# Indira Gandhi University Meerpur Rewari

**(A State University established under Haryana Act No.29 of 2013)**

**Examination Scheme & Syllabus for M.TECH (Mechanical Engineering)**
**Semester- I & II**

**OUTCOME BASED EDUCATION SYSTEM / LEARNING OUTCOME CURRICULUM FRAMEWORK OBES / LOCF,**

**CBCS CURRICULUM (w.e.f. 2019-20)**

## VISION AND MISSION OF THE DEPARTMENT

### VISION

To make contribution in the development of nation and evolution of technology by creating highly ethical professionals in Mechanical Engineering who are technically competent and are aware of their social responsibilities

### MISSION

- To produce highly qualified, socially responsible, ethical and motivated students having sound theoretical and practical knowledge of Mechanical Engineering as well as communicative skills who can serve the nation as well as at global level.
- To inspire students to be a part of research and development activities.
- To encourage students to participate in conferences, workshops, seminars and research activities.

**Programme Outcomes (PO), M.Tech, Mechanical Engineering , Indira Gandhi University, Meerpur, Rewari**

| | | |
|---|---|---|
| PO1 | Knowledge | Capable of demonstrating comprehensive disciplinary knowledge gained during course of study. |
| PO2 | Research Aptitude | Capability to ask relevant/ appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis. |
| PO3 | Communication | Ability to communicate effectively on general and scientific topics with the scientific community and with society at large. |
| PO4 | Problem Solving | Capability of applying knowledge to solve scientific and other problems. |
| PO5 | Individual and Team Work | Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, multidisciplinary settings. |
| PO6 | Investigation of Problems | Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions. |
| PO7 | Modern Tool usage | Ability to use and learn techniques, skills and modern tools for scientific practices. |
| PO8 | Science and Society | Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices. |
| PO9 | Life-Long Learning | Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life. |
| PO10 | Ethics | Capability to identify and apply ethical issues related to one’s work; avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work. |
| PO11 | Project Management | Ability to demonstrate knowledge and understanding of the latest technologies and apply these to manage projects. |

**Programme Educational Objectives (PEOs):**

The IGU has formulated the Programme Educational Objectives (PEO's) with those in fields. The Programme educational objectives (PEO) are the statement that describes the career and professional achievement after receiving the degree. The PEO's of the Master's degree in Mechanical Engineering are as follows:

**PEO1:** To impart education in Production & Industrial Engineering to have all-round development of students in order to serve the global society.

**PEO2:** To develop independent research attitude through projects/dissertations and its administrative & financial management as well as its dissemination to the PG students

**PEO3:** To encourage students to be ethically and socially responsible and articulate themselves to be a lifelong learner.

**Programme Specific Outcomes (PSO's):**

The Programme outcomes (PSO) are the statement of competencies/ abilities. PSOs are the statement that describes the knowledge and the abilities the post-graduate will have by the end of Programme studies.

**PSO1:** The detailed functional knowledge of theoretical concepts and experimental aspects of mechanical engineering.

**PSO2:** To integrate the gained knowledge with various contemporary and evolving areas in mechanical engineering like fluid mechanics, Computer Aided Design etc.

**PSO3:** An ability to independently carry out research /investigation and development work to solve practical problems.

**PSO4:** An ability to write and present a substantial technical report/document.

**Mapping of PEO's with PO's and PSO's**

| S. No. | *Programme Educational Objectives* | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **PEO1** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| 2 | **PEO2** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| 3 | **PEO3** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

# COURSE CODE AND DEFINITIONS

| Course Code | Definition |
|---|---|
| L | Lecture |
| T | Tutorial |
| P | Practical |
| BSC | Basic Science Courses |
| ESC | Engineering Science Courses |
| HSMC | Humanities and Social Sciences including Management courses |
| PCC | Professional Core Courses |
| LC | Laboratory Courses |
| MC | Mandatory Courses |
| PT | Practical Training |
| S | Seminar |

**Seminar**

Max.Marks-25

Every candidate will have to deliver a seminar of 30 minutes duration on a topic (not from the syllabus) which will be chosen by him / her in consultation with the teacher of the department. The seminar will be delivered before the students and teachers of the department. A three member committee (one coordinator and two teachers of the department of different branches) duly approved by the departmental council will be constituted to evaluate the seminar. The following factors will be taken into consideration whileevaluating the candidate.

Distribution of marks will be as follows:

1. Presentation 10 marks
2. Depth of the subject matter 10 marks
3. Answers to the questions 05 marks

**Scheme Of Studies And Examination M.Tech 1st Year (Mechanical Engineering) w.e.f. 2019-20**

## Semester 1

| Sl. No | Course Code | Subject | Credit Pattern | | | | Examination Schedule (Marks) | | | | Duration of Exam (Hours) | No of Hours /week |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total Credits | Marks of Class work | Theory | Practical | Total | | |
| 1 | MTME101 | Micro Machining Processes | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 2 | MTME102 | Computer Aided Design & Manufacturing | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 3 | MTME103 | IC Engine Combustion & Pollution | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 4 | MTME104 | Machine Tool Design | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 5 | MTME105 | Seminar | - | - | - | 1 | | - | - | 25 | | - |
| 6 | MTME106 | Computer Aided Design & Manufacturing Lab | - | - | 2 | 2 | 50 | - | 50 | 100 | 3 | 4 |
| 7 | MTME107 | IC Engine Combustion & Pollution Lab | - | - | 2 | 2 | 50 | - | 50 | 100 | 3 | 4 |
| 8 | MTME 108 | Micro Machining Processes Lab | - | - | 2 | 2 | 50 | - | 50 | 100 | 3 | 4 |
| 9 | MTME109A or MTME109B or MTME109C | Elective I (DCEC) | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 10 | MTME 110 | Self Study Paper | | | | 1 | | | | 25 | | - |
| | | **TOTAL** | **28** | | | | | | | | | |

**NOTE**: Examiner will set nine questions in total. Question One will be compulsory and will comprise short answer type questions from all sections and remaining eight questions to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**ELECTIVE - I :** Choose any one from the following three papers:

