CURRICULUM

FOR

FOURTH SEMESTER

DIPLOMA IN

MECHANICAL ENGINEERING

SUBJECT STUDY SCHEME (4TH Semester: Mechanical Engineering)

		Time in Hours				Credits			
Course Code	**Subjects**	**Theory**	**Tutorial**	**Practical**	**Total**	**Theory**	**Tutorial**	**Practical**	**Total**
MEPC401	Fluid Mechanics and Hydraulic Machinery	3	0	-	3	3	-	-	3
MEPC402	Thermal Engineering- II	3	0	-	3	3	-	-	3
HS401	Entrepreneurship and Start ups	3	0	-	3	3	-	-	3
Program Elective-1		3	0	-	3	3	-	-	3
PE401	Computer Integrated Manufacturing								
PE402	Tool Engineering								
PE403	Industrial Robotics and Automation								
MEPC403	Advance Manufacturing Processes	3	0	-	3	3	-	-	3
Open Elective-1		3	0	-	3	3	-	-	3
OE401	Safety Engineering								
OE402	Renewable Energy Technologies								
OE403	Sustainable Engineering								
MEPC404	Fluid Mechanic and Hydraulic Machinery Lab	0	0	2	2	0	0	1	1
MEPC405	Thermal Engineering- II Lab	0	0	2	2	0	0	1	1
MEPC406	Advance Manufacturing Processes Lab	0	0	4	4	0	0	2	2
		18	**0**	**8**	**26***	**18**	**0**	**4**	**22**

*** Note: the 4hrs in a week shall be utilized for sports and other activities like debates, seminars etc.**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC401**	Course Title: **FLUID MECHANICS AND HYDRAULIC MACHINERY**
Semester: **4TH**	Credits: **3**
Periods Per Week: 3 **(L: 3, T: 1, P: 0)**	

COURSE OBJECTIVE:

To understand fluid flow and 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. Fundamental Concept and Pressure Measurement

1.1. Properties of fluid: Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapor Pressure, Compressibility.
1.2. Fluid Pressure and Pressure Measurement: Fluid pressure, Pressure head, Pressure intensity, Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differential manometers, Bourdon pressure gauge, Concept of Total pressure on immersed bodies, center of pressure, Simple problems on Manometers.

2. Flow of Fluid and Losses

2.1. Fluid Flow: Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli's theorem, Principle of operation of Venturimeter, Orifice meter and Pitot tube, Derivations for discharge, coefficient of discharge and numerical problems.
2.2. Flow Through Pipes: Laminar and turbulent flows; Darcy's equation and Chezy's equation for frictional losses, Minor losses in pipes, Hydraulic gradient and total gradient line, Numerical problems to estimate major and minor losses.

3. Hydraulic Jets

3.1. Impact of jets: Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet on curved vanes with special reference to turbines & pumps.
3.2. Simple Numerical problems on work done and efficiency.

4. Hydraulic Turbines

4.1. Hydraulic Turbines: Layout of hydroelectric power plant, Features of Hydroelectric power plant, Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available.
4.2. Construction and working principle of Pelton wheel, Francis and Kaplan turbines, Draft tubes – types and construction, Concept of cavitations in turbines, Calculation of Work done, Power, efficiency of turbines, Unit quantities and simple numerical.

5. Hydraulic Pumps

5.1. Centrifugal Pumps: Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Cavitations, Manometric head, Work done, Manometric

efficiency, Overall efficiency. Numerical on calculations of overall efficiency and power required to drive pumps.

5.2. Reciprocating Pumps: Construction, working principle and applications of single and double acting reciprocating pumps, Concept of Slip, Negative slip, Cavitations and separation.

COURSE OUTCOME

After the completion of the course, the student will be able to:

- Measure various properties such as pressure, velocity, flow rate using various instruments.
- Calculate different parameters such as co-efficient of friction, power, efficiency etc of various hydraulic systems.
- Describe the construction and working of turbines and pumps.
- Test the performance of turbines and pumps.

RECOMMENDED BOOK

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

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	8	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: MEPC402	Course Title: **THERMAL ENGINEERING-II**
Semester: **4TH**	Credits: **3**
Periods Per Week: 3 **(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To provide the knowledge to the students on the internal combustion engine and fuel system ofPetrol and Diesel Engine. To help them comprehend the IC engine's cooling and lubrication systems, and to educate students on the testing of engines and provide knowledge about various types of turbines used in power plants.

