	**--**	**100**	**100**	**340**	**1000**	**22**
											Grand Total			**1000**	**22**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +MP 4222 and +MP 4444 are same in all branches of Engineering

2. ***MP 4002 is same as MA/ME/MT 4002

3. **MP 40042 is same as MA/ME 40042

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Note:Students will go for 6 Weeks Summer Internship in the Summer Vacations after Fourth Semester. The assessment of the Summer Internship will be done in Fifth Semester

GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR

TEACHING AND EXAMINATION SCHEME

(SEMESTER SCHEME-2020-21)

FOR DIPLOMA **V SEMESTER MECHANICAL (PRODUCTION) ENGINEERING (MP)**

SESSION 2022-2023& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi	PR(S)		
PC	MP 5001	Mechatronics and Robotics	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	MP 5002	Automation & CNC Machines	3	0	0	3	60	3	-	-	20	20	-	100	3
OE	+MP 5100	**Open Elective-I** +**MP 51001**- Economic Policies in India +**MP 51002**- Engineering Economics & Accountancy	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	$$MP 5003	Industrial Engineering &Management	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	MP 5004	**Programme Elective-III** **MP 50041**- Total Quality Management **MP 50042**- Farm Equipment & Farm Machinery	3	0	0	3	60	3	-	-	20	20	-	100	3
PE	MP 5005	**Programme Elective-IV** **MP 50051**- Production Planning and Control **MP 50052**- Operations Research	3	0	0	3	60	3	-	-	20	20	-	100	3
SI	MP 5006	Summer Internship-II(6 weeks after IVSem)	0	0	0	0	-	-	100	-	-	-	--	100	3
PR	MP 5007	Major Project	0	0	2	2	-	-	--		-	-	--	-	--
VS	+MP 5555	Anandam (Joy of Giving)	0	0	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	**0**	**0**	**3**	**3**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	0
		Total	**18**	**0**	**6**	**24**	**360**	**--**	**100**	**--**	**120**	**120**	**100**	**800**	**-**
													Grand Total :	**800**	**23**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +MP 51001, +MP 51002 and +MP 5555 are same in all branches of Engineering

2. $$MP 5003 is same as ME/MT 5003

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Note:Major Project will be continued and Assesed in VI Semester

BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR

TEACHING AND EXAMINATION SCHEME

(SEMESTER SCHEME-2020-21)

FOR DIPLOMA **VI SEMESTER MECHANICAL (PRODUCTION) ENGINEERING (MP)**

SESSION 2021-2022& ONWARDS SESSION 2022-2023 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assign	PR(S)		
PC	+MP 6111	Entrepreneurship and Start-ups	3	1	0	4	60	3	-	-	20	20	-	100	4
OE	+MP 6200	**Open Elective-II** +**MP 62001**- Project Management +**MP 62002**- Renewable Energy Technologies	3	0	0	3	60	3	-	-	20	20	-	100	3
OE	+MP 6300	**Open Elective-III** +**MP 63001**- Product Design +**MP 63002**- Disaster Management	3	0	0	3	60	3	-	-	20	20	-	100	3
AU	+MP 6333	Indian Constitution	2	0	0	2	--	--	--	--	--	--	--	--	--
PC	MP 6001	Tool Engineering	3	0	0	3	60	3	-	-	20	20	-	100	3
PC	MP 6002	Industrial Equipment Maintenance	3	0	0	3	60	3	-	-	20	20	-	100	3
PR	MP 6003	Major Project	0	0	6	6	--	--	40		--	--	60	100	4
SE	MP 6004	Seminar	1	0	0	1	-	-	--	-	-	-	100	100	1
VS	+MP 6666	Anandam (Joy of Giving)	0	0	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	-	-
		Total	**18**	**1**	**10**	**29**	**300**	**15**	**40**	**-**	**100**	**100**	**260**	**800**	**23**
													Grand Total	**800**	**23**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +MP 6111, +MP 62001, +MP 62002,+MP 63001, +MP 63002, +MP 6333 and +MP 6666 are same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

III SEMESTER

(SESSION 2021-2022 & ONWARDS)

BASIC MECHANICAL ENGINEERING

Course Code	:	*MP 3001 (Same in MA/ME 3001)
Course Title	:	BASIC MECHANICAL ENGINEERING
Number of Credits	:	3(L: 2, T: 1, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To understand General Principles of Mechanical Engineering.
- To understand laws of thermodynamics, thermal and thermodynamic Processes.
- To understand working principles of power develops and power absorbing devices.
- To understand basic materials and manufacturing processes.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand basics of thermodynamics and components of a thermal power plant
CO2	Understand basics of heat transfer, refrigeration and internal combustion engines
CO3	Understand mechanism of thermal power plant and boiler operation
CO4	Identify engineering materials, their properties, manufacturing methods encountered in engineering practice
CO5	Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines

COURSE CONTENTS:

1. INTRODUCTION TO THERMODYNAMICS

- 1.1 Role of Thermodynamics in Engineering and Science.
- 1.2 Basic Concept of thermodynamic laws
  - 1.2.1 Types of system, Thermodynamic Equilibrium, properties (basic Concept only)
  - 1.2.2 Elementary introduction to Zeroth Law, First Law, Heat and work
  - 1.2.3 Second laws of thermodynamics Kelvin-Planck and Clausius Statements
  - 1.2.4 Concept of Heat Engine, Heat Pump & Refrigerator, Efficiency/COP
  - 1.2.5 Carnot Cycle, Carnot Efficiency, T-S and P-V Diagrams

2. HEAT TRANSFER & THERMAL POWER PLANT

- 2.1 Modes of Heat Transfer
- 2.2 Conduction:
  - 2.2.1 Composite Walls and Cylinders
- 2.3 Simple Numerical Problems
- 2.4 Thermal Power Plant Layout
- 2.5 Fire Tube and Water Tube boilers (only working principal and types)

3. STEAM TURBINES

- 3.1 Impulse and Reaction Turbines;
- 3.2 Condensers: Jet & Surface Condensers (only working principal of both type)
- 3.3 Cooling Towers(only working principal and types)

4. MATERIAL AND MANUFACTURING PROCESSES` ``

- 4.1 Engineering Materials
  - 4.1.1 Classification and their Properties
- 4.2 Metal Casting: Moulding, Patterns
- 4.3 Metal Working process: Hot and Cold working (Introduction only)
- 4.4 Metal Forming processes (Introduction Only)
- 4.5 Press Working process (Introduction and working)
  - 4.5.1 Press Working operations: - Cutting, bending, Drawing,
  - 4.5.2 Punch, blanking, piercing, notching, lancing

4.5.3 effect of clearance.

5. SUPER FINISHING AND METAL COATING PROCESSES

5.1 Finishing by grinding: (basic concept only and no mathematical formulation)
- 5.1.1 Honing,
- 5.1.2 Lapping,
- 5.1.3 Super finishing;

5.2 Electroplating: Basic principles and applications;

5.3 Hot dipping: Galvanizing, Tin coating

5.4 Metal spraying: (Basic Principle);

5.5 Finishing specifications.

REFERENCES:

1. Basic Mechanical Engineering – M.P. Poonia & S.C. Sharma, Khanna Publishing House, Delhi
2. Elements of Mechanical Engineering – M. L. Mathur, F. S. Mehta and R. P. Tiwari, Jain Brothers, New Delhi
3. Engineering Heat Transfer – Gupta & Prakash, Nem Chand & Brothers, New Delhi
4. Workshop Technology (Vol. 1 and 2) – B. S. Raghuvanshi, Dhanpath Rai and Sons, New Delhi.
5. Basic Mechanical Engineering – J Benjamin
6. Elements of Mechanical Engineering – Roy and Choudhary
7. Engineering Thermodynamics – Spalding and Cole

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METROLOGY & MEASUREMENTS

Subject Code	:	MP 3002
Course Title	:	METROLOGY & MEASUREMENTS
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- To study advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
- To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

COURSE CONTENTS:

1. Introduction to measurements:

1.1. Introduction: Definition and significance
1.2. Systems of measurements: Basic and derived units, types of measuring systems
1.3. Methods of measurements: Direct & Indirect;
1.4. Standards of measurements: Primary & Secondary; Line and end standards
1.5. Factors influencing selection of measuring instruments;
1.6. Terms applicable to measuring instruments
  1.6.1. Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration;
1.7. Errors in Measurements: Classification of errors, Systematic and Random error.
1.8. Linear Measurment:
  1.8.1. Introduction;
  1.8.2. Vernier instruments: Principle of vernier instruments, least count, Types, precautions and errors
  1.8.3. Vernier calipers, vernier height gauge, vernier depth gauge, bore gauge.
  1.8.4. Micrometers: principle, types, source of errors
  1.8.5. Slip gauges: Introduction, wringing, precautions and selection of slip gauges
  1.8.6. Comparators: Characteristics of comparators, principle, requirements of a good comparator, applications
  1.8.7. Classifications of comparators;
  1.8.8. Surface finish measurement: Definition, Terminology of surface finish, need of control on surface finish, factors affecting surface finish, order of geometrical irregularities, representation of surface finish, measurement and evaluation of surface finish, Talysurf surface roughness tester;

2. Transducers and Strain gauges:

2.1. Introduction;
2.2. Transducers: Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer;
2.3. Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements.
2.4. Measurement of force, torque, and pressure:
  2.4.1. Force measurement: Spring Balance, Proving ring, Load cell;
  2.4.2. Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer;
  2.4.3. Pressure measurement: Mcloed gauge.

3. Applied mechanical measurements:

3.1. Speed measurement: Classification of tachometers,
3.2. Revolution counters, Eddy current tachometers;
3.3. Displacement measurement: Linear variable Differential transformers (LVDT);
3.4. Flow measurement: Rotometers, Turbine meter;
3.5. Temperature measurement: Resistance thermometers, Optical Pyrometer.
3.6. Miscellaneous measurements:
  3.6.1. Humidity measurement: hair hygrometer
  3.6.2. Density measurement: hydrometer

4. Limits, Fits & Tolerances:

4.1. Concept of Limits, Fits, and Tolerances: Terminology
4.2. Selective Assembly; Interchangeability; Hole And Shaft Basis System;
4.3. Gauges: types of gauges (plug, ring, snap and limit gauges)
4.4. Taylor's Principle of design of gauges: Design of Plug, ring, snap and limit gauges
4.5. Concept of multi gauging and inspection.
4.6. Angular Measurement:
  4.6.1. Instruments For Angular Measurements: Working and use of sprit level,bevel protractors, sine bars, combination sets and clinometers
  4.6.2. Angle Gauges.
4.7. Screw thread Measurements:
  4.7.1. Screw threads: ISO grades, Types, Terminology and applications
  4.7.2. Errors in threads; Pitch errors;
  4.7.3. Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch;
  4.7.4. Thread gauge micrometer;

5. Gear Measurement and Testing:

5.1. Introduction: Types and terminology
5.2. Measurement of tooth thickness and pitch
5.3. Gear tooth vernier
5.4. Errors in gears and testing : analytical and functional inspection, rolling test
5.5. Machine tool testing:
  5.5.1. Parallelism;
  5.5.2. Straightness;
  5.5.3. Squareness;
  5.5.4. Coaxiallity;
  5.5.5. roundness;
  5.5.6. Alignment testing of lathe and drilling machines as per IS standard procedure.

Reference Books:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Anand K Bewoor,Vinay kulakarni, Tata McGraw Hill, New Delhi, 2009
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.
4. Workshop technology and metrology – Keshar M. Saini, Kumawat L.R., Neelkanth publishers, Jaipur-2012
5. Principles of Engineering metrology – Rega Rajendra, Jaico publishers, 2008
6. Dimensional Metrology – Connie Dotson, DELMAR, cenage learning, 2007
7. Instrumentation measurement and analysis – B.C. Nakara, K.K. chaudary, second edition, Tata cgraw Hill, 2005.
8. A text book of Engineering metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005
9. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS
10. Engineering Metrology – K. J. Hume, Kalyani publishers

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
CO2	Distinguish between various types of errors.
CO3	Understand the principle of operation of an instrument and select suitable measuring device for a particular application.
CO4.	Appreciate the concept of calibration of an instrument
CO5	Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.

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FLUID MECHANICS & HYDRAULIC MACHINERY

Course Code	:	*MP 3003 (Same in MA/ME 3003)
Course Title	:	FLUID MECHANICS & HYDRAULIC MACHINERY
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To understand fluid flow & related machinery for power generation, water supply and irrigation.
- To Select and use appropriate flow measuring device.
- To Select and use appropriate pressure measuring device.
- To understand and analyze the performance of pumps and turbines.