**MTME109A** - NUMERICAL METHODS & COMPUTING

**MTME109B** - METHOD ENGINEERING & ERGONOMICS

**MTME109C** - COMPUTATIONAL FLUID DYNAMICS

## Scheme Of Studies And Examination M.Tech 1st Year (Mechanical Engineering) w.e.f. 2019-20

### Semester 2

| Sl. No | Course Code | Subject | Credit Pattern | | | | Examination Schedule (Marks) | | | | Duration of Exam (Hours) | No of Hours/ week |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total Credits | Marks of Class works | Theory | Practical | Total | | |
| 1 | MTME201 | Welding & Allied Processes | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 2 | MTME202 | Total Quality Management | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 3 | MTME203 | Seminar | - | | - | 1 | | - | - | 25 | | 1 |
| 4 | MTME204 | Mechatronics Lab | - | - | 2 | 2 | 50 | - | 50 | 100 | 3 | 4 |
| 5 | MTME205 | Advanced Welding Lab | - | - | 2 | 2 | 50 | - | 50 | 100 | 3 | 4 |
| 6 | MTME206A or MTME206B or MTME206C | Elective-II | 4 | 0 | - | 4 | 50 | 100 | - | 150 | 3 | 4 |
| 7 | MTME207 | Foundation Elective | 2 | 0 | - | 2 | | | | | | |
| 8 | MTME208 | Self Study Paper | | | | 1 | | | | 25 | | - |
| | | **TOTAL** | **20** | | | | | | | | | |

**NOTE:** Examiner will set nine questions in total. Question One will be compulsory and will comprise short answer type questions from all sections and remaining eight questions to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**Elective II** : Choose any one from the following three papers:

**MTME206A**-Modeling&Simulation

**MTME206B** - Jigs & Fixture

**MTME206C**-Tool&Diedesign

**Foundation Elective**: A candidate has to select this paper from the pool of Foundation Electives provided by the University.

## MTME101- MICRO-MACHINING PROCESSES

| L | T | P | CREDIT | |
|---|---|---|---|---|
| 4 | 0 | 0 | 4 | |

**SESSIONAL:50Marks**

**THEORY :100Marks**

**TOTAL :150 Marks**

**DURATIONOFEXAM.:3Hrs.**

***Objectives of the course***

a. To understand New Machining Technologies.
b. To study Micro Electro mechanical systems paradigms. Materials for MEMS, Future trends.
c. To understand the concept of Electro Chemical Machining, fundamental principles, process parameters characteristics etc.
d. To study about EDM, metal removal rate, machining accuracy and surface finish optimization etc.

**UNIT-I**

Introduction to New Machining Technologies: Micro electromechanical Systems (MEMS), Non Conventional Machining Process, Comparison of conventional machining processes and new technologies.

**UNIT-II**

Micro-electro-mechanical System Description, System Process, MicroElectromechanical systems paradigms, Materials for MEMS, Future trends: Mechanical Transducers, Optical Transducers, and Multi Disciplinary Applications..

**UNIT-III**

Ultrasonic machining, Whirling jet machining, fundamental principles, process parameters characteristics, tool design, metal removal rate analysis, important part design, analysis of process. Machining Accuracy and Surface Finish Optimization.

Electro Chemical Machining- Introduction, principles, scheme, process parameters, metal removal rate, Electrochemical grinding: Introduction, tools, process parameters, metal removal rate, Honing, Accuracy and Surface finish Optimization.

**UNIT-IV**

EDM- Introduction – basic principles, metal removal rate, machining accuracy and surface finish optimization, selection of tool material and dielectric, analysis of process. Wire electric discharge machining: Principle, Process variables.

**Course Outcomes (COs):**

At the end of the course, the student shall be able:

CO1: To Explore the ability to understand various techniques which can be used for the manufacturing of micro- products.

CO2: To Understand the Micro-electromechanical systems (MEMS)-based Manufacturing involves, largely,

CO3: To Develop the various techniques such as photolithography,

CO4: To Study the chemical-etching, plating, LIGA, laser fabrication, etc. while non sMEMS-based manufacturing often involves techniques such as mechanical machining.

CO5: To define the various problem of machining process.

Mapping of Paper No. MTME-101

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | M | S | S | S | M | S | S | S | S | S | S | S |
| CO3 | S | M | S | S | M | S | S | S | S | S | S | S | M | S | S |
| CO4 | M | S | S | S | S | S | S | S | S | M | S | S | S | S | M |
| CO5 | S | S | S | S | S | M | S | S | S | S | M | S | S | S | S |

S=Strong M=Medium W=Weak

**Reference Books:**


1. Manufacturing Sciences by Ghosh & Malik.
2. Newer machining processes; H.S.Shan
3. Advance machining processes by B. Bhushan
4. Fundamentals of Micro-machining by M.J Madou CRC Press.

## MTME102- COMPUTER AIDED DESIGN AND1 MANUFACTURING

| L | T | P | CREDIT | | |
|---|---|---|---|---|---|
| 4 | 0 | 0 | 4 | | |

**SESSIONAL:50 Marks**

**THEORY:100Marks**

**TOTAL :150Marks DURATIONOFEXAM.:3Hrs.**

***Objectives of the course***

**a.** To impart fundamental knowledge to students in the latest technological topics on Computer Aided Design

b. To prepare them for taking up further research in the areas of Computer Aided Manufacturing and Computer Aided Engineering Analysis.

c. To create congenial environment that promotes learning, growth and imparts ability to work with inter disciplinary groups in professional, industry and research organizations.

d. To study about CNC tooling Machine.

### UNIT-I

**Introduction:** Introduction, Review of vectors & Matrices, Basics of geometric and solid modeling, explicit, implicit, intrinsic and parametric equations, coordinate systems. Transformations : Introduction , Transformation of points & lines,2-D Translation , Shearing, Rotation , Reflection, Scaling & Combined Transformation, Homogeneous Co- ordinates, 3- D Scaling, Shearing, Rotation , Reflection & Translation, Combined Transformation, orthographic , axonometric, oblique & perspective projections.

### UNIT –II

Curves & Surfaces Geometry and topology, Algebraic & geometric forms of straight lines, circle, bezier curves & B – splines curves, blending functions, Reparametrization, plane surfaces, sixteen point forms, four curves form, ruled surfaces of revolution, Tabulated cylinder, lofted surfaces, bi- cubic surfaces, bezier surfaces, B-splines surfaces, Coons patch.

### UNIT –III

Introduction to CAM, Computer Hardware & Software, APT Language, Introduction to NC, CNC & DNC Systems, Convention of Machine axis and coordinate systems. CNC tooling Machine Tools. Automatic tool changers. Open loop and closed loop systems. Adaptive control encoders.

### UNIT-IV

Manual part programming, CNC part programming, canned cycles, G-codes & M-codes. High language programming: Flexible manufacturing systems, Computer aided process planning, and Automated Material handling.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To study CAD/CAM Engineering

CO2: To explore the abilities and capabilities in developing and applying computer software and hardware to mechanical design and manufacturing fields.

CO3: To design the 3-D scaling model

CO4: To understand the CNC tooling, Machine Tools. Automatic tool changers.

CO5: To develop the carious design of various processes.