COURSE CONTENT

1. Internal Combustion Engines

- **1.1** Introduction.
- **1.2** Working principle of two stroke and four stroke cycle, SI engines and CI engines,Otto Cycle, diesel cycle and dual cycle.
- **1.3** Location and functions of various parts of IC engines and materials used for them.

2. Fuel Supply and Ignition System

- **2.1** Concept of carburetor
- **2.2** Air fuel ratio
- **2.3** Simple carburettor and its application, MPFI, common rail system, Super chargingand turbo charger
- **2.1** Description of battery coil and magneto ignition system, Fault finding and remedial action in ignition system

3. Fuel system and Diesel Engine

- **3.1** Components of fuel system
- **3.2** Description and working of fuel feed pump
- **3.3** Fuel injection pump
- **3.4** Injectors

4. Cooling and Lubrication

- **4.1** Function of cooling system in IC engine.
- **4.2** Air cooling and water cooling system, use of thermostat, radiator and forcedcirculation in water cooling (description with diagram).
- **4.3** Function of lubrication.
- **4.4** Types and properties of lubricant.
- **4.5** Lubrication system of engine.
- **4.6** Fault finding in cooling and lubrication system and remedial action.

5. Testing of IC Engines

- **5.1** Engine power- indicated and brake power.
- **5.2** Efficiency- mechanical, thermal, relative and volumetric.
- **5.3** Methods of finding indicated and brake power.
- **5.4** Morse test for petrol engine.

5.5 Concept of pollutants in SI and CI engines, pollution control, norms for two orfour wheelers-EURO-1, EURO-2, methods for reducing pollution in IC engines.

6. Steam Turbines and Steam Condensers

6.1 Function and use of steam turbine.
6.2 Steam nozzles- types and application.
6.3 Steam turbines- impulse, reaction simple and compound, construction and working principle.
6.4 Governing of steam turbines.
6.5 Function of a steam condenser, elements of condensing plant
6.6 Classification- jet condenser, surface condenser.
6.7 Cooling pond and cooling towers.

7. Gas Turbines and Jet Propulsion

7.1 Classification, open cycle gas turbine and closed cycle gas turbine, comparison of gas turbines with reciprocating IC engines, applications and limitations of gas turbine
7.2 Open cycle constant pressure gas turbines - general layout, PV and TS diagram and working of gas turbine
7.3 Closed cycle gas turbines, PV and TS diagram and working
7.4 Principle of operation of ram-jet engine and turbo jet engine - application of jet engines
7.5 Rocket engine - its principle of working and applications

COURSE OUTCOME

After the completion of the course, the student will be able to:

- Explain the different types of IC engines and the functions and materials of various parts of the engine.
- Describe the workings of the diesel engine as well as the fuel supply and fuel system.
- Demonstrate the cooling and lubrication systems of the IC engine.
- Perform the testing of the IC engine.
- Describe different type of turbines and working of jet propulsion.

RECOMMENDED BOOKS

1. Elements of Heat Engines by Pandey and Shah; Charotar Publishing House, Anand.
2. Thermal Engineering by PL. Ballaney; Khanna Publishers, New Delhi.
3. Engineering Thermodynamics by Francis F Huang; McMillan Publishing Company, Delhi.
4. Engineering Thermodynamics by CP. Arora; Tata McGraw Hill Publishers, New Delhi.
5. Thermal Engineering by RK Purohit; Standard Publishers Distributors, New Delhi.
6. Thermodynamics: An engineering Approach YA Cengel and MA Boles TMH Publication.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	10
2	6	12
3	6	12
4	8	16
5	8	16
6	8	16
7	8	18
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **HS401**	Course Title: **ENTREPRENEURSHIP AND START UPS**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

Acquiring entrepreneurial spirit and resource fullness. Familiarization with various uses of human resource for earning dignified means of living. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation. Acquiring entrepreneurial quality, competency, and motivation, Learning the process and skills of creation and management of entrepreneurial venture.