COURSE CONTENT:

1. **Introduction of basic Properties of fluid**
   - 1.1 Surface tension, Capillarity,
   - 1.2 **Fluid Pressure & Pressure Measurement:**
     - 1.2.1 Fluid pressure, Pressure head, Pressure intensity
     - 1.2.2 Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure,
     - 1.2.3 Simple and differential manometers,
     - 1.2.4 Bourdan pressure gauge,
     - 1.2.5 Concept of Total pressure on immersed bodies, center of pressure,
     - 1.2.6 Simple problems on Manometers.
2. **FLUID FLOW:**
   - 2.1 Types of fluid flows,
   - 2.2 Continuity equation,
   - 2.3 Bernoulli's theorem,
   - 2.4 Principle of operation of Venturimeter,
   - 2.5 Orifice meter
   - 2.6 Pitot tube
   - 2.7 Numerical problems.
   - 2.8 Minor and major losses in pipes, Hydraulic gradient and total gradient line,
   - 2.9 Numerical problems to estimate major and minor losses
3. **IMPACT OF JETS**
   - 3.1 Impact of jet on fixed and vertical flat plates,
   - 3.2 Impact of jet on curved vanes,
   - 3.3 Simple Numericals on work done and efficiency.
4. **HYDRAULIC TURBINES**
   - 4.1 Layout of hydroelectric power plant (Basic Concept)
   - 4.2 Classification and selection of hydraulic turbines,
   - 4.3 Construction and working principle of Pelton wheel,
   - 4.4 Francis and Kaplan turbines (Derivation for work and efficiency)
   - 4.5 Draft tubes – types and construction,
   - 4.6 Concept of cavitation in turbines,
   - 4.7 Simple problem related to Calculation of Work done, Power, efficiency of turbines,
   - 4.8 Unit quantities
5. **CENTRIFUGAL PUMPS**
   - 5.1 Principle working and applications of centrifugal pump (with Derivation for work done and efficiency),
   - 5.2 Numericals on calculations of overall efficiency and power required to drive pumps
   - 5.3 Reciprocating Pumps:
     - 5.3.1 working principle and applications of reciprocating pumps,
   - 5.4 Concept of Slip,
   - 5.5 Cavitation and separation.

REFERENCES:

1. Fluid Mechanics & Hydraulic Machines, S.S. Rattan, Khanna Publishing House, New Delhi

2. Hydraulic, fluid mechanics & fluid machines – Ramamrutham S, Dhanpath Rai and Sons, New Delhi.
3. Hydraulics and fluid mechanics including Hydraulic machines – Modi P.N. and Seth S.M., Standard Book House. New Delhi
4. One Thousand Solved Problems in Fluid Mechanics – K. Subramanya, Tata McGraw Hill.
5. Hydraulic, fluid mechanics & fluid machines – S. Ramamrutham, Dhanpat Rai and Sons, New Delhi
6. Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Publications, New Delhi

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Measure various properties such as pressure, velocity, flow rate using various instruments.
CO2	Calculate different parameters such as co-efficient of friction, power, efficiency etc of various Systems.
CO3	Describe the construction and working of turbines and pumps.
CO4	Test the performance of turbines and pumps.
CO5	Plot characteristics curves of turbines and pumps.

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INDUSTRIAL PRODUCTION TECHNOLOGY –I

Subject Code	:	MP 3004
Course Title	:	INDUSTRIAL PRODUCTION TECHNOLOGY-I
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- To understand the types of pattern, casting, moulding, furnaces and casting processes.
- To know the construction and working principles various welding processes.
- To understand various forming technologies and metal powder manufacturing methods.

1. Foundry Technology

1.1. Patterns:

1.1.1. Definition, types of pattern: solid piece, split piece, loose piece, match plate, sweep, skeleton, segmental, shell

1.1.2. Pattern materials and Pattern allowances.

1.2. Moulding:

1.2.1. Moulding sand constituents,types of moulding sand, properties of moulding sand, preparation of moulding sand

1.2.2. Moulding tools, Moulding boxes, types of mould, green sand mould, dry sand mould, loam sand mould, methods of moulding

1.2.3. Moulding machines: Jolting,Squeezing, sand slinger ,construction and working principle

1.3. Cores: Essential qualities of core, materials, core sand preparation,

1.4. Core binders, core boxes, CO_2 process core making, types of core.

1.5. Melting furnaces: Cupola furnace, Crucible furnace, types of Pit furnace, Coke fired, Oil fired, Induction furnace, working principles.

2. Casting

2.1. Shell mould casting, Investment casting, Pressure die casting, hot chamber die casting, Cold chamber die casting, Gravity die casting, Centrifugal casting

2.2. Defects in casting: causes and remedies

3. Welding Technology

3.1. Arc welding:

3.1.1. Definition, arc welding equipment, electrode types, filler and flux materials

3.1.2. Arc welding methods: Metal arc, Metal inert gas (MIG), Tungsten inert gas (TIG), Submerged arc, electro slag welding, Resistance welding, Spot, butt, seam, plasma arc welding, Thermit welding, Electron beam welding, Laser beam welding, ,Ultrasonic welding, Induction welding

3.2. Gas welding:

3.2.1. Oxy-acetylene welding, Advantages and limitations, gas welding equipment, three types of flames, welding techniques, filler rods ,flame cutting, soldering, brazing, difference between soldering and brazing

3.2.2. Types of welded joints, Selection of welding rod and type of flame for gas welding of ferrous metals, Merits and demerits of welded joints

4. Forming Technology

4.1. Forging:

4.1.1. Hot working, cold working, Advantages of hot working and cold working

4.1.2. Hot working operations- Rolling, Forging, Smith forging, Drop forging ,Upset forging ,Press forging ,Roll forging

4.2. Press working: Types of presses, Mechanical and hydraulic press

5. Powder Metallurgy:

5.1. Methods of manufacturing metal powders, Atomization, Compacting, Sintering, Sizing, Infiltration,

5.2. Mechanical properties of parts made by powder metallurgy

Reference Books:

1. Elements of Workshop Technology Volume I & II, Hajra Chowdry & Bhatt Acharaya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology, Rajendersingh, New age International (P) Ltd. New Delhi- 110002, 2006
3. Manufacturing Process Begeman, Tata McGraw Hill, New Delhi.
4. Workshop Technology- Volume I, II, & III, WAJ Chapman Viva Books Pvt. Ltd., New Delhi

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Demonstrate understanding of casting process
CO2	Illustrate principles of forming processes
CO3	Demonstrate applications of various types of welding processes
CO4.	Explains the concepts of rolling, forming and forging.
CO5	Illustrates the concept of powder metallurgy

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HEAT POWER ENGINEERING

Course Code	:	MP 3005
Course Title	:	HEAT POWER ENGINEERING
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- Describe internal combustion engine.
- Select appropriate type of compressor to suit the requirements.
- Calculate performance parameters of Air compressor.
- Understand Refrigeration & Air-conditioning processes and their application.

COURSE CONTENT:

1. Basics of Thermodynamics and Thermodynamic Processes of Perfect Gases:

1.1. Introduction, definitions and units of
- 1.1.1. Mass, weight, volume, density, specific weight and specific volume
- 1.1.2. Units of pressure, temperature, absolute temperature, S.T.P and N.T.P conditions

1.2. Heat - specific heat capacity at constant volume and at constant pressure, work , power , energy, Law of conservation of energy

1.3. Law of thermodynamics: Zeroth , first and second, problems

1.4. Law of Perfect gases: Boyle's, Charles , Joule's, Regnault's, Avogadro's laws , General Gas Equation- characteristic gas equation, Relation between specific heats and gas constant, universal gas constant, problems

1.5. Thermodynamic Processes: Constant volume, constant pressure, isothermal(hyperbolic) , isentropic (reversible adiabatic), polytropic, p-V and T-s diagrams, Work done, Change in internal energy , Heat transfer , Change in enthalpy , Change in entropy for various processes, problems Free expansion and throttling processes.

2. Thermodynamic Air Cycles and Steady Flow Energy Equation & Applications:

2.1. Air cycles: air standard efficiency, reversible and irreversible processes, assumptions in deriving air standard efficiency
- 2.1.1. Carnot cycle
- 2.1.2. Otto cycle
- 2.1.3. Joule cycle
- 2.1.4. Diesel cycle
- 2.1.5. Comparison of Otto cycle and Diesel cycle
- 2.1.6. Comparison of ideal and actual p-V diagrams of Otto and Diesel cycles, problems, Dual combustion cycle (description only).

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

3. Air Compressors:

3.1. Uses of compressed air

3.2. Classifications of Air compressor, reciprocating compressor

3.3. Single stage reciprocating compressor
- 3.3.1. Power required to drive the compressor (Neglecting clearance Volume), problems
- 3.3.2. Clearance volume and its effects, volumetric efficiency
- 3.3.3. Power required to drive the compressor with clearance volume

3.4. Multi stage compression, merits and demerits
- 3.4.1. Two stage compressor with imperfect cooling with perfect inter cooling, work input
- 3.4.2. Condition for minimum work input in multi stage compressor with perfect inter cooling ratio of cylinder diameters for minimum work input

3.5. Rotary compressors – roots blower - vane blowers

3.6. Centrifugal and axial flow air compressors.

4. Fuels & Combustion of Fuels and Internal Combustion Engines:

4.1. Classifications of fuels- merits and demerits, requirements of a good fuel
4.2. combustion equations, stoichiometric air required for complete combustion of fuels, excess air, products of combustion, problems,
4.3. calorific value of fuels: higher and lower calorific values
4.4. Internal combustion engines.
4.4.1. Classifications of I.C Engines –
4.4.2. Components of I.C Engines and functions
4.4.3. Four stroke cycle petrol and diesel engines –
4.4.4. Two stroke cycle petrol and diesel engines –
4.4.5. Comparison of four stroke and two stroke engines –
4.4.6. Comparison of petrol and diesel engines –

5. Refrigeration and Air- Conditioning:

5.1. Introduction: COP of Heat Pump and refrigerator, Tonnes of Refrigeration.
5.2. Vapour compression system, Vapour compression refrigeration cycle, components of Vapour Compression Cycle.
5.3. Applications: Water Cooler Domestic refrigerator, Ice plant & cold storage.
5.4. Psychrometry, Properties of air, psychrometric chart & processes (No Numerical)
5.5. Air conditioning systems, Definition of Air conditioning and classification of Air Conditioning Systems.

Reference Books:

1. Thermal Engg, R. K. Rajput,8th Edition, Laxmi publications Pvt. Ltd, New Delhi.
2. Applied Thermodynamics, P. K. Nag, 2nd Edition, TATA McGraw – Hill Publishing Company, New Delhi.
3. Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co,NewDelhi
4. Thermal Engineering, B. K. Sarkar, 3rd Edition, Dhanpat Rai & Sons New Delhi
5. Applied Thermodynamics, Domkundwar and C. P.Kothandaraman, 2nd Edition, Dhanpat Rai & Sons, New Delhi.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Explain the basics of systems and laws of thermodynamics and thermodynamic processes. Explain different Air Cycles.
CO2	Apply steady flow energy equation for nozzles and condensers.
CO3	Familiarize the parts, functions and types of Air compressors and determine their efficiency. Describe the working of the gas turbines.
CO4.	Explain different type of fuels and their combustion phenomenon.
CO5	Explain the types and functions of IC engines.

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COMPUTER AIDED MACHINE DRAWING LAB

Course Code	:	MP 3006
Course Title	:	COMPUTER AIDED MACHINE DRAWING LAB
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites (Course code)	:	Engineering Graphics (1005)
Course Category	:	PC

COURSE OBJECTIVES:

- To use computer aided drafting,
- To prepare geometrical model of various machine elements
- To draw the different views of machine elements
- To interpret the drawing in engineering field and illustrate three dimensional objects.

COURSE CONTENTS:

1. Introduction to CAD software.
2. Drawing aids and editing commands.
3. Basic dimensioning, hatching, blocks and views.
4. Isometric drawing, printing and plotting
5. Machine Drawing practice using Auto CAD:
   Detailed drawings of following machine parts are to be given to the students to assemble and draw the sectional or plain elevations, plans and side views with dimensioning and bill of materials using cad software (**9 exercises**).
   - 5.1 Sleeve & Cotter Joint
   - 5.2 Spigot & Cotter Joint
   - 5.3 Knuckle Joint
   - 5.4 Screw Jack
   - 5.5 Foot Step Bearing
   - 5.6 Universal Coupling
   - 5.7 Machine Vice
   - 5.8 Connecting Rod
   - 5.9 Protected Type Flanged Coupling.

REFERENCES:

1. Bhatt, N.D., Machine Drawing, Charotar Publishing House, 2003.
2. Sidheswar, N., Kannaiah, P. and Sastry, V.V.S., Machine Drawing, Tata McGraw Hill Book Company, New Delhi, 2000.
3. Kannaih, P., Production Drawing, New Age International , 2009

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the representation of materials used in machine drawing
CO2	Draw the development of surfaces for sheet metal working applications.
CO3	Draw the machine elements including keys, couplings, cotters, riveted, bolted and welded joints.
CO4	Construct an assembly drawing using part drawings of machine components
CO5	Represent tolerances and the levels of surface finish of machine elements.

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PRODUCTION DRAWING LAB

Course Code	:	MP 3007
Course Title	:	PRODUCTION DRAWING LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES

- Production Drawing provides a convenient means to create designs for almost every engineering discipline.
- Computer Aided Design software can be used for the component drawings and explaining clearly the tolerances, surface roughness‘s etc.

COURSE CONTENT

1. Representation Materials & Machine Components
2. Limits and Fits
3. Form and Positional Tolerances
4. Surface Roughness and its Indication & Heat and Surface Treatment Symbols
5. Detailed and Part Drawings
    a. Stuffing Box
    b. Crosshead
    c. Eccentric
    d. Connecting rod
    e. Screw jack
    f. Pipe vice
    g. Plummer block
    h. Lathe tool post
    i. Oldham coupling
    j. Universal coupling
    k. Spring
    l. loaded relief valve

Reference Books:

1. Bhatt, N.D., Machine Drawing, Charotar Publishing House, 2003.
2. Sidheswar, N., Kannaiah, P. and Sastry, V.V.S., Machine Drawing, Tata McGraw Hill Book Company, New Delhi, 2000.
3. Kannaih, P., Production Drawing, New Age International , 2009
4. Machine Drawing with AutoCAD,/ Pohit and Ghosh, PE
5. Geometrical Dimensioning and Tolerancing, James D. Meadows, B.S. Publications

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Draw the conventional representation of different materials used in engineering practice like wood, glass, metal etc., and the limits and tolerances.
CO2	Understand and indication of form and position tolerances on drawings, types of run-out, total run-out and their indication.
CO3	Improve visualization ability of surface roughness and its indications with respect to the material surface.
CO4.	Apply the drawing techniques to draw various part drawings and assembly, tolerances, roughness etc.
CO5	Explains the internal features of different part drawings and assembly

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INDUSTRIAL PRODUCTION TECHNOLOGY-I LAB

Course Code	:	MP 3008
Course Title	:	INDUSTRIAL PRODUCTION TECHNOLOGY-I LAB
Number of Credits	:	1.5 (L: 0, T: 0, P: 3)
Prerequisites (Course code)	:	INDUSTRIAL PRODUCTION TECHNOLOGY-I(MP-304)
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving sound casting.
- To impart knowledge about welding behaviour of machine and process during welding, analysis of common and newer welding techniques and metallurgical and weldability aspects of different common engineering materials.