Mapping of Paper No. MTME-102

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | S | S | S | S | S | S | M |
| CO3 | M | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO5 | S | S | S | S | S | M | S | S | M | S | S | S | S | S | S |

S=Strong M=Medium W=Weak

**Text Books:**

1. CAD/CAM by M.P. Groover, PHI
2. CAD/CAM Theory and Practice, Teid
3. Understanding CAD/CAM by D.J. Bowman

**Reference Book:**

1. CAD/CAM Handbook, tiecholz
2. Computer Aided Manufacturing, P.N. Rao.

## MTME103- I.C. ENGINES COMBUSTION AND POLLUTION

**L T P CREDIT** **SESSIONAL:50 Marks**

**4 0 0 4** **THEORY :100Marks**

**TOTAL :150 Marks DURATION OFEXAM.:3Hrs.**

***Objectives of the course***

a. Make students familiar with the design and operating characteristics of modern internal combustion engines apply analytical techniques to the engineering problems.
b. To study about the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions.
c. To introduce students to the environmental and fuel economy challenges facing the internal combustion engine.
d. To Recognize and understand reasons for differences among operating characteristics of different engine types and designs

### UNIT-I

Fuel air Cycles analysis, Thermodynamics of combustion, Chemical equilibrium, Dissociation, Combustion Charts and gas tables for air fuel mixtures and the products of Combustion. Types of Hydrocarbons in Petroleum fuels, Gasoline grades, required properties of SI and CI engine fuels. Rating of fuels.

### UNIT-II

Definition of combustion, combustion modes and flame types, review of property relation, Law of thermodynamics, reactant and product mixtures adiabatic flame temperature, chemical equilibrium and product of combustion. Laminar premixed flame, definition principle characteristics, factors, influencing flame velocity and thickness, flammability limits and quenching of laminar flow, ignition, turbulent flames : turbulent flame propagation, flame stabilization

### UNIT-III

Burning of carbon, coal combustion, effect of pollutant emissions from premixed combustion and from non- premixed combustion. Detonation, principle, characteristics one-dimensional, detonation velocity, structure of detonation waves.

### UNIT-IV

Pollution : Exhaust gases and analysis, orset apparatus , infrared analyzer, determination of air fuel ratios, air pollution and engines.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To study different internal combustion engine designs

CO2: To Recognize and understand reasons for differences among operating characteristics of different engine types and designs

CO3: To understand engine design specification, predict performance and fuel economy trends with good accuracy Based on an in-depth analysis of the combustion process,

CO4: To predict concentrations of primary exhaust pollutants Exposure to the engineering systems needed to set-up and run engines in controlled laboratory environments.

CO5: To explore the various pollution process.

Mapping of Paper No. MTME-103

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | M | S | S | S | S | S | S | S | S |
| CO2 | S | S | S | M | S | S | S | S | S | S | S | S | S | M | S |
| CO3 | S | S | S | S | S | S | S | S | M | S | S | S | M | S | S |
| CO4 | S | S | M | S | M | S | S | S | S | S | M | S | S | S | S |
| CO5 | S | S | S | S | S | M | S | S | M | S | S | S | S | S | S |

**Text Books:**

1. I.C engine Vol. 1 & 2 by Taylor
2. Thermodynamics and Gas Dynamics of IC engines, Vol. 1 & 2 by Horlock and Winter bone.

**Reference Books:**

1. I.C engine Vol 1 & 2 by Benson and Whitehouse.
2. Thermodynamics analysis of combustion engines, by Campbell

# MTME104-MACHINE TOOL DESIGN

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50Marks**
**THEORY :100Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course***

**a.** The course provides students with fundamental knowledge and principles in material removal processes.
**b.** To demonstrate the fundamentals of machining processes and machine tools.
**c.** To develop knowledge and importance of metal cutting parameters.
d. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes

**UNIT- I**

Introduction to Machine Tools and Mechanisms: General principles of machine tool design, working and auxiliary motions, machine tool drives, hydraulic and mechanical transmission and its elements, general requirements of machine tool design, layout of machine tools. Regulation of Speed and Feed Rates: Purpose, stepped regulation of speed-design of speed box, machine tool drives using multiple speed motors, developing the gearing diagram, step-less regulation of speed and feed rates.

**UNIT- II**

Machine Tool Structure: Functions and requirements, design criteria, materials used and their properties, static and dynamic stiffness, cross-sectional shapes used for machine tool structures and basic design procedure for the design of beds, columns and other structural elements, model techniques used in design, introduction to Finite Element Method (FEM).

**UNIT- III**

Guideways and Power Screws: Function and types, design considerations & procedure for slideways, design of power screws.

**UNI -IV**

Spindles and Spindle Supports: Functions and requirements, materials, effect of machine tool compliance on machining accuracy, design of spindles, bearings design/selection. Control Systems: Functions, requirements and classification, control systems for speeds, feeds & auxiliary motions, manual control systems, automatic control systems, adaptive control systems, criteria and economic selection of machine tools, future trends in development of machine tools.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To understand cutting mechanics to metal machining based on cutting force and power consumption.
CO2: To analysis lathe, milling machines, drill press, grinding machines, etc.
CO3: To develop the cutting tool materials and tool geometries for different metals.
CO4: To explore the appropriate machining processes and conditions for different metals. Learn machine tool structures and machining economics.
CO5: To design the various machine tool.

Mapping of Paper No. MTME-104

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | S | S | S | S | S | S | S | S |
| CO2 | S | W | S | S | S | S | S | M | S | S | M | S | S | S | S |
| CO3 | S | S | S | S | W | M | S | S | S | S | S | S | M | S | S |
| CO4 | S | S | M | S | S | S | S | S | S | S | S | S | S | S | S |
| CO5 | M | S | S | S | S | S | M | S | M | S | S | S | S | S | S |

**Text Book:**

Machine tool design By N.K.Mehta Design of Machine Tool By S.K.Basu

## MTME106- COMPUTER AIDED DESIGN & MANUFACTURING LAB

| L | T | P | CREDIT | |
|---|---|---|---|---|
| 0 | 0 | 4 | 2 | |

**SESSIONAL/Class work:50Marks**

**Practical(external) :50 Marks**

**TOTAL :100 Marks**

**DURATION OFEXAM.:3 Hrs.**

***Objectives of the course:***

a. This course introduces students to CAD software in general and SolidWorks 2016 software in particular.
b. Students will learn theory and practice related to solid modeling, assembly modeling, drafting, parametric modeling, free form surface modeling.
c. All major manufacturing companies and their suppliers use CAD software to design parts and evaluate them with respect to fit, form and function.
d. Students are able how to use of CAD models for some downstream engineering activities such as motion simulation and manufacturing.