COURSE CONTENT

1. **Introduction to Entrepreneurship and Start – Ups**
   - **1.1** Definitions, Traits of an entrepreneur, Entrepreneurship, Motivation.
   - **1.2** Types of Business Structures, Similarities/differences between entrepreneurs andmanagers.
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 Strategies

- **6.1** Exit strategies for entrepreneurs.
- **6.2** Bankruptcy, succession and harvesting strategy.

COURSE OUTCOME

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

- Understanding the dynamic role of entrepreneurship and small businesses
- Organizing and Managing a Small Business
- Financial Planning and Control

- Forms of Ownership for Small Business
- Strategic Marketing Planning
- New Product or Service Development
- Business Plan Creation

RECOMMENDED BOOKS

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company Steve Blank and Bob Dorf K & S Ranch.
2. The Lean Startup: How today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses Eric Ries Penguin UK.
3. Demand: Creating What People Love Before They Know They Want It Adrian J. Slywotzky with Karl Weber Headline Book Publishing.
4. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business Clayton M. Christensen Harvard business

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted (%)
1	6	14
2	8	18
3	10	20
4	8	16
5	8	16
6	8	16
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **PE401**	Course Title: **Computer Integrated Manufacturing**
Semester: **4TH**	Credits: **3**
Hours Per Week: 3 **(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

The main objective of this course is to familiarize candidates with principles of Computer Integrated Manufacturing and Design in Mechanical Engineering. To get the knowledge about the flexible manufacturing and concept of Automation used in the manufacturing industries.

COURSE CONTENT

1. Computer Integrated Manufacturing

1.1 Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.

2. Computer Aided Design

2.1 CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre

3. Computer Aided Manufacturing

3.1 Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirementsplanning (MRP)

4. Flexible Manufacturing System

4.1 Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.

5. Automation

5.1 Integrating NC machines, robots, AGVs, and other NC equipment; Computer aidedquality control; business functions, computer aided forecasting; office automation

COURSE OUTCOME

After completion of the course the student will be able to:

- Demonstrate the various components of CIM
- Describe the concept of Flexible manufacturing.
- Explain the working of NC machines
- Perform the NC part programing on machines.
- Highlight the various applications and parts of Robots in industries

RECOMMENDED BOOKS

1. CAD, CAM, CIM-P. Radhakrishnan and S. Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing - Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation – S.R. Deb, Tata McGraw Hill.
4. Computer Integrated Manufacturing Systems by Dr. V. Jaykumar, Lakshmi Publication
5. CIM by A.W Scheer, Springer-Verlag

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	10	22
2	8	18
3	10	22
4	10	20
5	10	18
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **PE401**	Course Title: **TOOL ENGINEERING**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To understand metal cutting and forming process and factors affecting machinability, to develop knowledge of tools, dies and tool materials, to understand processes for increased productivity and quality.

COURSE CONTENT

1. Metal Cutting

1.1 Mechanics of Metal cutting; requirements of tools; cutting forces; types of chips; chip thickness ratio; shear angle; simple numerical only; types of metal cutting process; orthogonal; oblique and form cutting

1.2 Cutting fluids: types; characteristics and applications.

1.3 Tool wear: Types of tool wear; Tool life; Tool life equations.

2. Machinability

2.1 Definition: factors affecting machinability; machinability index.

2.2 Tool material: Types; characteristics; applications; Heat treatment of tool steels;specification of carbide tips; Types of ceramic coatings.

2.3 Cutting tool geometry: Single point cutting tool; drills; reamers; milling cutters.

3. Types of Die and construction

3.1 Simple Die; Compound Die; Progressive Die; Combination Die.

3.2 Punch & Die mountings: pilots; strippers; misfeed detectors; Pressure Pads; Knock outs; stock guide; Feed-Stop; guide bush; guide pins.

4. Die Design Fundamentals

4.1 Die Operations; blanking; piercing; shearing; cropping; notching; lancing; coining; embossing; stamping; curling; drawing; bending; forming; Die set; Die shoe; Die area; Calculation of clearances on die and punch for blanking and piercing dies; Strip layout; Calculation of material utilization factor.

5. Forming Dies

5.1 Bending methods; Bending Dies; bend allowance; spring back; spanking; bendingpressure; pressure pads; development of blank length.

5.2 Drawing: operations; Metal flow during drawing; Calculation of Drawing blank size; variables affecting metal flow during drawing; single action and double action dies; combination dies.