COURSE CONTENT:

- **Prepare the green sand mould using the following patterns.**
  1. Solid pattern: Stepped pulley, Bearing top
  2. Split pattern: Bent Pipe with core print, T-pipes with core print
  3. Loose Piece Pattern: Dovetail
  4. Core preparation for Bent pipe/T-pipe

- **Make the following Arc welding (Raw Material: 25 mmx6mm MS flat)**
  5. Lap joint
  6. Butt joint
  7. T-joint

- **Make the following Gas Welding (Raw Material: 25mmx3mm Ms flat)**
  8. Lap joint
  9. Butt joint
  10. Gas cutting: (GI/MSSheet-3mm thickness)
  11. Spot welding: Lap joint

Reference Books:

1. Elements of Workshop Technology Volume I & II, Hajra Chowdry & Bhatt Acharaya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology, Rajendersingh, New age International (P) Ltd. New Delhi- 110002, 2006
3. Manufacturing process Begeman Tata McGraw Hill, New Delhi 1981. 5th Edition, 1981
4. Workshop Technology- Volume I, II, & III, WAJ Chapman Viva Books Pvt. Ltd., New Delhi

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Identify the tools used in foundry.
CO2	Make sand mould by using the different types of pattern.
CO3	Make sand core for bend pipe and T pipe
CO4	Identify the tools used and safety precautions in welding
CO5	Apply the knowledge to make different types of joints by arc and gas welding.

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PRECISION METROLOGY LAB

Course Code	:	MP 3009
Course Title	:	PRECISION METROLOGY LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites (Course code)	:	Metrology & Measurements(MP 3002)
Course Category	:	PC

COURSE LEARNING OBJECTIVES

• To understand techniques for precise measurement of the dimensions of various objects and shapes.

COURSE CONTENT:

1) LINEAR MEASUREMENTS:

a) Determine the thickness of ground MS flat to an accuracy of 0.02mm using Vernier caliper.
b) Determine the diameter and length of cylindrical objects to an accuracy of 0.02mm using vernier caliper.
c) Determine the inside diameter of a bush component to an accuracy of 0.02 using Vernier caliper.
d) Determine the diameter of a cylindrical component to an accuracy of 0.01mm using micrometer and check the result with digital micrometer
e) Determine the height of gauge block or parallel bars to an accuracy of 0.02mm using Vernier height gauge.
f) Determine the depth of a blind bore component to an accuracy of 0.02mm using vernier depth gauge.
g) Determine the thickness of ground MS plates using slip gauges.

2) ANGULAR MEASUREMENTS:

a) Determine the angle of V-block, Taper Shank of Drill and Dovetails in mechanical components using universal bevel protractor.
b) Determine the angle of machined surfaces of components using sine bar with slip gauges.

3) III. GEOMETRIC MEASUREMENT

a) Measure the geometrical dimensions of V-Thread
b) Measure the geometrical dimensions of spur gear.

4) IV. MACHINE TOOL TESTING

Geometrical Test: Position of machine tool components and displacement of machine tool components relative to one another is checked.

The instruments required for Geometrical tests are Dial Gauge, test mandrel, Straight edge, Squareness, sprit level.

- Test for level of installation of machine tool in Horizontal and Vertical Planes.
- Test for Flatness of machine bed and for straightness and parallelism of bed ways on bearing surface.
- Test for perpendicular of guide ways to other guide ways or bearing surface.
- Test for true running of the main spindle and its axial movements.
- Test for parallelism of spindle axis to guide ways or bearing surfaces.
- Test for line of movements of various members like spindle and table cross slides.
- Practical test in which some test pieces are done and their accuracy and finish is checked.

Reference Books:

1. Measurement System (Application and Design) – Ernest O Doebelin.
2. Mechanical and Industrial measurements- R. K. Jain
3. Engineering precision metrology – R. C. Gupta
4. A text book of engineering of metrology- I. C. Gupta.
5. Hand book of Industrial Metrology – ASME

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Measure various component of linear measurement using Vernier calipers and Micrometer
CO2	Measure various component of angle measurement using sine bar and bevel Protractor
CO3	Measure the geometrical dimensions of V-thread and spur gear

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HEAT POWER ENGINEERING LAB

Course Code	:	MP 3010
Course Title	:	HEAT POWER ENGINEERING LAB
Number of Credits	:	1.5 (L: 0, T: 0, P: 3)
Prerequisites (Course code)	:	HEAT POWER ENGINEERING (MP 3005)
Course Category	:	PC

Course Learning Objectives:

- To understand working of various IC Engines and familiarise with various parts of different engines physically
- To understand and relate the working of an engine as studied in theory.
- Understand and familiarise with the working of desert cooler air compressor, refrigeration system.

Course Content:

1. Study by models, charts and actual units of Petrol Engine
2. Study by models, charts and actual units of Diesel Engine
3. Study by models, charts and actual units of Carburetor
4. Study by models, charts and actual units of Diesel fuel pump and fuel injector
5. Study of reciprocating air compressor.
6. Study of rotary air compressor.
7. Study of centrifugal air compressor.
8. Study of desert cooler
9. Study of room Air conditioner
10. Study of domestic Refrigerator

Reference Books:

1. Fundamental of thermodynamics, by Richard E Snnatag, Claus Borgnakke, Gordon J Vanwylen, Wiley Student edition, 6th Ed.,
2. Basic and applied thermodynamics by P. K. Nag ,Tata McGraw hill New delhi 2009
3. Heat engines(Vol-I & Vol-II) by Patel and Karmachandani
4. I. C. Engine Fundamentals by Hey wood
5. Thermal Engineering by R. S. Khurmi

Course outcomes:

At the end of the course, the student will be able to:

CO1	Understand the working of Petrol Engine
CO2	Understand the working of Diesel Engine
CO3	Understand the difference between working of two stroke and four stroke engine
CO4.	Understand the working of various types of air compressor
CO5	Understand the working of room Air conditioner, domestic Refrigerator

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GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

IV SEMESTER

(SESSION 2021-2022 & ONWARDS)

INDUSTRIAL PRODUCTION TECHNOLOGY-II

Subject Code	:	MP 4001
Course Title	:	INDUSTRIAL PRODUCTION TECHNOLOGY-II
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	Nill
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- To understand basic production processes and technologies of relevance to the manufacturing industry and related sectors, particularly in the production, process and development areas.
- To select, operate and control the appropriate processes for specific applications and production processes, surface finishing processes and plastic processes.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Use the basic machine tools like lathe, drilling and milling.
CO2	Understand reciprocating machines like planer, shaper and slotter.
CO3	Understand milling and gear cutting processes
CO4.	Identify abrasive process and broaching
CO5	Demonstrate concepts and use of Non-Conventional machining processes

COURSE CONTENT:

1. Lathe Machines, Drilling Machines and Boring Machines

1.1. **Lathe Machines** :Introduction, Types of lathes, Specification of lathes, Functions of lathes, Various operations performed on lathes, Attachments on lathe

1.2. **Drilling Machines**: Drills-Flat drills-Twist drills-Nomenclature, Types of drilling machines, Principle of operation in drilling -drilling holes, Drilling-operation-reaming-counter sinking-counter boring-spot facing-tapping-deep hole.

1.3. **Boring Machines:** Types Boring machines-horizontal and vertical types, Fine boring machines, Boring tools

2. Reciprocating Machines:

2.1. **Planer:** Types of planers-description of double housing planer specifications, Principles of operation drives-quick return mechanism-feed mechanism, Work holding devices and special fixtures.

2.2. **Shaper:** Types of shapers-specifications-standard-plain-universal, Principles of operations-drives-quick return mechanism-crank and slotted link-feed mechanism

2.3. **Slotter:** Types of slotters –specifications, Method of Operation-Whitworth quick return mechanism- feed mechanism

2.4. Difference between planer, shaper and slotter

3. Milling Machines:

3.1. Types-column and knee type-plain-universal milling machine-vertical milling machine

3.2. Specification of milling machines, Principles of operation-

3.3. work and tool holding devices and Types of milling cutters

3.4. Milling process: Indexing Methods- Simple and direct indexing

3.5. Gear Generating Processes: Gear shaper-Gear hobbing, Principle of operation only-Gear finishing processes-Burnishing-Shaving-Grinding and Lapping,

4. Abrasive Process and Broaching:

4.1. Abrasive process: Types, classification and specifications- Rough grinding, Belt grinders, Precision grinding cylindrical grinder, Centerless grinders, Surface grinder, Principles of operations

4.2. Grinding wheels abrasives-natural and artificial diamond wheels, Types of bonds-grit, grade and structure of wheels-wheel shapes and sizes, Dressing and truing of wheels-balancing of grinding wheels

4.3. **Broaching**: Types of broaching machine-horizontal, vertical and continuous broaching, Principles of operation, Types of broaches classification- broach tool nomenclature, Broaching operations

5. Non-Conventional Machining Processes:

5.1. Construction, working and applications of Ultrasonic machining, Electro chemical grinding, Electrical discharge machining and LASER machining

5.2. Advantages – Disadvantages

Reference Books:

1. Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, , Ed. 11, published by Media Promoters and Publishers Pvt. Ltd.,
2. Production Technology, HMT, , Edn. 18, Tata McGraw Hill Publishing Co.
3. Manufacturing process, Myro N Begman, Edn. 5, Tata McGraw Hill Publishing Co. Ltd.
4. Workshop Tech Vol I,II, III, WAJ. Chapman, published by Viva Books Pvt. Ltd. New Delhi
5. Production processes, NITTTR, published by 5, Tata McGraw Hill Publishing Co. Ltd.

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STRENGTH OF MATERIALS

Course Code	:	MP 4002 (Same in MA/ME/MT 4002)
Course Title	:	STRENGTH OF MATERIALS
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Engineering Mechanics 2005
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the concept of Simple Stresses and Strains.
- To understand the concept of Strain Energy.
- To understand the concept of Shear Force and Bending Moment Diagrams.
- To understand the concept of Theory of Simple Bending and Deflection of Beams.
- To understand the concept of Torsion in Shafts and springs.
- To understand the concept of Thin Cylindrical Shells.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Compute stressand strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.
CO2	Calculate thermal stresses, in bodies of uniform section and composite sections.
CO3	Define resilience, proof – resilience and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.
CO4	Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of for UDL and Point loads.
CO5	Calculate the safe load, safe span and dimensions of cross section.
CO6	Compare strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

COURSE CONTENT:

1 SIMPLE STRESSES AND STRAINS

1.1 Types of forces; Stress, Strain and their nature
1.2 Mechanical properties of common engineering materials
1.3 Significance of various points on stress – strain diagram for M.S. and C.I. specimens
1.4 Significance of factor of safety
1.5 Relation between elastic constants
1.6 Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces
1.7 Thermal stresses in bodies of uniform section and composite sections
1.8 Related numerical problems on the above topics
1.9 Strain Energy and its significance
1.10 Derivation of strain energy for the following cases: Gradually applied load, Suddenly applied load,
Impact/shock load

2. SHEAR FORCE & BENDING MOMENT DIAGRAMS

2.1 Types of beams
2.2 Types of Loads
2.3 SFD and BM Diagram for various types of beams
2.4 Analytical method for SF and BM of Simply supported beam
2.5 Over hanging beam with point loads,
2.6 Combination of point and UDL for the above; Related numerical problems

3. THEORY OF SIMPLE BENDING AND DEFLECTION OF BEAMS

3.1 Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of

Resistance,Bending stress, Radius of curvature(Definition only)

3.3 Problems involving calculations of bending stress, modulus of section and moment of resistance
3.4 Calculation of safe loads and safe span and dimensions of cross- section
3.5 Definition and explanation of deflection as applied to beams(Standard cases only)
3.6 Related numerical problems

4. TORSION IN SHAFTS AND SPRINGS

4.1 Definition and function of shaft
4.2 Calculation of polar M.I. for solid and hollow shafts
4.3 Assumptions in simple torsion
4.4 Problems on design of shaft based on strength and rigidity
4.5 Numerical Problems related to comparison of strength and weight of solid and hollow shafts
4.6 Classification of springs
4.7 Deflection formula for closed coil helical spring (without derivation)
4.8 Stiffness of spring
4.10 Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils

5. THIN CYLINDRICAL SHELLS

5.1 Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell
5.2 Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells
5.3 Related numerical Problems for safe thickness and safe working pressure

REFERENCE BOOKS:

1. Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017.
2. Strength of Materials – B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi, 2013.
3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi.
4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi.
5. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi.