**LIST OF EXPERIMENTS**

1. To create a 2-Dimensional Sketch with the help of all geometrical Shapes.
2. To list the coordinate of given diagram
3. To prepare a part programme for facing & turning operation on a CNC Lathe.
4. Prepare part programme for facing & taper turning operation on CNC Lathe in single cut programming in word address format.
5. To create a solid with all of all solid entities of basic solid modeling commands.
6. Practice Boolean operation on solids.
7. Create surface with help of ruled & the tabulated surfaces.
8. Create a surface with the help of a surface of revolution & edgesurface.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To Design and drafting of Part Modelling and Assembling Modellings in2D and 3D models.
CO2: To Understand the working of CNC Machines, Robots, Machine Vision Design and machine.
CO3: To Study the Various CAD/CAM packages like Master CAM and Surface
CO4: To Design and Machining using Master CAM
CO5: To developed the various modeling of manufacturing process.

Mapping of Paper No. MTME-106

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | S | S | S | S | S | S | M |
| CO3 | M | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO5 | S | S | S | S | S | M | S | S | M | S | S | S | S | S | S |

## MTME107- I.C. ENGINES COMBUSTION & POLLUTION LAB

**L T P CREDIT**

**0 0 4 2**

**SESSIONAL/CLASS WORK:50MARKS**

**PRACTICAL(EXTERNAL) :50 MARKS**

**TOTAL :100 MARKS**

**DURATION OFEXAM.:3 HRS.**

***Objectives of the course:***

a. The course should enable the students to understand effect of vehicle population and emitted pollutants on human health and environment and various types of emissions.
b. Understand the formation mechanism of various types of pollutants from SI and CI engines.
c. Conceive the significance of emission control methods.

**List of Experiments :**

1. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
2. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
3. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
4. To find the indicated horse power (IHP ) on multi-cylinder petrol engine/diesel engine by Morse Test.
5. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp,fhp, vs speed ( ii) volumetric efficiency & indicated specific specific fuel consumption vs speed.
6. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method petrol engine.

**Course Outcomes (COs):** At the end of the course, the student shall be able to understand:

CO1: To analyze the impact of vehicle population on pollution and the effects HC, CO, CO2, NOX, smoke,

CO2: To study particulates, lead and aldehydes on health and environment.

CO3: To describe the effects of transient operation of vehicle on emissions and types of emissions.

CO4: To describe the formation mechanism of HC, CO, CO2, NOX, smoke, particulates and aldehydes in SI and CI engines.

CO5: To Study the Comprehend the factors that lead to global warming and the issues. Analyze the design and operating parameters on emissions.

CO6: To Describe about noise pollution, measurement and control

Mapping of Paper No. MTME-107

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | S | S | M | S | S | M | S | S | S | S | S | S |
| CO2 | S | M | S | S | S | S | S | S | S | S | S | S | S | M | S |
| CO3 | S | S | S | S | W | S | M | S | S | S | S | S | S | S | S |
| CO4 | S | S | W | S | S | S | S | S | S | S | M | S | S | S | S |
| CO5 | M | S | S | S | S | W | S | S | M | S | S | S | M | S | S |
| CO6 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |

## MTME108-MICRO MACHINING PROCESSES LAB

| L | T | P | CREDIT |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**SESSIONAL:50 Marks**
**Practical :50 Marks**
**TOTAL :100 Marks DURATIONOFEXAM.:3Hrs.**

***Objectives of the course:***

a. The course aims in identifying the classification of unconventional machining processes.
b. To understand the principle, mechanism of metal removal of various unconventional machining processes.
c. To study the various process parameters and their effect on the component machined on various unconventional machining processes.
d. To understand the applications of different processes.

**LIST OF EXPERIMENTS**

1. Study and applications of Abrasive Jet Machining.
2. Study and applications of Electrical Discharge M/C
3. Study and applications of Electrochemical Grinding
4. Study and applications of Ultrasonic Machining
5. Study and applications of Electrochemical Machining
6. Study and applications Jet Machining
7. Study and applications wire Electrical Discharge M/C

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To understand the completion of course, the student shall understand the principle of working,
CO2: To study mechanism of metal removal in the various unconventional machining process.
CO3: To identify the process parameters, their effect and applications of different processes.

Mapping of Paper No. MTME-108

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | S | M | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | M | S | S | M | S | S | S | S | S | S | S | S | S |
| CO3 | M | S | S | S | S | S | S | S | S | S | S | M | S | S | S |

## MTME109A - NUMERICAL METHODS AND COMPUTING

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100 Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

a. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions
b. Apply numerical methods to obtain approximate solutions to mathematical problems.
c. Analyze and evaluate the accuracy of common numerical methods.

### UNIT-1 ERRORS IN NUMERICAL CALCULATIONS

Introduction. Numbers and their accuracy. Absolute. Relative and percentage errors and their analysis General error formula.in Erpolation And Curv LiftingTaylor series and calculation of functions. Introduction to interpolation. Lagrange approximation. Newton polynomials. Chebyshev polynomials least squares fine. curve fitting. Interpolation by spline function

### UNIT-2 NUMERICAL DEFFERENTIATION AND INTEGRATION

Approximating the derivative. Numerical differentiation formulas. Introduction to Numerical quadrature. Newton-cores formula. Gausion quadrature,solution of nonlinear equations.

Bracketing methods for locating a roor. Initial approximations and convergence criteria. Newton-Raphsen and secant methods. Solution of problems through a structural programming language such as C or pascal.

### UNIT-3 SOLUTION OF LINEAR SYSTEMS

Direct Meghods. Gaussian elimination and pivoting. Matrix inversion. UV factorization. Iterative methods for linear systems solution of problems through a structured programming language such as C or Pascal. EIGEN VALUE PROBLEME Jacobi. Given's and Householder's methods for symmetric matrices. Rutishauser method for general matrices, power and inverse power methods solution of problems through a structured programming language such as C or Pascal.

### UNIT-4 SOLUTION OF DIFFERENTIAL EQUATIONS

Introduction to differential equations. Initial value problems. Euler's methods. Heun's method. Runge- Kutta methods. Taylor series mefthod. Predictor-corrector methods. Systems of differential equations. Boundary valve problems. Finite-difference method. Solution of problems through a structured programming language such as C or Pascal. PARTIAL DIFFERENTIAL EQUATIONS Solation of hyperbolic. Parabolic and elliptic equations. The eigenvalue problem thepower method and the Jacobi's method for eigen value problems. Solution of problems through a structured programming language such as C or Pascal.