5.3 Fundamentals of other Tools: Constructional features of - Pressure Die casting dies; metal extrusion dies; injection molding dies; forging dies; plastic extrusion dies.

COURSE OUTCOME

After completion of the course the student will be able to:

- Explain the concepts, principles and procedures of tool engineering.
- Classify and explain various tools and tool operations.
- Select proper tool and a die for a given manufacturing operation to achieve highest productivity.
- Estimate tool wear and tool life.

RECOMMENDED BOOK

1. Tool Design - Donaldson Anglin, Tata McGraw Hill.
2. Production Technology- H.M.T.Jain, Tata McGraw Hill.
3. A Text Book of Production engineering – P.C. Sharma, S.Chand & Co.
4. Production Technology, R.K.Jain, Khanna Publishers.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	8	16
4	10	20
5	10	24
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **PE 401**	Course Title: **INDUSTRIAL ROBOTICS AND AUTOMATION**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

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, to select the robots according to its usage, to discuss about the various applications of robots, justification and implementation of robot, to conceptualize automation and understand applications of robots in various industries.

COURSE CONTENT

1. Fundamentals of Robotics

1.1 Introduction; Definition; Robots anatomy (parts) and its working:

1.2 Robots components; Manipulator, End effect; Construction of links, Types of joints; Classification of robots; Cartesian , Cylindrical, Spherical, Scara, Vertical Articulated;

1.3 Structural Characteristics of robots; Mechanical rigidity; effects of structure on control work envelope and work

1.4 Volume; Robot work volumes, Comparison; Advantages and disadvantages of robots

2. Robotic Drive System and controller

2.1 Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion.

2.2 Feedback devices; Potentiometers; Optical encoders; DC tachometer.

2.3 Robot controller; Level of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control; Point to point, Continuous path control and Sensor based path control; Controller programming.

3. Sensors

3.1 Requirements of a sensor; Principles and Applications of the following types of sensors.

3.2 Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing.

3.3 Introduction to Machine Vision: Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videoconcamera (Working principle & construction).

3.4 Applications of Robot vision system: Inspection, Identification, Navigation & serving.

4. Robot kinematics and Robot Programming

4.1 Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems.

4.2 Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands; and Simple programs

5. Advanced Automation

5.1 Basic elements of automated system, advanced automation functions, levels ofautomation.

5.2 Industrial Applications: Application of robots in machining; welding; assembly andmaterial handling.

COURSE OUTCOME

After completion of the course the student will be able to:

- Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.
- Explain the various robotic actuators on hydraulic, pneumatic and electrical drives.
- Explain about various types of sensors and concepts on robot vision system.
- Highlight the concepts of robot programming languages and various methods of robot programming.
- Explain the various applications of robot.

RECOMMENDED BOOK

1. Introduction to Robotics: Analysis, Systems, Applications – Saeed B. Niku, Pearson Education Inc. New Delhi 2006.

2. Industrial Robotics: Technology, Programming and Applications – M.P. Groover, Tata McGraw Hill Co, 2001.

3. Robotics Control, Sensing, Vision and Intelligence – Fu.K.S. Gonzalz.R.C and Lee C.S.G, McGraw Hill Book Co, 1987.

4. Robotics for Engineers – Yoram Koren, McGraw Hill Book Co, 1992.

5. A Text book on Industrial Robotics – Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.

6. Robotics Technology and Flexible Automation – S.R. Deb & Sankha Deb, Tata McGraw-Hill, 2010.

7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	8	18
3	10	22
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC403**	Course Title: **ADVANCE MANUFACTURING PROCESSES**
Semester: 4TH	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To distinguish between non-conventional machining and traditional machining processes. To know about the advancements in the area of manufacturing and production processes and impart knowledge & skills necessary for working in modern manufacturing environment. To get familiarized with working principles and operations performed on non-traditional machines, machining center, SPM, automated machines and maintenance of machine tools.