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THEORY OF MACHINES & MECHANISMS

Course Code	:	MP 4003
Course Title	:	THEORY OF MACHINES & MECHANISMS
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Engineering Mechanics
Course Category	:	PC

COURSE OBJECTIVES:

- To understand different types of cams and their motions and also to draw cam profiles for various motions.
- To understand the mechanism of various types of drives available for transmission of power.
- To understand the design of Brakes, Dynamometers, Bearings and Clutches and their function and working.
- To understand the need for balancing of masses in the same plane
- To know different types of governors.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Know different machine elements and mechanisms.
CO2	Understand Kinematics and Dynamics of different machines and mechanisms.
CO3	Select Suitable Drives and Mechanisms for a particular application.
CO4	Appreciate concept of balancing and Vibration.
CO5	Develop ability to come up with innovative ideas.
CO6	Understand different types of cams and their motions and also draw cam profiles for various motions

COURSE CONTENT:

1. CAMS AND FOLLOWERS

1.1. Concept Definition and application of Cams and Followers
1.2. Classification of Cams and Follower
1.3. Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation
1.4. Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method)

2. POWER TRANSMISSION:

2.1. Types of Drives – Belt, Chain, Rope, Gear drives & their comparison, Belt Drives - flat belt, V– belt & its applications Material for flat and V-belt Angle of lap, Belt length, Slip and Creep, Determination of Velocity Ratio, Ratio of tight side and slack side tension, Centrifugal tension and Initial tension, Condition for maximum power transmission.
2.2. Chain Drives – Advantages & Disadvantages, Selection of Chain & Sprocket wheels, Methods of lubrication, Gear Drives, Spur gear terminology, Types of gears , Gear trains,

3. FLYWHEEL AND GOVERNORS:

3.1. Flywheel -Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals), Coefficient of fluctuation of energy, Coefficient of fluctuation of speed.
3.2. Governors Types, Explanation with neat sketches (Centrifugal, Watt and Porter); Concept, function and applications, Terminology of Governors, Comparison between Flywheel and Governor

4. BRAKES, DYNAMOMETERS, CLUTCHES & BEARINGS

4.1. Function of brakes and dynamometers, Types of brakes and Dynamometers
4.2. Comparison between brakes and dynamometers
4.3. Construction and working of: Shoe brake, Band Brake, Internal expanding shoe brake, Disc Brake, Concept of Self Locking & Self energizing brakes
4.4. Construction and working of : Rope Brake Dynamometer, Hydraulic Dynamometer, Eddy current Dynamometers

4.5. Clutches- Uniform pressure and Uniform Wear theories, Function of Clutch and its application,

4.6. Construction and working of :Single plate clutch, Multiplate clutch, Centrifugal Clutch, Cone clutch, Diaphragm clutch

4.7. Bearings: Simple Pivot, Collar Bearing, Conical pivot, Torque & power lost in friction (no derivation)

5. BALANCING & VIBRATIONS:

5.1 Concept of balancing
5.2 Balancing of single rotating mass
5.3 Graphical method for balancing of several masses revolving in same plane
5.4 Concept and terminology used in vibrations
5.5 Causes of vibrations in machines
5.6 Their harmful effects and remedies

REFERENCE BOOKS:

1. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.
2. Theory of machines – R.K.Bansal ,Laxmi publications.
3. Theory of machines – R.S. Khurmi & J.K.Gupta , S.Chand publications.
4. Dynamics of Machines – J B K Das, Sapna Publications.
5. Theory of machines – Jagdishlal, Bombay Metro – Politan book Ltd.

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MATERIAL SCIENCES AND HEAT TREATMENT

Subject Code	:	MP 40041
Course Title	:	MATERIAL SCIENCE AND HEAT TREATMENT
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

COURSE LEARNING OBJECTIVES:

- Material and its treatment has been an important field of study and analysis for any production engineer.
- This subject is designed to give the student basic knowledge about material, structure, heat treatment processes etc. for ferrous as well as non-ferrous metals

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Explain about materials properties with different phases of steel
CO2	Explain the Crystalline structure of metals and their deformation
CO3	Describe about the Operations of heat treatment
CO4.	Describe about classification of ferrous and non-ferrous metals with their properties.
CO5	Explain the plastic materials, their classifications and general characteristics of plastic materials

COURSE CONTENT:

1. Introduction and Properties of Materials:

1.1. Engineering materials and their classification
1.2. Purpose of heat treatment
1.3. Different phases of steel
1.4. Iron carbon diagram

2. Structure of Metals and their Deformation :

2.1. Metal structure
2.2. Arrangement of atoms in metals
2.3. Crystalline structure of metals
2.4. Deformation of metal

3. Commonly used Operation of Heat Treatment:

3.1. Annealing: Objects of annealing, Process annealing
3.2. Normalizing and Hardening: Quenching, Hardening defects
3.3. Tempering: Low, Medium and High temperature tempering
3.4. Austempering: T.T.I. curve or S curve or Isothermal curve
3.5. Martempering
3.6. Case hardening: Carburising, Nitriding, Cyaniding, Induction hardening, Flame hardening
3.7. Heat treatment of hammer, dies and die moulds, Heat treatment of high speed steel

4. Ferrous and Non Ferrous Materials :

4.1. Classification of iron and steels: Manufacturing of pig iron, wrought iron, cast iron and steel
4.2. Types of cast iron : White, malleable and grey
4.3. Classification of steels
4.4. Effect of various alloying elements on steel and alloy steel
4.5. Non Ferrous Materials :Important ores properties of Al, Co, Zn, Tin and Lead

5. Plastic Materials

5.1. Definitions and Classifications
5.2. General characteristics of plastic materials: Thermosetting plastic, Thermo-plastic plastic
5.3. Common engineering applications of plastic materials: Thermosetting plastic, Thermo-plastic plastic

REFERENCE BOOKS:

1. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.
2. Material Science & Engineering – R.K. Rajput, S.K. Kataria & Sons, New Delhi, 2004
3. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi.
4. Workshop Technology Chapman

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MATERIAL HANDLING SYSTEMS

Subject Code	:	MP 40042 (Sane as MA/ME 40042)
Course Title	:	MATERIAL HANDLING SYSTEMS
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

Course Learning Objectives:

- To know the operational features of the material handling equipment & its practical applications.
- To understand, select, operate and maintain the material handling equipments.
- To understand different material handling processes used in industries.
- To understand & appreciate safety instrumentation for equipment.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand constructional & operational features of various materials handling systems.
CO2	Identify, compare & select proper material handling equipment for specified applications.
CO3	Know the controls & safety measures incorporated on material handling equipment.
CO4.	Appreciate the role of material handling devices in mechanization & automation of industrial process.
CO5	Understand & appreciate safety instrumentation for equipment

COURSE CONTENT:

1. **Introduction to Material Handling System**:
   - 1.1. Main types of Material handling equipments & their applications
   - 1.2. Types of load to be handled
   - 1.3. Types of Movements, Methods of stacking, loading & unloading systems
   - 1.4. Principles of Material Handling Systems; Modern trends in Materials handling.

2. **Hoisting Machinery & Equipments**:
   - 2.1. Construction and Working of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Electric & Pneumatic hoists;
   - 2.2. Construction and Working of different types of cranes such as Mobile cranes, Bridge cranes, Cable cranes, & Cranes traveling on guide rails;
   - 2.3. Construction and Working of Elevating equipments such as Stackers, Industrial lifts, Freight elevators, Passenger lifts.

3. **Conveying Machinery**:
   - 3.1. Construction and Working of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators;
   - 3.2. Construction and Working of Traction less type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders.
   - 3.3. Surface Transportation Equipment: Construction, Function, Working of Trackless equipment such as Hand operated trucks, Powered trucks, Tractors, Automatic Guided vehicle

4. **Components of Material Handling Systems:**
   - 4.1. Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, Fastening methods of wire & chains, Eye bolts, Lifting tackles, Lifting & Rigging practices;
   - 4.2. Load handling attachments: a) Various types of hooks-Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter. d) Grabbing attachment for loose materials e) Crane attachment for handling liquids/molten metals;

5. **Mechanism used in Material Handling Equipment**:
   - 5.1. Steady state motion; Starting & stopping of motion in following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism.
   - 5.2. Selection of Material Handling Equipment: Factors affecting choice of material handling equipment such as Type of loads, Hourly capacity of the unit, Direction & length of travel,

Reference Books:

1. Material Handling (Principles & Practice) – Allegri T. H., CBS Publisher, New Delhi.
2. Plant Layout & Materials Handling – Apple J. M., John Wiley Publishers.
3. Material Handling Equipment – N. Rundenko, Peace Publisher, Moscow.
4. Material Handling Equipment – M. P. Alexandrov, MIR Publisher, Moscow.
5. Material Handling Equipment – Y. I. Oberman, MIR Publisher, Moscow.

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QUALITY & ENVIRONMENTAL ENGINEERING

Subject Code	:	MP 40051
Course Title	:	QUALITY & ENVIRONMENTAL ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

COURSE LEARNING OBJECTIVES:

- The subject Quality and Environmental Engineering is devised to keep the student concurrent on the quality aspects emerging in the manufacturing world. It will be and elementary exposure to the student to the field of quality management.
- To understand basic engineering is concerned with protecting the environment from the potentially deleterious effects of human activity, protecting human populations from the effects of adverse environmental factors, and improving environmental quality for human health and well being.
- The knowledge of Quality and Environmental Engineering is ensuring to work and produce most efficient, economical and eco-friendly finished products.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the basics of Quality, quality tools and techniques
CO2	Understand ISO-9000, TQM and Other quality systems models
CO3	Understand environment, pollution and effects of environmental pollution on human health
CO4.	Identify Environmental technology and Environmental regulations
CO5	Demonstrate concepts and use Environment management systems

COURSE CONTENT:

1. Quality and Quality tool and techniques:

1.1. Basic concepts of quality
1.2. Definitions of quality
1.3. Background
1.4. Quality of conformance
1.5. Quality objectives
1.6. Quality function deployment (QFD)
1.7. Quality assurance
1.8. Zero defects
1.9. Quality management

2. Quality tool and techniques

2.1. Introduction 7 QC tools
2.2. Cause and Effect Diagram
2.3. Pareto Analysis
2.4. Flow Chart (Stratification)
2.5. Scatter Diagram
2.6. Check Sheet
2.7. Histogram
2.8. Control Charts
2.9. Advantages of 7 QC tools

3. ISO-9000 and TQM:

3.1. Introduction to ISO-9000, Background and Clauses of ISO-9001
3.2. Advantages of ISO-9000 and Other quality systems models
3.3. Introduction and Definition to TQM
3.4. TQM models, Approach to TQM and Advantage of TQM
3.5. An introduction to TPM

4. **Introduction to environment :**

4.1. The environment
4.2. Pollution and environmental awareness

4.3. Effects of environmental pollution on human health
4.4. Improvement of environmental quality
4.5. Non conventional sources of energy

5. **Environmental technology :**
   5.1. Equipment for controlling air pollution
   5.2. Equipment for controlling water pollution
   5.3. Equipment for controlling other pollution
   5.4. Environmental regulations :
      5.4.1. National environmental policy and its implementation
      5.4.2. Water pollution act
      5.4.3. Air pollution control act
      5.4.4. Pollution control provision and motor vehicle act

6. **Environment management systems :**
   6.1. Green house effect
   6.2. Global warming
   6.3. Acid rains,
   6.4. Ozone hole,
   6.5. Heat Island or Urban Heat Island
   6.6. Rio summit
   6.7. Latest trends in environment management

Reference books:

1. Quality planning & analysis frank gryna
2. ISO 9000 & TQM g.j. gyani
3. Research papers reports & handbooks
4. Principles of environmental science s.e. jorgensen and & technology i. Johnson
5. Management of energy / environment systems foell, w.k. ed.

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ADVANCED MANUFACTURING PROCESSES

Subject Code	:	MP 40052
Course Title	:	ADVANCED MANUFACTURING PROCESSES
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	Basic Mechanical Engineering (MP 3001) Industrial Production Technology-I (MP 3004)
Course Category	:	PE

COURSE LEARNING OBJECTIVES:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand various classifications of manufacturing processes
CO2	Understand working principles of mechanical energy based processes
CO3	Understand working principles of electrical energy based processes
CO4.	Understand working principles of chemical and electro-chemical energy based processes
CO5	Understand working principles of thermal energy based processes

COURSE CONTENT:

1. **Introduction:**
   - 1.1. Unconventional machining Process, Need
   - 1.2. Classification
   - 1.3. Brief overview.

2. **Mechanical Energy Based Processes:**
   - 2.1. Abrasive Jet Machining,
   - 2.2. Water Jet Machining,
   - 2.3. Abrasive Water Jet Machining,
   - 2.4. Ultrasonic Machining
   - 2.5. Working Principles equipment used
   - 2.6. Process parameters
   - 2.7. MRR and Applications.

3. **Electrical Energy Based Processes:**
   - 3.1. Electric Discharge Machining (EDM)
   - 3.2. working Principle equipments
   - 3.3. Process Parameters
   - 3.4. Surface Finish and MRR- electrode / Tool
   - 3.5. Power and control Circuits
   - 3.6. Tool Wear
   - 3.7. Dielectric
   - 3.8. Flushing
   - 3.9. Wire cut EDM
   - 3.10. Applications.

4. **Chemical and Electro-Chemical Energy Based Processes:**
   - 4.1. Chemical machining and Electro-Chemical machining (CHM and ECM)
   - 4.2. Process Parameters
   - 4.3. Surface finish and MRR-Applications.
   - 4.4. Principles of ECM equipments-
   - 4.5. Surface Roughness and MRR Electrical circuit-
   - 4.6. Process Parameters ECG and ECH, Applications.

5. **Thermal Energy Based Processes:**
   - 5.1. Laser Beam machining and drilling (LBM),
   - 5.2. Plasma Arc machining (PAM) and Electron Beam Machining (EBM).