**Course Outcomes (COs):** At the end of the course, the student shall be able :

CO1: To Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
CO2: To understand the numerical methods to obtain approximate solutions to mathematical problems.
CO3: To analyze and evaluate the accuracy of common numerical methods

Mapping of Paper No. MTME-109-A

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | S | S | S | S | S | S | M |
| CO3 | M | S | S | S | M | S | S | S | S | S | S | S | S | S | S |

**Text Books:**

1. Applied Numerical Analysis by Curtis E. Gerald and Patrick Q. Wheatley- published by Addition Wesley.
2. Applied Numerical Methods- carnahan. B.H. Luthar. H.A. and Wilkes. J.O. Pub-j. Wiley. New York

**Reference Books:**

1. Numerical Solution of Differential Equations. By M.K.Jain. published by Wiley Eastern. New York.
2. Introductory Methods of Numerical Analysis by S.D. Sastry. Published by Prentice Hall of India.
3. Numerical Methods- Hornbeek. R.W. Pub-prentice Hall. Englewood Cliffs. N.J.
4. Numerical Methods for Mathematics. Science and Engineering by John H.Mathews. PHI New Delhi

## MTME109B-METHOD ENGINEERING AND ERGONOMICS

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3Hrs.**

***Objectives of the course:***

a. To provide knowledge necessary to either initiate a new or improve an existing ergonomics program for controlling health and performance problems.
b. to educate and convince management of the cost benefits of an ergonomically sound workplace.
c. to proactively identify potential risks and determine cost effective and sustainable jobsite modifications

**UNIT-I**

Introduction to industrial engineering and productivity, measurement of productivity, Introduction to work study, methods study principles and motion economy, Filming techniques and micro-motion analysis, Introduction to work measurement. Time study, performance allowances, work sampling,

**UNIT-II**

Introduction of Ergonomics, system approach to ergonomic model, .Area of study covered under ergonomics ,man/machine systems, characteristics of man machine system, limitation of man & machine with respect to each other. Design approach: Work design consideration, General principles for carrying out the physical activities, Design
of work place, machine at work place, seat for workplace.

**UNIT-III**

Controls: Criteria for control design, Hand controls and foot controls,
Relationship between controls and display instruments, Controls for high precision work (Push buttons, Toggle switches, knobs etc.), Layout of panels and machine Displays:- Types of displays, Design recommendation for quantitative displays.

**UNIT-IV**

**Climates:** Heat Humidity- Fundamentals of human thermal regulation, measuring the thermal environment, work in hot climate,work in cold climate protection against climatic extremes,effect of climate on performance.

**Noise:-** Terminology, physiological effects of noise, annoyance of noise, speed interference, hearing loss, temporary and permanent threashold shift, effect of noise on performance reduction of noise, personal noise protection.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To Understand ergonomics and its three major components. Outline the components of an ergonomics program.
CO2: To Describe the components of office and shop floor ergonomic evaluations.
CO3: To study the common risk factors and areas for ergonomic improvement within foundries.
CO4: To Describe how to evaluate, select and implement ergonomic solutions. Describe the essential elements.

Mapping of Paper No. MTME-109-B

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | S | S | M | S | S | S | S | M | S | S |
| CO3 | S | S | M | S | M | S | S | S | S | S | S | S | S | S | S |
| CO4 | S | S | S | M | S | S | S | S | S | S | M | S | S | S | S |

**Text Books:**

1. Method Engineering study – Krick, S.V.
2. Work study and Ergonics – Suresh Dalela, Saurabh.

**Reference Books**:

1. Introduction of Ergonomics-Bridger-Tata McGraw Hill 1995
2. Work Study - Khanna– Dhanpat Rai & Sons-1995

## MTME109C-COMPUTATIONAL FLUID DYNAMICS

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100 Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

a. To provide the knowledge base essential for application of computational fluid dynamics to engineering flow problems.
b. Provide the essential numerical background for solving the partial differential equations governing the fluid flow Develop students' skills of using a commercial software package.

### UNIT-1

**Introduction**

History of CFD: Comparison of the three basic approaches in engineering problems solving analytical. Experimental and computational methods. Beam advance in computational techniques.

### UNIT-II

**Problem formulation**

The standard procedure for formulating a problem physical and mathematical classification of problems: types of governing differential equations. Methods of Discretisation:Basic of finite difference method: Finite element method. Finite volume method and spectral method. Treatment of boundary conditions.

### UNIT-III

**Numerical solution of Heat conduction problems:**

Steady-state problems: (i) One dimensional heat conduction transfer through a pin- fin- din, two dimensional conduction through a plate unsteady state problem: One dimensional transient heat conduction. Explicit and implicit methods. Stability of numerical methods.

### UNIT-IV

**Numerical solution of fluid flow problems**

Types of fluid flow and their governing equation: Viscous incompressible flows calculation of flow field using the stream function-vorticity method: calculation of boundary layer over a flet plate: Numerical algorithm for solving complete Navier- Stokes equation-MAC method SIMPLE algorithm: Project Problem.

**Course Outcomes (COs):** At the end of the course, the student shall be able :

CO1: To Understand solution of aerodynamic flows.

CO2: To Study the CFD software and its application. Simplify flow problems and them exactly Define and setup flow problem properly within CFD context, performing solid modelling

CO3: To Understand CAD package and producing grids via meshing tool

CO4: To Understand both flow physics and mathematical properties of governing.

Mapping of Paper No. MTME-109-C

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | S | S | S | S | M | S |
| CO2 | S | S | S | S | S | S | S | M | S | S | S | S | S | S | S |
| CO3 | S | S | M | S | S | S | S | S | S | S | S | S | M | S | S |
| CO4 | S | S | S | S | M | S | S | S | M | S | S | S | S | S | S |

**Books recommended:**

Numerical heat transfer and fluid flow by Suhas V. Patankar, taylor and francis. Computational fluid dynamics by J. Anderson

## MTME201- WELDING AND ALLIEDPROCESSES

| L | T | P | CREDIT | SESSIONAL:50 Marks |
|---|---|---|---|---|
| 4 | 0 | 0 | 4 | THEORY :100Marks |
| | | | | TOTAL :150 Marks DURATIONOFEXAM. :3 Hrs |

***Objectives of the course:***

a. To know the fundamentals of welding processes.

b. Weld in (flat, horizontal, vertical, and overhead positions) using the basic welding processes SMAW, GMAW, FCAW, and GTAW.

c. Perform metal layout processes. Cut metals using (oxy fuel and, plasma, arc) cutting process.

**UNIT 1.**

Introduction: Basic classification of welding processes, weldability, weld thermal cycle, metallurgy of fusion welds, solidification mechanism and microstructural products in weld metal, epitaxial, cellular and dendritic solidification, metallurgical changes in weld metal, phase transformation during cooling of weld metal in carbon and low alloy steel, prediction of microstructures and properties of weld metal. Heat affected zone, re-crystallization and grain growth of HAZ, gas metal reaction, effects of alloying elements on welding of ferrous metals.