COURSE CONTENT

1. Milling

- **1.1** Specification and working principle of milling machine
- **1.2** Classification, brief description and applications of milling machines
- **1.3** Details of column and knee type milling machine
- **1.4** Milling machine accessories and attachment – Arbors, adapters, collets, vices, circular table, indexing head and tail stock, vertical milling attachment
- **1.5** Milling methods - up milling and down milling
- **1.6** Identification of different milling cutters and work mandrels
- **1.7** Work holding devices
- **1.8** Milling operations – face milling, angular milling, form milling, straddle milling and gang milling.
- **1.9** Cutting speed and feed, simple numerical problems.
- **1.10** Indexing on dividing heads, plain and universal dividing heads.
- **1.11** Indexing methods: direct, Plain or simple, compound, differential and angularindexing, numerical problems on indexing.
- **1.12** Thread milling

2. Grinding

- **2.1** Purpose of grinding
- **2.2** Various elements of grinding wheel – Abrasive, Grade, structure, Bond
- **2.3** Common wheel shapes and types of wheel – built up wheels, mounted wheels anddiamond wheels. Specification of grinding wheels as per BIS.
- **2.4** Truing, dressing, balancing and mounting of wheel.
- **2.5** Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
- **2.6** Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centre-lessgrinder, tool and cutter grinder.
- **2.7** Selection of grinding wheel.
- **2.8** Thread grinding.

3. Gear Manufacturing and Finishing Processes

- **3.1** Gear hobbing
- **3.2** Gear shaping

3.3 Gear finishing processes

4. Modern Machining Processes

4.1 Mechanical Process - Ultrasonic machining (USM): Introduction, principle, process, advantages and limitations, applications

4.2 Electro Chemical Processes - Electro chemical machining (ECM)– Fundamental principle, process, applications, Electro chemical Grinding (ECG)– Fundamental principle, process, application

4.3 Electrical Discharge Machining (EDM) - Introduction, basic EDM circuit, Principle, metal removing rate, dielectric fluid, applications

4.4 Laser beam machining (LBM)–Introduction, machining process and applications

4.5 Electro beam machining (EBM)-Introduction, principle, process and applications

5. Metallic Coating Processes

5.1 Metal spraying – Wire process, powder process, applications

5.2 Electro plating, anodizing and galvanizing

5.3 Organic Coatings- oil base paint, rubber base coating

6. Metal Finishing Processes

6.1 Purpose of finishing surfaces.

6.2 Surface roughness-Definition and units

6.3 Honing Process, its applications

6.4 Description of hones.

6.5 Brief idea of honing machines.

6.6 Lapping process, its applications.

6.7 Description of lapping compounds and tools.

6.8 Brief idea of lapping machines.

6.9 Super finishing process, its applications.

6.10 Polishing

6.11 Buffing.

COURSE OUTCOME

After completion of the course the student will be able to:

- Know the Operation and control of different advanced machine tools and equipment.
- Produce jobs as per specified requirements by selecting the specific machining process.
- Develop the mind set for modern trends in manufacturing and automation.
- Identify the different fabrication methods viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
- Know different non-traditional machining processes, CNC milling machines, special purpose machines.

RECOMMENDED BOOKS

1. Production Technology – HMT, Banglore, Tata Mc-Graw Hill

2. CNC machines – Pabla B. S. & M. Adithan, New Age international limited.

3. Non-conventional Machining – P. K. Mistra, Narvasa Publishining House

4. Manufacturing Processes – Begman & Amsted, John Willey and Sons.

5. Advanced manufacturing technology – David L. Goetsch

6. Exploring Advanced Manufacturing Technologies – Stephen F. Krar & Arthur Gil, Industrial Pres

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	12	26
2	10	20
3	5	10
4	6	14
5	5	10
6	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC404**	Course Title: **SAFETY ENGINEERING**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To provide in-depth knowledge to students about the safety in engineering industry and its applications in various fields. To provide in-depth knowledge of various processes involved in engineering industry and the associated hazards. To familiarize the student with occupational hazards associated with various industrial Processes, to expose the students to the risk control process of identified hazards

COURSE CONTENT

1. **Introduction**
   - **1.1** Definitions- classification of industry- different processes in the engineering industry.
2. **Foundry Operations**
   - **2.1.** Furnace-health hazard - safe methods of operation. Forging operations - heat radiation -maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills.
3. **Safety in The Use Of Power Presses**
   - **3.1** Shearing -bending - rolling - drawing - turning - boring - milling - planning - grinding.
   - **3.2** Selection and care of tools - health hazards and prevention
4. **Safety In General Engineering Workshop**
   - **4.1.** Safety in handling and storage, disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection.
5. **Care and Maintenance**
   - **5.1** Equipment like rope chains slings, hooks, clamps general safety consideration in material handling – manual and mechanical handling. Handling assessments- handling techniques – lifting.
   - **5.2** Occupational diseases due to physical and chemical agents.