5.3. Principles, Equipment , Types
5.4. Beam control techniques
5.5. Applications. Introduction to manufacturing;

Reference Books:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2007.
3. Benedict. G.F. "Non-Traditional Manufacturing Processes", Marcel Dekker Inc., New York, 1987.
4. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.
5. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in Manufacturing" Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001

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STRENGTH OF MATERIALS & HYDRAULIC MACHINERY LAB

Subject Code	:	MP 4006
Course Title	:	STRENGTH OF MATERIALS & HYDRAULIC MACHINERY LAB
Number of Credits	:	1(L: 0, T: 0, P: 2)
Prerequisites (Course code)	:	Strength of Materials (MP 4002) and Fluid Mechanics & Hydraulic Machinery (MP 3003)
Course Category	:	PC

COURSE LEARNING OBJECTIVES

- Define the various properties of materials such as: Yield stress, Ultimate stress, percentage elongation, Young's Modulus.
- Appreciate the importance of various mechanical properties such as hardness, impact strength. Appreciate the practical applications of orifice meter and venturi meter.
- Understand flow through pipes and the importance of pipe friction in practical environment.
- Understand the method of evaluating the performance characteristics of turbine, for a given set of input data.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Determine the various types of stress and plot the stress strain diagram for mild steel.
CO2	Determine the Rockwell hardness for various materials.
CO3	Determine the torsion, bending, impact and shear values of given materials
CO4.	Determine the Cd of orifice meter, venturi meter, orifice, mouth piece and pipe friction factor
CO5	Determine performance of pumps and turbines

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COURSE CONTENT:

Strength of Materials Laboratory Exercises

1. **Test on Ductile Materials:** Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
2. **Hardness Test:** Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium
3. **Torsion test**: Torsion test on mild steel - relation between torque and angle of twist-determination of shear modulus and shear stress
4. **Impact test:** Finding the resistance of materials to impact loads by Izod test and Charpy test
5. **Tests on springs of circular section:** Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)
6. **Shear test:** Single or double shear test on M.S. bar to finding the resistance of material to shear load

Fluid Mechanics Laboratory Exercises

1. Verify the Bernoulli's Theorem.
2. Determination of co-efficient of discharge of a mouth piece / orifice by variable head method.
3. Determination of co-efficient of discharge of a venturimeter / orifice meter.
4. Determination of the friction factor in a pipe.
5. Performance test on reciprocating pump / centrifugal pump and to draw the characteristics curves.
6. Performance test on impulse turbine / reaction turbine and to find out the Efficiency.

Reference Books:

1. Strength of materials by R.S. Khurmi.
2. Strength of Materials by D.S. Bedi.
3. Mechanics of materials by B.C. Punamia
4. Applied Mechanics & Strength of Materials by S. Ramamrutham.
5. Hydraulic and Pneumatic Controls by K. S. Sundaram.
6. Fluid Power with Applications by Anthony Esposito.

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CAD/CAM LAB

Subject Code	:	MP 4007
Course Title	:	CAD/CAM LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

Course Learning Objectives:

- To understand the fundamentals and use CAD.
- To conceptualize drafting and modeling in CAD.
- To interpret the various features in the menu of solid modeling package.
- To synthesize various parts or components in an assembly.
- To prepare CNC programmes for various jobs.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Explain the 3D commands and features of a CAD software
CO2	Create 3D solid model and find the mass properties of simples solids
CO3	Demonstrate the working of CNC turning and milling machine
CO4.	Develop the part program for Lathe
CO5	Develop the part program for Drilling and Milling.

COURSE CONTENT:

1. Introduction to Part modelling - Datum Plane – constraint – sketch – dimensioning – extrude – revolve sweep
2. Exercises of 3D Drawing
   2.1. Bearing Block
   2.2. Bushed bearing
   2.3. Connecting Rod
3. Study of CNC lathe and milling.
4. Study of standard codes: G-Codes and M-Codes
5. Format – Dimensioning methods.
6. Create a part program using Linear and Circular interpolation and produce component.
7. Create a part program for multiple turning operations and produce component in the Machine.
8. Create a part program for drilling, tapping, counter sinking and produce component in the Machine.
9. Create a part program using canned cycle for thread cutting, grooving.
10. Create a part program by using subprogram

Reference Books:

1. Machine Drawing P.S. Gill S. K. Kataria & Sons, Delhi., 17th Revised edition 2001
2. Mechanical Draughtsmanship, G.L. Tamta Dhanpat Rai & Sons, Delhi, 1992
3. Inside AutoCAD D. Raker and H. Rice, BPB Publications, New Delhi, 1985
4. CAD/CAM/CIM P. Radhakrishnan, S. Subramaniyan & V. Raju, New Age International Pvt. Ltd., New Delhi, 3rd Edition, 2008

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INDUSTRIAL PRODUCTION TECHNOLOGY-II LAB

Subject Code	:	MP 4008
Course Title	:	INDUSTRIAL PRODUCTION TECHNOLOGY **-II** LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- Operate various machines like lathe, shaper etc.
- Perform plain turning, taper turning, and screw cutting etc. on lathe machine.
- Perform machining operations on shaper.
- Perform shaping operations

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Identify the parts of a center lathe and types of tools used.
CO2	Make use of lathe for machining various cylindrical components
CO3	Identify the parts of a drilling machine and types of tools used.
CO4.	Make use of drilling machine for drilling, reaming and tapping operations
CO5	Make use of drilling machine for counter sink and counter bore operations

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COURSE CONTENT:

1. EXERCISES ON DRILLING MACHINE

1.1. To Drill two or three different sizes holes
1.2. To Drill different holes by maintain minimum distance between them

2. EXERCISES ON SHAPER

2.1. Cutting key ways, grooves
2.2. Shaping step block and cut dovetail.

3. EXERCISES ON MILLING MACHINE

3.1. Milling key ways of different types with indexing and without indexing
3.2. Generation of spur gear teeth on a round bar.

4. EXERCISES ON GRINDING WHEELS

4.1. Grinding of Cutting tools and milling cutters etc
4.2. Grinding flat surface on a surface grinder
4.3. Cylindrical grinding of external surface and internal surface

5. EXERCISES ON LATHE MACHINE

5.1. Turning
5.2. Step Turning
5.3. Knurling
5.4. Chamfering
5.5. Taper turning
5.6. Thread cutting

Reference Books:

1. Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, Ed. 11th, Media Promoters and Publishers Pvt. Ltd.
2. Production Technology, HMT, , Ed. 18th, Tata McGraw Hill Publishing Co. Manufacturing Process, Myro N Begman, Ed. 5th, Tata McGraw Hill Publishing Co. Ltd.

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ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

Course Code	MP 4222 (Same in All Branches of Engg.)
Course Title	Essence of Indian Knowledge and Tradition
Number of Credits	0(L-2,T-0, P-0)
Prerequisites	None
Course Category	AU

COURSE CONTENTS:

Basic Structure of Indian Knowledge System:

(i)वेद,

(ii)उनवेद (आयुवेद,धनुवेद,गन्धवेद,स्थानत्यआदद)

(iii)वेदथाथांग (शिक्था, कलन, ननरुत, व्याकरण, ज्योनतषछथांद),

(iv)उनथाइग (धर्मशथास, र्ीर्थाथांसथा, नुरथाण, तकशरथास)

- •Modern Science and Indian Knowledge System
- •Yoga and Holistic Health care
- •Case Studies.

REFERENCES /SUGGESTED LEARNING RESOURCES:

1. V. Sivarama Krishna, " Cultural Heritage of India- Course Material", Bhartiya Vidya Bhavan, Mumbai, fifth Edition, 2014.
2. Swami Jitatmanand, " Modern Physics and Vedant", Bhartiya Vidya Bhavan.
3. Fritz of Capra, " The wave of Life".
4. Fritz of Capra, " Tao of Physics".
5. V N Jha, " Tarka sangraha of Annam Bhatta, International" Cinmay Foundation, Velliarnad, Amakuam.
6. R N Jha, " Science of Consciousness Psychotheraphy and Yoga Practices" Vidya nidhi Prakasham, Delhi, 2016.

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GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

V SEMESTER

(SESSION 2021-2022 & ONWARDS)

MECHATRONICS AND ROBOTICS

Subject Code	:	MP 5001
Course Title	:	MECHATRONICS AND ROBOTICS
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES

- To understand the basic concepts and characteristics of measurement systems.
- To learn various types of sensors and transducers various mechanical, electrical and pneumatic actuation systems.
- To learn the concepts of digital communications and develop PLC programs.
- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Describe about various types of sensors and transducers.
CO2	Explain the various mechanical, electrical and pneumatic actuation systems.
CO3	Explain the basic PLC architecture and PLC programming concepts.
CO4.	Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.
CO5	Explain about various types of sensors and concepts on robot vision system.

COURSE CONTENT:

1. **Introduction**:
   - 1.1. Mechatronic systems, closed and open loop measurement systems, The Mechatronics approach, Sensors microprocessors and transducers, displacement, position and proximity pickups.
   - 1.2. Measurement Systems: Measurement errors, Reliability, Data acquisition and processing systems, Data presentation.
   - 1.3. Applied Instrumentation:
     - 1.3.1. Measurement of mechanical and process parameters.
     - 1.3.2. Measurement of force, torque, temperature, pressure and flow.
     - 1.3.3. Measurement of displacement velocity and acceleration.
     - 1.3.4. Measurement of noise and vibration

2. **Programmable Logic Controller (PLC):**
   - 2.1. Definition – Basic block diagram and structure of PLC – Input/Output processing –
   - 2.2. PLC Programming: Ladder diagram, its logic functions, latching and sequencing –
   - 2.3. PLC mnemonics – Timers, internal relays and counters.

3. **Fundamentals of Robot:**
   - 3.1. Robot – Definition – Co-ordinate Systems, Work Envelope,
   - 3.2. types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load –
   - 3.3. Basic robot motions - Point to point control, Continuous path control.
   - 3.4. Robot Parts and Their Functions – Need for Robots – Different Applications.
   - 3.5. Robot drive systems: Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features,
   - 3.6. Applications and Comparison of all these Drives. End Effectors – Grippers

4. **Sensors and Machine Vision:** Requirements of a sensor, Principles and Applications of the following types of sensors –
   - 4.1. Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders),
   - 4.2. Range Sensors (Structured, Lighting Approach, Laser Range Meters),
   - 4.3. Proximity Sensors (Inductive, Capacitive, and Ultrasonic),
   - 4.4. Touch Sensors, (Binary Sensors, Analog Sensors),

4.5. Wrist Sensors, Compliance Sensors, Slip Sensors.

5. **Robot kinematics and Robot Programming:**
   - 5.1. Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional) – Deviations and Problems.
   - 5.2. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple Programs
   - 5.3. Industrial Applications: Application of robots in machining, welding, assembly, and material handling.

1. Reference Books:

2. Mechatronics W. Bolton, Pearson Education, Asia 2007
3. A Text Book on Mechatronics, R. K. Rajput, S. Chand & Co, New Delhi 2011
4. K.S. Fu., R.C.Gonalez, C.S.G.Lee, " Robotics Control sensing ", Vision and Intelligence, McGraw Hill International Edition, 1987.
5. M. P. Groover, "Industrial Robotics – Technology, Programming and Applications", Mc- Graw-Hill, 2001
6. Fu. K. S. Gonzalz. R. C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987
7. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
8. Janakiraman. P. A., "Robotics and Image Processing", Tata McGraw-Hill, 1995
9. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

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AUTOMATION & CNC MACHINES

Subject Code	:	MP 5002
Course Title	:	AUTOMATION & CNC MACHINES
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	Basic Mechanical Engineering (MP 3001) Industrial Production Technology-I (MP 3004)
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- To understand basics of industrial automation
- To identify various types of automation
- To create CAM Tool path and NC- G code output.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Demonstrate basics of industrial automation
CO2	Demonstrate use of automated controls using pneumatic and hydraulic systems
CO3	Identify various types of automation
CO4.	Explain the concept of CNC machines and controls
CO5	Prepare CNC part programming for various jobs

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COURSE CONTENTS:

1. Introduction

1.1. Basic concept of automation, Types of automation, Feasibility etc

1.2. Industrial Hydraulics

1.2.1. Introduction, basic concepts

1.2.2. Hydraulic fluids, Classification and properties of hydraulic fluids

1.2.3. Fluid power generators i.e. Gear, vane, piston pumps

1.2.4. Linear and rotary actuators: Direction control valves, types, actuation methods, pressure control valves, pressure reducing valves, pressure relief valve, unloading valve, sequence Valve, Counter balance valve, Flow control valve, simple and pressure compensated type.

2. **Pneumatics**

2.1. Introduction, basic components, Source, storage and distribution, treatment of compressed air

2.2. Linear and Rotary actuators: Direction control valves- types, actuation methods, Pressure control valves

3. **Automated assembly system:**

3.1. Development of Automated assembly process, Transfer devices-continuous, Intermittent

3.2. Vibratory feeders and mechanical feeders

4. **CNC machine and Components**

4.1. Numerical control, definition, components of NC systems, development of NC-DNC-Adaptive control system

4.2. Working principle of CNC system, Features of CNC machine, Advantages of CNC machine, difference between NC and CNC

4.3. Drives: Spindle drive, DC motor, Feed drives, dc servo motor and stepped motor, hydraulic systems, slide ways, requirements, types, friction slide ways and anti friction slide ways, linear motion bearings, recirculation ball screw, ATC, tool magazine, feedback devices, linear and rotary transducers.

5. **Part programming**

5.1. NC part programming methods, manual programming, conversational programming, APT programming, format, sequential and word address formats, sequence number coordinated system

5.2. Types of motion control: point to point, paraxial and contouring, datum points, machine zero, work zero, tool zero NC dimensioning, reference points, tool material, tool inserts, tool offsets and compensation.