Welding Arc: Arc efficiency, temperature distribution in the arc; arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc.

Types of electrodes, AWS and Indian system of classification and coding of covered electrode for mild steel, Shielding gases and associated mixtures

**UNIT 2.**

**Metaltransfer :** Short circuit/ dip transfer. Free flight. Globular type. Spray type, Forces affecting metal transfer. Weld bead geometry and shape factors, Weld dilution.

Electric arc welding principle, MIG: - welding equipment and processes, shielding gas, types of metal transfer. Tungsten inert gas arc welding (GTAW): - welding equipment, electrodes, inert gases and torches. Submerged arc welding (SAW):- principle of processes, applications, fluxes and welding electrodes used. $CO_2$ welding: - difference from MIG welding, Principle of operation, equipment, welding parameters and applications.

**UNIT 3.**

**Solid state welding:** Introduction, main features and applications of Ultrasonic welding, Friction welding,FRICTION STIR WELDING ,FRICTION STIR PROCESSING and Explosive welding.

**Welding of plastics:** Difficult ies in welding of Plastics, Processes for welding of Plastics.

**Surfacing and metal spraying:** Surfacing methods such as SMAW, MIG, TIG, SAW. Thermal spraying: Introduction, Procedures, Applications, Advantages and Disadvantages.

**Under water Welding:** Introduction, methods and applications.

**UNIT 4.**

**Automation in Welding:** Introduction, Semiautomatic welding, Automatic welding, Welding mechanization, Flexible Automated. Welding, Robotic welding, Types of Welding Robots, Robot Selection Mechanics, Joint tracking system.

**Course Outcomes (COs):** At the end of the course, the student shall be able to:

CO1: To know the fundamentals of welding processes.

CO2: To study the principles of metallurgy during the welding process.

CO3: To understand the basic blueprints and welding symbols to fabricate components.

CO4: To study the basic math and measurement. Follow industry safety practice

Mapping of Paper No. MTME-201

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | S | S | S | S | S | S | M |
| CO3 | M | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |

**REFERENCE BOOKS**


1. Welding processes & technology by Dr. R.S.Parmar Khanna Publishers
2. Welding Engineering & Technology by Dr. R.S.Parmar Khanna Publishers
3. Modern Arc Welding Technology by S.V. Nandkarni Oxford & IDH publishing Co. Principles of Welding Technology by L.M. Gourd ELBS/ Edward Arnold
4. The Physics of welding by Lancaster; Pergaman Press.
5. The Metallurgy of welding by Lancster; George Allen & Unwin Ltd. U.K. Welding handbook, Vol. 1 & 2, seventh edition; American welding society. Metal Handbook, Vol 6, 73; ASME
6. Procedure Handbook of ARC welding; Lincoln Electric Co. USA.
7. The Solid phase welding of metals by Tylecote; Edward Arnold Pvt. Ltd. Welding & Welding Technology Richard L. Little, McGraw Hill. Welding Technology by Rossi; McGraw Hill.
8. Welding Technology by Koenigsberger and Adaer; Macmillan.

## MTME202- TOTAL QUALITY MANAGEMENT

| L | T | P | CREDIT | SESSIONAL:50 Marks |
|---|---|---|---|---|
| 4 | 0 | 0 | 4 | THEORY :100Marks |
| | | | | TOTAL :150 Marks DURATION OFEXAM.:3Hrs. |

***Objectives of the course:***

a. Quality issues are of increasing importance in an increasing number of business sectors.
b. The development of TQM started in the products industry (i.e cars), it then spread to the private service sectors.
c. Improved quality in products and services is necessary to compete for the customers in a globalized market.
d. It is also a venue to better profitability for most industries and service companies.

**UNIT1.**

**1. TQM Perspective and TQM Implementation:**

Quality, Chain Reaction, Dimensions of Quality, Evolution Of Quality, Quality Control, Quality Assurance, Quality Planning, Quality Improvement, Quality Management, Total Quality Management, Cost Of Quality, Classification of Failure Cost, Reducing Costs, Juran's Model Of Optimum Quality Costs, Analysis of COQ For Improvement, Analysis Of External Nd Internal Failure Costs, TQM, Elements Of TQM, Leadership For TQM, Demings 14 Points For Top Management, TQM Tools And Techniques, PDSA, Barriers For TQM Implementation

**UNIT 2**.

**2. TQM principles and Strategies:**

Customer Satisfaction & Employee Involvement.Service Quality, Features Of Services, The Kano Model, Employee Motivation, Motivation Theory Of Individual Employees, Effective Communications, Training And Mentoring, Recognition And Reward.

Continuous Process Improvement and Process Approach.Juran's Triology, Kaizan, PDCA, Seven Quality Tools, BPR, Seven Deadly Wastes, ETX Model, Lean Manufacturing, Kanban System, Cellular Manufacturing, Single Piece Flow, Zero Defects

**UNIT 3.**

**3. Statistical Process Control & TQM Tools**

The Seven Quality Control Tools, Standard Normal Distribution, AQL, Seven Management Tools, Benchmarking, QFD, Taguchi's Design, TPM,FMEA

**Unit 4**.

**4. Quality Systems** ISO9000 standard, EMS14001, Quality Awards

**5.** Supplier Partnership and Performance Measures-Importance Of Suppliers, Selection And Standards, Quality

Audit,Product Audit, Vendor Rating System, PDCA For Measurements, Performance Measure Design, BSC

**Course Outcomes (COs):** At the end of the course, the student shall be able :

CO1: To not only participate in all kind of TQM activates in their own company or institution,
CO2: To understand the TQM development in selected areas.
CO3: The course draws heavily on practical cases and the professors own industrial
CO4: To analyse the theories taught.