COURSE OUTCOME

After completion of the course the student will be able to:

- Describe the various processes in engineering industries.
- Identify the various hazards associated with different operations.
- Formulate the methods of safe operations by effectively controlling the occupational health and safety hazards.
- Highlight the various safety requirements for material handling

RECOMMENDED BOOKS

1. Safety and Health for Engineers by Roger L. Breuer John Wiley & Sons, Inc.
2. Ronald P. Blake, Industrial Safety: Prentice Hall, New Delhi, Reference Books.
3. Accident Prevention Manual for Industrial Operations: National Safety Council, Chicago
4. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	8	18
2	10	20
3	8	18
4	10	20
5	12	24
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC 404**	Course Title: **RENEWABLE ENERGY TECHNOLOGIES**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

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 CONTENT

1. **Introduction**
   - **1.1** World Energy Use, Reserves of Energy Resources, Environmental Aspects of Energy Utilization.
   - **1.2** Renewable energy Scenario in India and World, Potentials Achievements/ Applications, Economics of renewable energy systems.
2. **Solar Energy**
   - **2.1** Solar Radiation, Measurements of Solar Radiation, Flat Plate and Concentrating Collectors.
   - **2.2** Solar direct Thermal applications, Solar Thermal Power Generation.
   - **2.3** Fundamentals of Solar Photovoltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV applications.
3. **Wind Energy**
   - **3.1** Wind Data and Energy Estimation, Types o f Wind Energy Systems, Performance.
   - **3.2** Site Selection, Details of Wind Turbine Generator, Safety and EnvironmentAspects.
4. **Bio-Energy**
   - **4.1** Biomass direct combustion, Biomass gasifiers, Biogas plants, Digesters.
   - **4.2** Ethanol production, Bio Diesel, Cogeneration, Biomass applications.
5. **Other Renewable Energy Sources**
   - **5.1** Tidal Energy, Wave Energy, Open and Closed OTEC Cycles.
   - **5.2** Small Hydro-Geothermal Energy, Hydrogen and Storage.
   - **5.3** Fuel Cell Systems, Hybrid Systems.

COURSE OUTCOME

After the completion of course, the student will be able to:

- Describe present and future energy scenario of the world
- Identify various methods of solar energy harvesting
- Identify various wind energy systems
- Evaluate appropriate methods for Bio energy generations from various Bio wastes
- Identify suitable energy sources for a location

RECOMMENDED BOOKS

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., 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, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 200

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	10	20
3	9	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC 404**	Course Title: **SUSTAINABLE ENGINEERING**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To develop an increased awareness among students on issues in areas of sustainability, to make students understand the role of engineering and technology within sustainable development, to give students some familiarity with the methods and tools used for sustainable product-service system development, to establish in students an understanding of the role and impact of engineering activities and engineering decisions on environmental, societal, and economic well-being

COURSE CONTENT

1. Sustainable Energy

1.1 **Introduction to Sustainable Energy-** Sustainable development, concepts of sustainable development: three pillar model, engg of sustainability model, Atkisson's pyramid model, prism model, principles of sustainable development, sustainable engineering threats for sustainability.

1.2 **Environment Ethics and Legislations-** Environment ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India- The Water Act, The Air Act, The Environment Act.

2. Environment Issues

2.1 **Local Environmental Issues-** Solid waste, impact of solid waste on natural recourses, zero waste concept and three R concept, waste to energy technology: thermo-chemical conversion, biochemical conversion.

2.2 **Global Environmental Issues-** Resource degradation: deterioration of water resources, land degradation air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

3. Tools for Sustainability

3.1 Environmental management System (EMS), concept of ISO14000, life cycle assessment (LCA): basic components, advantages, disadvantages, case study. Environmental impact assessment (EIA) , environment auditing, bio mimicking, case studies.