5.3. Preparatory functions and G codes, miscellaneous functions and M codes, interpolation, linear interpolation and circular interpolation

5.4. CNC program procedure : Part program, macro sub program, canned cycles, thread cutting, sample program for lathe, linear interpolation and circular interpolation, stock removal turning, peck drilling, thread cutting and sample programs for milling, linear interpolation and circular interpolation, sub program, drilling.

Reference Books:

1. Anthony Esposito, "Fluid Power with Application", 5th Edition, Pearson Education (2003).
2. Majumdar S R, "Oil Hydraulic System", Tata McGraw Hill (2001).
3. Bolton W, "Mechatronics", 2nd Edition, Pearson Education, New Delhi (1999).
4. Necsulelscu Dan, "Mechatronics", Pearson Education, New Delhi (2002).
5. Geoffrey Boothroyd, "Assembly Automation and Product Design", Marcel Dekker Inc (1991).
6. CNC Programming, S. K. Sinha, Galgotia Publications Pvt. Ltd.
7. Computer Control of Manufacturing Systems, Yoram Koren, McGraw Hill Book.

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ECONOMIC POLICIES IN INDIA

Course Code	MP 51001(Same in All Branches of Engg.)
Course Title	Economic Policies in India
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES:

The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

CO1	Understand Indian economics policy, planning strategies
CO2	It will enable to students to comprehend theoretical and empirical development across countries and region for policy purposes
CO3	Development Economics as a discipline encompasses different approach es to the problems of unemployment, poverty, income generation, industrialization from different perspectives
CO4	Able to identify the problems and capable to decide the application for future development
CO5	Analyze economic issues and find solutions to complex economic problems and take correct economic judgment

COURSE CONTENTS:

1. BASIC FEATURES AND PROBLEMS OF INDIAN ECONOMY:

1.1. Economic History of India;
1.2. Nature of Indian Economy
1.3. Demographic features and Human Development Index,
1.4. Problems of Poverty, Unemploy-ment, Inflation, income inequality, Blackmoney in India.

2. SECTORAL COMPOSITION OF INDIAN ECONOMY:

2.1. Issues in Agriculture sector in India,
2.2. land reforms
2.3. Green Revolution
2.4. agriculture policies of India,

3. INDUSTRIAL DEVELOPMENT,

3.1. Small scale and cottage industries,
3.2. Industrial Policy,
3.3. Public sector in India,
3.4. Service sector in India.

4. ECONOMIC POLICIES:

4.1. Economic Planning in India,
4.2. Planning commission v/s NITI Aayog,
4.3. Five Year Plans,
4.4. Monetary policy in India,
4.5. Fiscal Policy in India,
4.6. Centre state Finance Relations,
4.7. Finance commission in India
4.8. LPG policy in India

5. EXTERNAL SECTOR IN INDIA

5.1. India's foreign trade value composition and direction,
5.2. India Balance of payment since 1991,
5.3. FDI in India,
5.4. Impact of Globalization on Indian Economy,
5.5. WTO and India.

REFERENCE BOOKS:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy .S Chand & Co.Ltd. New Delhi.
2. Mishra S. K & V. K Puri (2017). Indian Economy and Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, NewDelhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India ,Oxford University Press.

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ENGINEERING ECONOMICS & ACCOUNTANCY

Course Code	MP 51002(Same in All Branches of Engg.)
Course Title	Engineering Economics & Accountancy
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
Course Category	OE

COURSE OBJECTIVES

•To acquire knowledge of basic economicst of a cilitate the process of economic decision making.
•To acquire knowledge on basic financial management aspects.
•To develop the basic skills to analyze financial statements.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the macro-economic environment of the business and its impact on enterprise
CO2	Understand cost elements of the product and its effect on decision making
CO3	Prepare accounting records and summarize and interpret the accounting datafor managerial decisions
CO4	Understand accounting systems and analyze financial statements using ratio analysis
CO5	Understand the concepts of financial management and investment

COURSE CONTENTS

1. INTRODUCTION:

1.1. Managerial Economics;
1.2. Relationship with other disciplines;
1.3. Firms: Types, objectives and goals;
1.4. Managerial decisions;
1.5. Decision analysis.

2. DEMAND & SUPPLY ANALYSIS:

2.1. Demand;
2.1.1. Types of demand;
2.1.2. Determinants of demand;
2.1.3. Demand function;
2.1.4. Demand elasticity;
2.1.5. Demand forecasting;
2.2. Supply;
2.2.1. Determinants of supply;
2.2.2. Supply function;
2.2.3. Supply elasticity.

3. PRODUCTION AND COST ANALYSIS:

3.1. Production function;
3.2. Returns to scale;
3.3. Production optimization;
3.4. Least cost input; Iso quants;
3.5. Managerial uses of production function;
3.6. Cost Concepts;
3.6.1. Cost function;
3.6.2. Types of Cost;
3.6.3. Determinants of cost;

3.6.4. Short run and Long run cost curves;
3.6.5. Cost Output Decision;
3.6.6. Estimation of Cost.

4. PRICING:

4.1. Determinants of Price;
4.2. Pricing under different objectives and different market structures;
4.3. Price discrimination;
4.4. Pricing methods in practice;
4.5. Role of Government in pricing control.

5. FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT):

5.1. Balance sheet and related concepts;
5.2. Profit & Loss Statement and related concepts;
5.3. Financial Ratio Analysis;
5.4. Cash flow analysis;
5.5. Funds flow analysis;
5.6. Comparative financial statements;
5.7. Analysis & Interpretation of financial statements;
5.8. Investments;
5.9. Risks and return evaluation of investment decision;
5.10. Average rate of return;
5.11. Payback Period;
5.12. Net Present Value;
5.13. Internal rate of return,

REFERENCE BOOKS:

1.Mc Guigan, Moyer and Harris,' Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.
2.Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4th edition,2005.
3.Samuelson. Paul A and Nordhaus W. D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
4.Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, NewDelhi, 2007.
5.Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson SouthWestern, 4th Edition, 2001.

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INDUSTRIAL ENGINEERING & MANAGEMENT

Subject Code	:	*MP 5003 (Same as ME 5003)
Course Title	:	INDUSTRIAL ENGINEERING & MANAGEMENT
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To take the right decisions to optimize resources utilization by improving productivity of the Lands, Buildings, People, Materials, Machines, Money, Methods and Management effectively.
- To eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes.
- To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Explain the different types of layout and plant maintenance with safety
CO2	List and explain the need of method study and work measurements
CO3	Explain the production planning and quality control, and its functions
CO4	Understand the basic principles, approaches and functions of management and identify concepts to specific situations
CO5	List and explain the different financial sources and methods of inventory management

COURSE CONTENT:

1. PLANT ENGINEERING

1.1 Plant
1.2 Selection of site of industry
1.3 Plant layout
1.4 Principles of a good layout
1.5 Types; Process; Product and Fixed position;
1.6 Techniques to improve Layout

2. WORK STUDY

2.1 Productivity,
2.2 Standard of living
2.3 Method of improving Productivity
  2.3.1 Objectives
2.4 Importance of good working conditions
2.5 Method Study
  2.5.1 Definition
    2.5.1.1 Objectives
  2.5.2 Selection of a job for method study
  2.5.3 Basic procedure for conduct of Method study
  2.5.4 Tools used: Operation, Flow and Two-handed process chart
  2.5.5 Man Machine chart
  2.5.6 String diagram
  2.5.7 Flow diagram
2.6 Work Measurement
  2.6.1 Definition
  2.6.2 Basic procedure in making a time study
  2.6.3 Employees rating factor

2.6.4 Application of time allowances
2.7 Calculation of standard time
2.8 Numerical Problems
2.9 Basic concept of production study
2.10 Techniques of Work Measurement
2.11 Pre-determined Motion Time System (PMTS)

3. PRODUCTION PLANNING AND CONTROL

3.1 Introduction
3.2 Major functions of Production Planning and Control
3.3 Pre planning
3.4 Methods of forecasting
3.5 Routing and Scheduling
3.6 Dispatching and Controlling
3.7 Concept of Critical Path Method (CPM)
3.8 Types of Production
3.8.1 Mass Production
3.8.2 Batch Production
3.8.3 Job Order Production; Characteristics
3.9 Economic Batch Quantity (EBQ)
3.10 Principles of Product and Process Planning
3.11 Make or Buy decision
3.12 Numerical problems
3.13 Quality Control
3.13.1 Definition
3.13.2 Objectives
3.13.3 Types of Inspection
3.13.3.1 First piece
3.13.3.2 Floor
3.13.3.3 Centralized Inspection
3.13.4 Advantages and Disadvantages
3.13.5 Sampling Inspection; Single and Double Sampling plan
3.13.12 Concept of ISO 9001:2008
3.13.13 Quality Management System Registration/Certification procedure
3.13.14 Benefits of ISO to the organization

4. PRINCIPLES OF MANAGEMENT

4.1 Definition of Management
4.2 Administration; Organization
4.3 F.W. Taylor's and Henry Fayol's Principles of Management
4.4 Functions of Manager
4.5 Types of Organization
4.5.1 Line
4.5.2 Staff
4.5.3 Taylor's Pure functional types
4.5.4 Line and staff and committee type
4.6 Directing
4.7 Leadership
4.8 Styles of Leadership
4.9 Qualities of a good leader
4.10 Motivation; Positive and Negative Motivation
4.11 Management Information Systems
4.13 Personnel Management
4.13.1 Responsibility of Human Resource Management
4.13.2 Selection Procedure
4.13.3 Training of Workers
4.13.3.1 Apprentice Training
4.13.3.2 On the Job training
4.13.3.3 Vestibule School Training
4.13.4 Job Evaluation

5. FINANCIAL MANAGEMENT

- 5.1 Fixed and Working Capital
- 5.2 Resources of Capital
- 5.3 Shares Preference and Equity Shares
- 5.4 Debentures
  - 5.4.1 Type of debentures
- 5.5 Public Deposits
- 5.6 Factory Costing
  - 5.6.1 Direct Cost
  - 5.6.2 Indirect Cost
  - 5.6.3 Factory Overhead
  - 5.6.4 Selling Price of a product
  - 5.6.5 Profit
- 5.7 Numerical Problems
- 5.8 Depreciation; Causes
- 5.9 Methods
  - 5.9.1 Straight line
  - 5.9.2 Sinking fund
  - 5.9.3 Percentage on Diminishing Value Method
- 5.10 Numerical Problems
- 5.11 Material Management
  - 5.11.1 Objectives of good stock control system
  - 5.11.2 ABC analysis of Inventory
  - 5.11.3 Procurement and Consumption cycle
  - 5.11.4 Minimum Stock, Lead Time, Reorder Level
  - 5.11.5 Economic Order Quantity problems
  - 5.11.6 Supply Chain

REFERENCE BOOKS:

1. Industrial Engineering & Management, S.C. Sharma, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.
3. Management, A global perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition 1994.
4. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
5. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi

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TOTAL QUALITY MANAGEMENT

Subject Code	:	MP 50041
Course Title	:	TOTAL QUALITY MANAGEMENT
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

COURSE LEARNING OBJECTIVES:

- To introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality management methodology for the implementation of total quality management in any sphere of business and public sector.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Develop an understanding on quality management philosophies and frameworks
CO2	Develop in-depth knowledge on various tools and techniques of quality management
CO3	Learn the applications of quality tools and techniques in both manufacturing and service industry
CO4.	Develop analytical skills for investigating and analysing quality management issues in the industry and suggest implement able solutions to those.
CO5	Emerging concepts for quality and Taguchi optimization technique for off-line

COURSE CONTENT:

1. **Basic concepts**: Definitions and history of quality control;
   - 1.1. Quality function and concept of quality cycle;
   - 1.2. Quality policy and objectives.
   - 1.3. Economics of quality and measurement of the cost of quality.

2. **Process control:**
   - 2.1. Machine and process capability analysis;
   - 2.2. Use of control charts
   - 2.3. Use of process engineering techniques for implementing the quality plan.

3. **Acceptance Sampling:**
   - 3.1. Single, double and multiple sampling
   - 3.2. Lot quality protection
   - 3.3. Features and types of acceptance sampling tables,
   - 3.4. Acceptance sampling of variables
   - 3.5. Statistical tolerance analysis.

4. **Quality education**:
   - 4.1. Principles of participation and
   - 4.2. Participative approaches to quality commitment.

5. **Emerging concepts of quality management:**
   - 5.1. Taguchi's concept of off-line quality control
   - 5.2. Ishikawa's cause and effect diagram.

Reference Books:

1. Total Quality Management, M.P. Poonia & S.C. Sharma, Khanna Publishing House, 2018.
2. Total Quality Management – An Introductory Text by Paul James, Prentice Hall
3. Quality Control and Applications by Housen & Ghose
4. Industrial Engineering Management by O.P. Khanna

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FARM EQUIPMENT AND FARM MACHINERY

Subject Code	:	MP 50042
Course Title	:	FARM EQUIPMENT AND FARM MACHINERY
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

COURSE LEARNING OBJECTIVES:

- Able to find and characterize the machinery based on crop production.
- Able to find the field efficiency and capacities to calculate the economics of machinery.
- Able to find the machines usages for different tillage, and its power requirement calculations.
- Able to understand sowing, planting & transplanting equipment based on crop.
- Able to understand machinery materials and heat effects for different farm machinery equipment

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Describe the objectives of Farm mechanization.
CO2	Classify the Farm Machineries, equipment and materials.
CO3	Explain selection of the machineries.
CO4.	Discuss the forces acting on tillage tools and hitching systems.
CO5	Understand the calibration, constructional features and working of various farm equipment.