Mapping of Paper No. MTME-202

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | S | S | S | S | S | S | S | S |
| CO2 | S | S | S | S | S | S | S | M | S | S | S | S | M | S | S |
| CO3 | S | S | M | S | S | S | S | S | S | S | S | S | S | S | S |
| CO4 | M | S | S | S | S | S | S | S | S | S | M | S | S | S | S |

**REFERENCE BOOKS:**


1. "Total Quality Management" by Oakland (Butterworth - Heinamann Ltd.)
2. "Managing for total quality from Deming to Taguchi and SPC" by Logothetis N. (PHI)
3. "Total Quality Control" by Feigenbaum A.V. (MGH)
4. "Total Quality Management" by Besterfield Dale H (Pearson Education)
5. "A slice by slice guide to TQM" by John Gilbert (Affiliated East West Press).
6. "The TQM toolkit - a guide to practical techniques for TQM" by Waller Jenny, Allen Derek and Burna Andrew (Kogan Page)

## MTME204- MECHATRONICS LAB

| L | T | P | CREDIT |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**SESSIONAL:50 Marks**
**Practical :50Marks**
**TOTAL :100 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

a. Have a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and of the newest technologies.
b. Be able to design, analyze, and test "intelligent".
c. processes that incorporate appropriate computing tools, sensors, and actuators

**LIST OF EXPERIMENTS:**

1. Study of sensor & Transducers.
2. Study of operational Amplifier
3. Study of Pneumatic & Hydraulic System
4. Study of Mechanical System
5. Study of Computer & Microprocessor equipments
6. Study of Programmable controller

**COURSE OUTCOME:**

CO1: To understand the Function effectively as members of multidisciplinary teams.

CO2: To communicate technical matters effectively in oral, written, and graphical form Identify and evaluate ethical ramifications and professional responsibilities in a variety of situations.

CO3: To Discuss the impact of engineering on society, safety, and environment in relation to contemporary issue

CO4: Use the techniques, skills, and modern mechatronics engineering tools necessary for engineering practice.

Mapping of Paper No. MTME-204

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | M | S | S | S | S | S | S |
| CO2 | S | S | M | S | S | S | S | S | S | S | S | S | S | S | M |
| CO3 | S | S | S | S | S | S | M | S | S | S | W | S | M | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |

**MTME205- ADVANCED WELDING LAB**

| L | T | P | CREDIT | SESSIONAL:50 Marks |
|---|---|---|---|---|
| 0 | 0 | 4 | 2 | Practical :50 Marks |

TOTAL :100 Marks DURATION OF EXAM. :3 Hrs.

***Objectives of the course:***

a. To impart knowledge on various advanced welding processes so that the students can apply them in engineering industry applications.
b. To develop the knowledge on the design of welded joints and the quality control of weldments.

## LIST OF EXPERIMENTS IN WELDING

1. To study Heat flow in Welding (Equipment for use-Gas Weldingequipment)

2.To study tensile property, Bead Geometry, Hardness of Bead, Micro structure of welding Bead in caseof:

i) MIG Welding ii) TIG Welding
iii) SAW Welding iv)Arc welding

3 To study mechanical behaviour( tensile strength Hardness of Bead, Micro structure of welding Bead ,impact strength ,corrosion and wear,fatigue behaviour )in case of.

1. Friction stir welding
2. Friction stir processing

**Course outcomes(COs)**

CO1 Apply the knowledge of solid state welding process for engineering applications
CO2 Understand the principles of radiant energy metal joining process.
CO3 Understand the fundamental principles of special arc welding process
CO4 Understand the knowledge of plasma arc in metal joining and cutting process
CO5 Understand the knowledge of design principles in weld joints. Apply the concept of quality control and testing of weldments in industrial environment

Mapping of Paper No. MTME-205

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | S | S | S | S | S | S | M |
| CO3 | M | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO5 | S | S | S | S | S | M | S | S | M | S | S | S | S | S | S |

## MTME206A-MODELLING & SIMULATION

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100 Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

- Learn to develop mathematical models of phenomena involved in various chemical engineering processes and solutions for these models.

### UNIT-I

Concept of system, system environment, elements of system, system modeling, types of models, Monte Carlo method. System simulation- a management laboratory, advantages & limitations of system simulation, continuous & discrete systems.

### UNIT-II

**Simulation of Continuous systems:** Characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formation.

**Simulation of discrete systems:** Time flow mechanisms, discrete and continuous probability density functions, Generation of random numbers, testing for randomness and for auto correlation, generation of random veriates for discrete distribution.

### UNIT-III

**Simulation of Queuing system:** Concept of queuing theory, characteristics of queues, stationary & time dependent queues, Queue discipline, time series analysis, measure of system performance, kendal's notation, simulation of single sever queues multi-server queues.

**Simulation of inventory systems:** Rudiments of inventory theory, MRP, in process inventory, necessity of simulation I inventory problems, forecasting & regression analysis, forecasting through simulation.

### UNIT-IV

**Design of simulation experiments:** Length of run, elimination of initial bias, variance reduction techniques, stratified sampling, antipathetic sampling, common random numbers.

**Simulation languages:** Continuous & discrete simulation languages, block structure, continuous languages, special purpose simulation languages, SIMSCRIPT, GPSS, SIMULA, importance & limitation of special purpose languages.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To Understand the important physical phenomena from the problem statement
CO2: To Develop model equations for the given system,
CO3: To Demonstrate the model solving ability for various processes/unit operations
CO4: To Demonstrate the ability to use a process simulation.

Mapping of Paper No. MTME-206-A

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | W | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | S | S | S | S | S | S | S | M | S | S |
| CO3 | S | S | M | S | S | S | S | W | S | S | M | S | S | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |

**Text Books:**

1. System simulation by Gordon
2. System simulation by Hira

## MTME206B- JIGS AND FIXTURES

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100 Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

- This subject enables the student to learn and apply the design of different tools.
- To understand the basic principles in designing general jigs and fixtures, as well as molds and dies;

### UNIT -I

Degree of freedom & Restrain, Location methods, Design of guide pins & dowel pins, Location of irregular geometrical product, Calculation of forces & Torque exerted by machining methods.

### UNIT -II

Purpose types and functions of jigs and fixtures, Tool design objectives - Production devices-Inspection devices-Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis.

### UNIT -III

Jigs, Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, Turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of jigs for given components.

### UNIT -IV

Fixtures for machining and inspection, General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and Shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1:To study the basic principles in designing general jigs and fixtures, as well as molds and dies;
CO2:To understand the assess the performance of a given tool design for meeting the specific design criteria.
CO3:To evaluate the effects of a given tool design on work quality
CO4: To design the jig and fixture

Mapping of Paper No. MTME-206-B

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | S | S | S | S | M | S | S | S | S | S | S | S |
| CO2 | S | S | S | S | S | S | S | S | S | S | W | S | S | S | S |
| CO3 | S | S | S | M | S | S | S | S | S | S | S | S | M | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |

**Reference Books:**


1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society, 1978
2. Joshi, P.H., “Jigs & Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, 5004
3. Hiram E Grant, “Jigs and Fixture”, Tata McGraw-Hill, 5003
4. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983
5. PSG College of Technology, Coimbatore – Design DataHandbook

## MTME206C- TOOL AND DIE DESIGN

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100 Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

- This subject enables the student to learn and apply the design of different tools, both technical and economical aspects, with reference to various production equipment and components.