4. Sustainable Habitat

4.1 **Sustainable Habitat-** Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment (GRIHA), leadership in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable transport system.

4.2 **Sustainable Industrialization and Urbanization-** Sustainable urbanization, industrialization, material selection, pollution prevention, industrial ecology, industrial symbiosis, poverty reduction.

5. Energy Resources and Businesses

5.1 **Renewable energy resource**s- Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydro plants, biogas systems, bio fuels, energy from ocean, geothermal energy, conservation of energy.

5.2 **Green technology and Green Business**: Sustainable business, green technology, green energy, green Construction, green transportation, green chemistry, green computing.

COURSE OUTCOME

After completion of the course the student will be able to:

- Explain sustainable development and different environmental agreements and protocols
- Explain local and global environmental issues.
- Differentiate between carbon emissions for regular and sustainable cities and explain different practices to move industries towards sustainability.
- Discuss real time activities causing environmental issues and different methods to use renewable energy resources.
- Discuss different renewable energy resources and explain methods to implement green Technology.

RECOMMENDED BOOKS

1. R. L. Rag and Lekshmi Dinachandran Remesh. Introduction to Sustainable Engineering. 2nd Edition, PHI Learning Pvt. Ltd., 2016.
2. Sustainable Development and Education by Dr. Nibedita Priyadarshini.
3. Environment and Sustainable Development by M.H. Fuleker, Bhawanr Pathak and R.K. Kele, Springer Publication.
4. Sustainable Energy for All by Ali Sayegh; Springer Publication.
5. Sustainable Development by Sondous Oressi/ Kate Drum.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	8	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC405**	Course Title: **FLUID MECHANIC AND HYDRAULIC MACHINERY LAB**
Semester: **4TH**	Credits: **01**
Hours Per Week: **2 (L: 0, T: 0, P: 2)**	

COURSE OBJECTIVE:

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.

LIST OF PRACTICALS TO BE PERFORMED

1. Measurement of pressure head by employing.
   - **1.1** Piezometer tube
   - **1.2** Single and double column manometer
2. To find out the value of coefficient of discharge for a venturimeter.
3. Measurement of flow by using venturimeter.
4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code:**MEPC406**	Course Title: **THERMAL ENGINEERING –II LAB**
Semester: **4TH**	Credits: **01**
Hours Per Week: **2 (L: 0, T: 0, P: 2)**	

COURSE OBJECTIVE:

To impart practical knowledge about the two-stroke engine and single-cylinder diesel engine along with this study of the cooling and lubrication systems of engines. Moreover, Perform testing different engines to calculate efficiency and performance at different parameters

LIST OF PRACTICALS

1. Dismantle a two stroke engine, note the function and material of each part, reassemble the engine.
2. Dismantle a single cylinder diesel engine. Note the function of each part, reassemble the engine.
3. Study of battery ignition system of a multi-cylinder petrol engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment.
4. Study of cooling of IC engine.
5. Study of lubricating system of IC engine.
6. Determination of BHP by dynamometer.
7. Morse test on multi-cylinder petrol engine.
8. Local visit to roadways or private automobile workshops.
9. Study of steam turbines through models and visit.
10. Study of steam condensers through model and visits.

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC407**	Course Title: **ADVANCE MANUFACTURING PROCESSES LAB**
Semester: **4TH**	Credits: **02**
Hours Per Week: **4(L: 0, T: 0, P: 4)**	

PRACTICAL EXERCISES

Advance Turning Shop

1. Exercise of boring with the help of boring bar.
2. Exercises on internal turning on lathe machine.
3. Exercises on internal threading on lathe machine.
4. Exercises on external turning on lathe machine.
5. Re sharpening of single point cutting tool with given geometry.

Machine Shop

1. Produce a rectangular block by facing on a slotting machine.
2. Produce a rectangular slot on one face with a slotting cutter.
3. Produce a rectangular block using a milling machine with a side and face cutter.
4. Prepare a slot on one face using milling machine.
5. Job on grinding machine using a surface grinder.
6. Prepare a job on cylindrical grinding machine.
7. Exercise on milling machine with the help of a form cutter.
8. Exercise on milling machine to produce a spur gear.
9. Grinding a drill-bit on tool and cutter grinder.
10. Exercise on dressing a grinding wheel.