COURSE CONTENT:

1. Unit-I

1.1. Introduction to farm mechanization
1.2. Classification of farm machines
1.3. Unit operations in crop production
1.4. Identification and selection of machines for various operations on the farm
1.5. Hitching systems and controls of farm machinery

2. Unit-II

2.1. Calculation of field capacities and field efficiency
2.2. Calculations for economics of machinery usage, comparison of ownership with hiring of machines
2.3. Introduction to seed-bed preparation and its classification
2.4. Familiarization with land reclamation and earth moving equipment

3. Unit-III

3.1. Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage
3.2. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines
3.3. Introduction to tillage machines like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, puddler, cultivators, identification of major functional components
3.4. Attachments with tillage machinery

4. **Unit-IV:**

4.1. Introduction to sowing, planting & transplanting equipment
4.2. Introduction to seed drills, no-till drills, and strip-till drills
4.3. Introduction to planters, bed planters and other planting equipment like sugarcane, potato
4.4. Study of types of furrow openers and metering systems in drills and planters
4.5. Calibration of seed-drills/ planters
4.6. Adjustments during operation

5. **Unit-V:**

5.1. Introduction to materials used in construction of farm machines

5.2. Heat treatment processes and their requirement in farm machines
5.3. Properties of materials used for critical and functional components of agricultural machines
5.4. Introduction to steels and alloys for agricultural application
5.5. Identification of heat treatment processes specially for the agricultural machinery components

Reference Books:

1. Principles of Farm Machinery by R.A. Kepner, Roy Bainer, and E. L. Berger
2. Farm Machinery and Equipment by H. P. Smith
3. Farm Machinery and equipment by C. P. Nakra
4. Engineering principles of Agril. Machines by Dr. Ajit K. Srivastav, Caroll E. Goering and Roger P. Rohrbach.
5. Farm Machinery – an Approach by S. C Jain & Grace Phillips
6. Agril. Engineering through worked out examples by Dr. R. Lal and Dr. A.C. Dutta
7. Farm Power and Machinery Engineering by Dr. R. Suresh and Sanjay Kumar

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PRODUCTION PLANNING AND CONTROL

Subject Code	:	MP 50051
Course Title	:	PRODUCTION PLANNING AND CONTROL
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

COURSE LEARNING OBJECTIVES:

- To provide students with information on the design and management of operations and production planning/control systems including capacity planning, materials requirements planning, inventory models, scheduling and sequencing, and line balancing for various aspects of the manufacturing and service industry.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Ability to use and compare various statistical forecasting models
CO2	Understand the plant layout and material handling from plant to warehouse.
CO3	Understand basic sequencing and scheduling techniques, dispatching rules minimize the cost.
CO4.	Develop materials requirements for a system including inventory levels, ordering policies, lot-sizes, material costs, and material demand
CO5	Apply management of capacity and demand methodologies in developing and improving the inventory planning and control systems

COURSE CONTENT:

1. Demand forecasting:

1.1. Long and short term demand
1.2. forecasting methods, Regression analysis and Smoothing methods; Estimation of trend, cycle, seasonality components;
1.3. Analysis of forecast error.

2. Plant location and Capacity planning

2.1. Plant location, capacity scheduling, Warehouse location and capacity scheduling;
2.2. Multiple Plant Production Facility Design;
2.3. Aggregate Planning and Master Production Planning and Scheduling.

3. **Operations scheduling and Control:**

3.1. Basic Sequencing and scheduling techniques
3.2. Despatching rules
3.3. Chasing and updating of Production Schedules.

4. **Design of Production Planning and Control Systems:**

4.1. System Design for continuous and intermittent Production Systems;
4.2. Integration of Master Production,
4.3. Material Requirement and Shop Scheduling Systems.

5. **Diagnostic Analysis of Production Planning and Control Systems:**

5.1. Techniques of analysis and evaluation of system performance.

Reference Books:

1. Production Systems Planning Analysis & Control by James L. Riggs, John Wiley & Sons
2. Modern Production / Operations Management by Elwood S. Buffa, Rakesh K. Sarin, John Wiley & Sons
3. Production / Operations Management: Concept, Structure & Analysis by Tersine R.J., North Holland

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OPERATIONS RESEARCH

Subject Code	:	MP 50052
Course Title	:	OPERATIONS RESEARCH
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

COURSE CONTENT:

1. Introduction

1.1. Development, Definition, Characteristics and phase of Scientific Method,
1.2. Types of models;
1.3. General methods for solving operations research models.

2. Allocation:

2.1. Introduction to linear programming formulation, Graphical solution, Simplex Method,
2.2. Artificial variable technique,
2.3. Duality principle. Sensitivity analysis.

3. Transportation Problem

3.1. Transportation Problem Formulation optimal solution, Unbalanced transportation problems,
3.2. Degeneracy. Assignment problem,
3.3. Formulation optimal solution.

4. Sequencing:

4.1. Introduction,
4.2. Terminology, notations and assumptions, Problems with n-jobs and two machines,
4.3. Optimal sequence algorithm, Problems with n-jobs and three machines.

5. Theory of games:

5.1. Introduction,
5.2. Two-person zero-sum games, The maximum –minimax principle, Games without saddle points
5.3. Mixed strategies, 2 x n and m x 2 games, Graphical solutions, Dominance property, Use of l.p. to games

Reference Books:

1. Operations Research: an introduction, Hamdy A. Taha, Pearson Education.
2. Operations. Re**search: theory and application, J.K. Sharma, Macmillan Publishers.**
3. **Introduction to** Operations Research: concept and cases, Frederick S. Hillier and Gerald J. Lieberman, Tata McGraw-Hill

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GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

VI SEMESTER

(SESSION 2021-2022 & ONWARDS)

ENTREPRENEURSHIP AND START-UPS

Course Code	MP 6111(Same in All Branches of Engg.)
Course Title	Entrepreneurship and Start-ups
Number of Credits	4 (L-3 ,T-1, P-0)
Prerequisites (Course code)	None
Course Category	HS

COURSE LEARNING OBJECTIVES:

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with varioususes ofhuman resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship-its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

LEARNING OUTCOME:

Upon completion of the course, these student will be able to demonstrate knowledge of the following topics:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. StrategicMarketing Planning
6. New Productor Service Development
7. Business Plan Creation

COURSE CONTENTS:

1. INTRODUCTION TO ENTREPRENEURSHIP AND START–UPS

- 1.1. Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- 1.2. Types of Business Structures,
- 1.3. Similarities / differences between entrepreneurs and managers.

2. BUSINESS IDEAS AND THEIR IMPLEMENTATION

- 2.1. Discovering ideas and visualizing the business
- 2.2. Activity map
- 2.3. Business Plan

3. IDEA TO START-UP

- 3.1. Market Analysis– Identifying the target market,
- 3.2. Competition evaluation and Strategy Development,
- 3.3. Marketing and accounting,
- 3.4. Risk analysis

4. MANAGEMENT

- 4.1. Company's Organization Structure,
- 4.2. Recruitment and management of talent.
- 4.3. Financial organization and management

5. FINANCING AND PROTECTION OF IDEAS

- 5.1. Financing methods available for start-ups in India
- 5.2. Communication of Ideas to potential investors– Investor Pitch
- 5.3. Patenting and Licenses

6. EXIT STRATEGIES FOR ENTREPRENEURS ,BANKRUPTCY, AND SUCCESSION AND HARVESTING STRATEGY

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN–978-0984999392
2.	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN–978-0670921607
3.	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN–978-0755388974
4.	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Chris Tensen	Harvard business ISBN:978-142219602

SUGGESTEDSOFTWARE/LEARNINGWEBSITES:

a. https://www.fundable.com/learn/resources/guides/startup
b. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatchstructure/
c .https://www.finder.com/small-business-finance-tips
d. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

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PROJECT MANAGEMENT

Course Code	MP 62001(Same in All Branches of Engg.)
Course Title	Project Management
Number of Credits	3(L:3,T:0,P:0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES

•To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.

•To develop an understanding of key project management skills and strategies.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand the importance of projects and its phases.
CO2	Analyze projects from marketing, operational and financial perspectives.
CO3	Evaluate projects based on discount and non-discount methods.
CO4	Develop network diagrams for planning and execution of a given project.
CO5	Apply crashing procedures for time and cost optimization.

COURSE CONTENTS

1. CONCEPT OF A PROJECT:

1.1. Classification of projects
1.2. Importance of project management
1.3. The project Life cycle
1.4. Establishing project priorities (scope-cost-time)
1.5. Project priority matrix
1.6. Work break down structure.

2. CAPITAL BUDGETING PROCESS:

2.1. Planning -Analysis-Selection-Financing-Implementation-Review.
2.2. Generation and screening of project ideas
2.3. Market and demand analysis
2.4. Demand forecasting techniques.
2.5. Market planning and marketing research process
2.6. Technical analysis

3. FINANCIAL ESTIMATES AND PROJECTIONS:

3.1. Cost of projects
3.2. Means of financing
3.3. Estimates of sales and production-cost of production
3.4. Working capital requirement and its financing
3.5. Profitability project , cash flow statement and balance sheet.
3.6. Breakeven analysis.

4. BASIC TECHNIQUES IN CAPITAL BUDGETING:

4.1. Non discounting and discounting methods
4.2. pay-back period
4.3. Accounting rate of return
4.4. Net present value
4.5. Benefit cost ratio
4.6. Internal rate of return.
4.7. Project risk.
4.8. Social cost benefit analysis andeconomic rate of return.
4.9. Non-financial justification of projects**.**

5. PROJECT ADMINISTRATION:

5.1. Progress payments,
5.2. Expenditure planning,

5.3. Project scheduling and network planning,
5.4. Use of Critical Path Method(CPM),
5.5. Schedule of payments and physical progress,
5.6. time-cost trade off.
5.7. Concepts and uses of PERT
5.8. Cost as a function of time,
5.9. Project Evaluation and Review Techniques
5.10. Cost mechanisms.
5.11. Determination of least cost duration.
5.12. Post project evaluation.
5.13. Introduction to various Project management softwares.

REFERENCE BOOKS

1.Project planning, analysis, selection, implementation and review –Prasannachandra–Tata McGraw Hill.
2.Project Management – the Managerial Process– Clifford F. Gray & Erik W. Larson-McGrawHill.
3.Project management- David I Cleland- Mcgraw Hill International Edition, 1999
4.Project Management– Gopala krishnan– Mcmillan India Ltd.
5.Project Management- Harry – Maylor – Peason Publication

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RENEWABLE ENERGY TECHNOLOGIES

Course Code	MP 62002(Same in All Branches of Engg.)
Course Title	Renewable Energy Technologies
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES

•To understand present and future scenario of world energy use.
•To understand fundamentals of solar energy systems.
•To understand basics of wind energy.
•To understand bio energy and its usage in different ways.
•To identify different available non-conventional energy sources.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

COURSE CONTENTS

1. INTRODUCTION:

1.1. World Energy Use;
1.2. Reserves of Energy Resources;
1.3. Environmental Aspects OF Energy Utilisation;
1.4. Renewable Energy Scenario in India and around the World;
1.5. Potentials; Achievements/ Applications;
1.6. Economics of renewable energy systems.

2. SOLAR ENERGY:

2.1. Solar Radiation;
2.2. Measurements of Solar Radiation;
2.3. Flat Plate and Concentrating Collectors;
2.4. Solar direct Thermal Applications;
2.5. Solar thermal Power Generation
2.6. Fundamentals of Solar Photo Voltaic Conversion;
2.7. Solar Cells;
2.8. Solar PV Power Generation;
2.9. Solar PV Applications.

3. WIND ENERGY:

3.1. Wind Data and Energy Estimation;
3.2. Types of Wind Energy Systems;
3.3. Performance; Site Selection;
3.4. Details of Wind Turbine Generator;
3.5. Safety and Environmental Aspects.

4. BIO-ENERGY:

4.1. Bio mass direct combustion;
4.2. Bio mass gasifiers;
4.3. Bio gas plants;
4.4. Digesters;
4.5. Ethanol production;
4.6. Bio diesel;
4.7. Cogeneration;

4.8. Bio mass Applications.

5. OTHER RENEWABLE ENERGY SOURCES:

5.1. Tidal energy;
5.2. Wave Energy;
5.3. Open and Closed OTEC Cycles;
5.4. Small Hydro Geothermal Energy;
5.5. Hydrogen and Storage;
5.6. Fuel Cell Systems;
5.7. Hybrid Systems.

REFERENCE BOOKS

1. Non-Conventional Energy Sources, Rai. G. D., Khanna Publishers, New Delhi, 2011.
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN SponLtd.,UK,2 006.
3. Solar Energy, Sukhatme. S. P., Tata Mc Graw Hill Publishing CompanyLtd. ,New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, G N Tiwari and M K Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment A Policy Analysis for India ,NH Ravindranath, U K Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, R A Ristinen and J J Kraushaar, second edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, J W T widell and A D Weir, ELBS, 2006.

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PRODUCT DESIGN

Course Code	MP 63001(Same in All Branches of Engg.)
Course Title	Product Design
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES

•To acquire the basic concepts of product design and development process
•To understand the engineering and scientific process in executing a design from concept to finished product
•To study the key reasons for design or redesign.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand the basic concepts of product design and development process.
CO2	Illustrate the methods to define thecustomer needs.
CO3	Describe an engineering design and development process.
CO4	Understand the intuitive and advanced methods used to develop and evaluate a concept.
CO5	Apply modelling and embodiment principles in product design and development process.

COURSE CONTENTS

1. DEFINITION OF A PRODUCT

1.1. Types of product;
1.2. Levels of product;
1.3. Product-market mix;
1.4. New prod-uct development (NPD) process;
1.5. Idea generation methods;
1.6. Creativity;
1.6.1. Creative attitude;
1.6.2. Creative design process;
1.7. Morpho logical analysis;
1.8. Analysis of inter-connected decision areas;
1.9. Brain storming.

2. PRODUCT LIFECYCLE;

2.1. The challenges of Product development;
2.2. Product analysis;
2.3. Product characteristics;
2.4. Economic considerations;
2.5. Production and Marketing aspects;
2.6. Characteristics of successful Product development;
2.7. Phases of a generic product development process;
2.8. Customer need identification;
2.9. Product development practices and industry-product strategies.

3. PRODUCT DESIGN

3.1. Design by evolution;
3.2. Design by innovation;
3.3. Design by imitation;
3.4. Factors affecting product design;
3.5. Standards of performance and environmental factors;
3.6. Decision making and iteration;
3.7. Morphology of design (different phases);
3.8. Role of aesthetics in design.

4. INTRODUCTION TO OPTIMIZATION IN DESIGN

4.1. Economic factors in design;
4.2. Design for safety and reliability;

4.3. Role of computers in design;
4.4. Modeling and Simulation;
4.5. The role of models in engineering design;
4.6. Mathematical modeling;
4.7. Similitude and scale models;
4.8. Concurrent design;
4.9. Six sigma and design for six sigma;
4.10. Introduction to optimization in design;
4.11. Economic factors and financial feasibility in design;
4.12. Design for manufacturing;
4.13. Rapid Proto typing (RP);
4.14. Application of RP in product design;
4.15. Product Development versus Design.

5. DESIGN OF SIMPLE PRODUCTS DEALING WITH VARIOUS ASPECTS OF PRODUCT DEVELOPMENT;

5.1. Design Starting from need till the manufacture of the product

REFERENCE BOOKS

1.Product Design and Development, Karl T.Ulrichand Steven D.Eppinger, TataMc Graw–Hill edition.
2.Engineering Design– George E. Dieter.
3.An Introduction to Engineering Design methods Vijay Gupta.
4.Merie Crawford: New Product management, McGraw-Hill Irwin.
5.Chitale A K and Gupta R C," Product Design and Manufacturing", Prentice Hall of India, 2005.
6.Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New Product Development, Pears on education.

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DISASTER MANAGEMENT

Course Code	MP 63002(Same in All Branches of Engg.)
Course Title	Disaster Management
Number of Credits	3 (L: 3, T: 0 ,P :0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES

Following are the objectives of this course:

•To learn about various types of natural and man-made disasters.
•To know pre and post-disaster management for some of the disasters.
•To know about various information and organizations in disaster management in India.
•To get exposed to technological tools and their role in disaster management.

COURSE OUTCOMES:

1.1. After competing this course, student will be:
1.2. Acquainted with basic information on various types of disasters
1.3. Knowing the precautions and awareness regarding various disasters
1.4. Decide first action to be taken under various disasters
1.5. Familiarised with organization in India which are dealing with disasters
1.6. Able to select IT tools to help in disaster management

COURSE CONTENTS

1. UNDERSTANDING DISASTER

1.1. Understanding the Concepts and definitions of Disaster,
1.2. Hazard,
1.3. Vulnerability,
1.4. Risk,
1.5. Capacity–Disaster and Development,
1.6. Disaster management.

2. TYPES, TRENDS, CAUSES, CONSEQUENCES AND CONTROL OF DISASTERS

2.1. Geological Disasters (earth quakes, land slides,tsunami, mining);
2.2. Hydro-Meteorological Di-sasters (floods, cyclones, lightning, thunder-storms, hailstorms, avalanches, droughts, cold and heat waves)
2.3. Biological Disasters (epidemics, pestattacks, forestfire);
2.4. Technological Disasters (chemical, industrial, radiological, nuclear)
2.5. Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters)
2.6. Global Disaster Trends
2.7. Emerging Risks of Disasters
2.8. Climate Change and Urban Disasters.

3. DISASTER MANAGEMENT CYCLE AND FRAME WORK

3.1. Disaster Management Cycle
3.2. Paradigm Shift in Disaster Management.
3.3. Pre-Disaster
3.4. Risk Assessment and Analysis,
3.5. Risk Mapping,
3.6. Zonation and Microzonation,
3.7. Prevention and Mitigation of Disasters,
3.8. Early Warning System
  3.8.1. Preparedness,
  3.8.2. Capacity Development;
  3.8.3. Awareness.
3.9. During Disaster
  3.9.1. Evacuation
  3.9.2. Disaster Communication
  3.9.3. Search and Rescue
  3.9.4. Emergency Operation Centre

3.9.5. Incident Comm and System
3.9.6. Relief and Rehabilitation
3.10. Post-disaster
3.10.1. Damage and Needs Assessment,
3.10.2. Restoration of Critical Infra structure
3.10.3. Early Recovery Reconstruction and Redevelopment;
3.10.4. IDNDR, Yokohama Stretegy, Hyogo Frame-work of Action.

4. DISASTER MANAGEMENT IN INDIA

4.1. Disaster Profile of India
4.2. Mega Disasters of India and Lessons Learnt.
4.3. Disaster Management Act 2005
4.4. Institutional and Financial Mechanism,
4.5. National Policy on Disaster Management,
4.6. National Guidelines and Plans on Disaster Management;
4.7. Role of Government (local, state and national),
4.8. Non-Government and Inter Governmental Agencies

5. APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT

5.1. Geo informatics in Disaster Management (RS, GIS, GPS and RS).
5.2. Disaster Communication System (Early Warning and Its Dissemination).
5.3. Land Use Planning and Development Regulations,
5.4. Disaster Safe Designs and Constructions,
5.5. Structural and Non Structural Mitigation of Disasters
5.6. S & T Institutions for Disaster Management in India

REFERENCES

1.Publications of National Disaster Management Authority (NDMA) on Various Templates and Guide lines for Disaster Management
2.Bhandani, R. K., An over view on natural & man-made disasters and their reduction, CSIR, New Delhi
3.Srivastava, H. N., and Gupta G. D. , Management of Natural Disasters in developing countries, Daya Publishers, Delhi
4.Alexander, David, Natural Disasters, Kluwer Academic London
5.Ghosh, G .K. ,Disaster Management, APH Publishing Corporation
6.Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

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INDIAN CONSTITUTION

Course Code	MP 6333(Same in All Branches of Engg.)
Course Title	Indian Constitution
Number of Credits	0 (L:2,T:0;P:0)
Prerequisites(Coursecode)	None
Course Category	AU

COURSE CONTENT

1. THE CONSTITUTION –

1.1. Introduction
1.2. The History of the Making of the Indian Constitution
1.3. Preamble and the Basic Structure, and its interpretation
1.4. Fundamental Rights and Duties and their interpretation
1.5. State Policy Principles

2. UNION GOVERNMENT

2.1. Structure of the Indian Union
2.2. President– Role and Power
2.3. Prime Minister and Council of Ministers
2.4. Lok Sabha and Rajya Sabha

3. STATE GOVERNMENT

3.1. Governor– Role and Power
3.2. Chief Minister and Council of Ministers
3.3. State Secretariat

4. LOCAL ADMINISTRATION

4.1. District Administration
4.2. Municipal Corporation
4.3. Zila Panchayat

5. ELECTION COMMISSION

5.1. Role and Functioning
5.2. Chief Election Commissioner
5.3. State Election Commission

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L.Fadia	Sahitya Bhawan; New edition(2017)
3.	Introduction to the Constitution of India	D D Basu	Lexis Nexis; Twenty-Third 2018 edition

SUGGESTED SOFTWARE / LEARNING WEBSITES:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

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TOOL ENGINEERING

Subject Code	:	MP 6001
Course Title	:	TOOL ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- To understand the concepts of cutting tools and cutting forces involved in metal cutting process.
- To understand tool angles of various cutting tools & their importance.
- To understand and evaluate the tool wear and tool life with the help of Taylors tool life equation.
- To understand the types of press, forming dies and their constructions.
- To understand the designing of strip layout for given component.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Select cutting tools and its material using data book. Estimate tool wear and tool life
CO2	Demonstrate understanding of metal cutting principles and mechanism
CO3	Identify cutting tool geometry of single point cutting tool
CO4.	Demonstrate concepts and use of jigs and fixtures
CO5	Use press tools and dies effectively

COURSE CONTENTS:

1. **Theory of Metal Cutting:**
   - 1.1. Mechanics of metal cutting - Merchant diagram
   - 1.2. Single point cutting tool-nomenclature and geometry
   - 1.3. Cutting tool material: High carbon Steel, High Speed Steel, Stellites, Cemented carbides, Ceramics, Composition and applications for the above-
   - 1.4. Tool life
   - 1.5. Chip formation and Type of chips

2. **Jigs and fixtures**: –
   - 2.1. Definitions and concept of Jig and fixture, necessity for jigs and fixtures,
   - 2.2. Type of jigs and fixtures and advantages of jigs and fixtures
   - 2.3. Difference between jigs and fixtures
   - 2.4. Principles of location and types of locators, types of clamping devices
   - 2.5. Elements of fixtures, design considerations,

3. **Work holding devices for flat, round and irregular surface**:
   - 3.1. Design of drill jigs,
   - 3.2. Bush specifications.
   - 3.3. Fixture for lathe operations,
   - 3.4. Fixture for milling, broaching, welding and modular fixture

4. **Press Working:**
   - 4.1. Types of presses: Mechanical presses, Hydraulic presses
   - 4.2. Press tools and accessories
   - 4.3. Press working operations: Bending operations angle bending, channel bending, curling, drawing, shearing operations, blanking, piercing, trimming, notching, lancing, shaving, parting off.
   - 4.4. Types of punches, standards die sets, scrap scrip layout
   - 4.5. Types of dies: Simple, compound, combination and progressive dies, working of progressive and compound dies

5. **Tool for forging, Design of drop forging dies:**
   - 5.1. Rolling,
   - 5.2. Strip rolling theory,
   - 5.3. Stress distribution in rolling,
   - 5.4. Roll separation force and torque.

Reference Books:

1. Tool Design – Cysil Donaldson TMH
2. Tool Design – Cole G.B.
3. Die Design Hand Book – ASTME
4. Jigs and Fixtures – Calving-Hoose
5. Jig and Fixture Design Hand Book – William and Boyes
6. Fundamentals of tool design – ASTME & Edward G. Hoffman
7. Fundamentals of Fixture Design – V. Koraskove Mir.
8. Metal Hand Book- ASM

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INDUSTRIAL EQUIPMENT MAINTENANCE

Subject Code	:	MP 6002
Course Title	:	INDUSTRIAL EQUIPMENT MAINTENANCE
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PC

COURSE LEARNING OBJECTIVES:

- To achieve minimum breakdown and keep the plant in good working condition at the lowest possible cost.
- Machines and other facilities should kept in such a condition which permits them to be used at their optimum (profit making) capacity without any interruption or hindrance.
- Maintenance division of the factory ensures the availability of the machines, buildings and services required by other sections of the factory for the performance of their functions at optimum return on investment whether this investment be in material, machinery or personnel.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Demonstrate the proper use of safety equipment, devices, and procedures in classroom and lab environments.
CO2	Understanding of the industrial equipment maintenance and practical laboratory experience to setup and repair industrial equipment and facilities.
CO3	Applies theoretical study and the knowledge of metering tools to troubleshoot mechanical, electrical, and electromechanical systems and repair them.
CO4.	Compares and contrasts the operations of various industrial machines.
CO5	Understand the friction, wear, and lubrication properties at mating parts of machines and tribological characteristics.

COURSE CONTENTS:

1. Introduction:

1.1. Introduction: Definition, need of maintenance management
1.2. Maintenance policies, Strategies,
1.3. Maintenance forms/ actions and their inter relationship;
1.4. Brief description of various maintenance actions.

2. Maintenance Organizations:

2.1. Introduction; prerequisities.
2.2. Factors determining effectiveness of maintenance organization,
2.3. Objectives, types, and design of maintenance organization,
2.4. Planning and control: Establishing a Maintenance plan and Systematic method of maintenance plan

3. Maintenance practices on production machines:

3.1. Lathe, Drilling machines, shapers, and welding machines.
3.2. Use of computer in maintenance.
3.3. Machine reconditioning,
3.4. Evaluation maintenance management: need of evaluation,

4. Spare parts Management:

4.1. Capacity utilization, cost reduction approach to spares.
4.2. Reliability and quality of spares.
4.3. Spare parts procurement.
4.4. Inventory control of spare parts.

5. Lubricants:

5.1. Introduction: Friction, wear, and lubrication, Purpose of lubrication, Lubrication regimes
5.2. Characteristics of lubricants: Viscosity, viscosity index, Oxidation stability, flash point, fire point, Pour point, cloud point, Carbon residue and ash content

5.3. Composition and classifications of lubricants.
5.4. Lubricating oils: refining , types, categories, and grading
5.5. Greases: compositions, functions, characteristics, thickeners, and additives
5.6. Solid lubricants, functional additives
5.7. Lubricants applications, testing, test methods, safety and health hazards.

Reference books:

1. Lubricants: Introduction to Properties and Performance: Marika Torbacke ,Åsa Kassman Rudolphi Elisabet Kassfeldt: John willy and sons 2014
2. ASM handbook vol-18: Friction, lubrication, and wear technology-2017
3. Handbook of maintenance management and engineering: Springer
4. Maintenance planning, scheduling, and coordination: Don Nyman, joel Levitt- Industrial press inc. NewYork-2001.

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