### UNIT -I

Tools Materials and their heat treatment, Mechanism and geometry of chip formation, effect of large and small shear angles on chip thickness and length of shear planes study of cutting forces, friction forces, mean shear strength coefficient of for cutting, method of calculating the metal remove rate. Influence of rake angle side cutting edge & nose radius on cutting forces. Relationship between temperature and hardness of cutting tool materials, Tool geometry of single point and Multipoint Cutting Tool

### UNIT - II

Press working terminologies and elements of dies and strip lay out, Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers– knockouts-stops – pilots-Selection of standard die sets strip lay out-strip lay out calculations.

### UNIT -III

Design and development of dies, Design and development of progressive and compound dies for Blanking and piercing, operations. Bending dies – development of bending dies- forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion,casting and plastic dies

### UNIT- IV

Plastic as a tooling material, commonly used plastic for tooling material, application of epoxy plastic tools, Construction methods of plastic tooling, Metal forming operation with Urethane dies. Calculating forces for Urethane pressure pads.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: To understand the basic principles in designing general jigs and fixtures, as well as molds and dies.
CO2: To Study the assess the performance of a given tool design for meeting the specific design criteria.
CO3: To analysis the effects of a given tool design on work quality.
CO4: To design the dies.

Mapping of Paper No. MTME-206-C

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | S | S | S | S | S | S |
| CO2 | S | S | S | S | S | W | S | S | S | S | S | S | S | S | S |
| CO3 | S | S | S | S | M | S | S | S | S | S | S | S | M | S | S |
| CO4 | S | S | S | S | S | S | S | S | M | S | S | S | S | S | S |

**Reference Books:**


1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society, 1978
2. Joshi, P.H., “Jigs & Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, 5004
3. Hiram E Grant, “Jigs and Fixture”, Tata McGraw-Hill, 5003
4. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983

# Indira Gandhi University Meerpur Rewari

**(A State University established under Haryana Act No.29 of 2013)**

**Examination Scheme & Syllabus for M.Tech (Mechanical Engineering)**
**Semester- III & IV**

**OUTCOME BASED EDUCATION SYSTEM / LEARNING OUTCOME CURRICULUM FRAMEWORK OBES / LOCF,**

**CBCS CURRICULUM (w.e.f. 2019-20)**

## VISION AND MISSION OF THE DEPARTMENT

### VISION

To make contribution in the development of nation and evolution of technology by creating highly ethical professionals in Mechanical Engineering who are technically competent and are aware of their social responsibilities

### MISSION

- To produce highly qualified, socially responsible, ethical and motivated students having sound theoretical and practical knowledge of Mechanical Engineering as well as communicative skills who can serve the nation as well as at global level.
- To inspire students to be a part of research and development activities.
- To encourage students to participate in conferences, workshops, seminars and research activities

**Scheme Of Studies And Examination M.Tech 2nd Year (Mechanical Engineering) w.e.f. 2019-20**

**Semester III**

| Sl. No | Course No. | Subject | Teaching Schedule | | | | Examination Schedule (Marks) | | | | Duration of Exam (Hours) | No of hours/ Week |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total credits | Marks of Class works | Theory | Practical | Total | | |
| 1 | MTME231 | Tribology & Maintenance Engineering | 4 | 0 | - | 4 | 50 | 100 | - | 150 | **3** | **4** |
| 2 | MTME232 | Robotics and Automation | 4 | 0 | - | 4 | 50 | 100 | - | 150 | **3** | **4** |
| 3 | MTME233 | Major Project (Dissertation Stage 1) | - | - | 4 | 4 | 100 | - | - | 100 | | **4** |
| 4 | MTME234 | Tribology & Maintenance Engineering Lab | - | - | 2 | 2 | 50 | - | 50 | 100 | | **2** |
| 5 | | Open Elective | | | | 3 | | | | | | |
| 6 | MTME235 | Self Study Paper | | | | 1 | | | | 25 | | |
| | | **TOTAL** | **20** | | | | | | | | | |

**NOTE:** Examiner will set nine questions in total. Question One will be compulsory and will comprise of all sections and remaining eight questions to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

**OPEN ELECTIVE**

A candidate has to select this paper from the pool of open electives provided by the University.

**Scheme Of Studies And Examination M.Tech 2nd Year (Mechanical Engineering) w.e.f. 2019-20**

**Semester IV**

| Sl. No | Course No. | Subject | Teaching Schedule | | | | Examination Schedule (Marks) | | | | No of Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | Marks of Class works | Theory | Practical | Total | |
| 1. | MTME241 | Major Project (Dissertation Stage 2) | - | - | - | - | 250 | - | 500 | 750 | **20** |
| | | **TOTAL** | **- -** | - | | **-** | **250** | **-** | **500** | **0** | |

**NOTE:**

1. Students have to publish a research paper in a UGC-CARE journal/International Confernce of the research work done in the semester.
2. Students will have to submit a soft copy of their thesis with the hard copies.
3. Students have to submit a plagiarism report with the thesis report obtained from Turnitin software. This software is available in IGU Library. Upto 25% of similarity of matter is permitted.

## MTME231 TRIBOLOGY & MAINTENANCE ENGINEERING

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100 Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

- To learn the properties of fiber-reinforced polymer composites
- To learn the mechanical performance of laminated composites, including failure behavior.
- To model, simulate and optimize the performance of composite structures.

### UNIT-1

Engineering Tribology Tribological system, Tribology in industries, friction and wear, lubricants and lubrication, fundamental of bearings, nano Tribology ,Introduction part of friction, theories of friction, adhesion theory of friction and its drawbacks, stick-slip theory of friction, friction measurement methods.

### UNIT-2

Wear, lubricants and bearings Cause, effect, classification and mechanism of wear, quantitative laws of wear, wear and wear rate, objective and properties of lubricants, synthetic lubricants, reasons of degradation of lubricating oils ,lubricant additives, boundary lubrication, hydrodynamic lubrication, mechanism of elasto hydrodynamic lubrication, classification of bearings, hydrostatic bearings, hydrodynamic bearings.

### UNIT-3

Maintenance Management Relevance of maintenance, maintenance: an over view, maintenance services, problems of the plant manager, automation and maintenance, maintenance objectives and costs, quality and quality circle in maintenance, Engineering reliability, maintainability Maintenance Types/systems Planned and unplanned maintenance, breakdown, corrective, opportunistic, routine, preventive, predictive, CBM, Design out maintenance .

### UNIT -4

Condition monitoring NDT concepts, visual and temperature monitoring, leakage monitoring, vibration monitoring, lubricant monitoring-methods, equipments, ferrography, spectroscopy, cracks monitoring, thickness monitoring, corrosion monitoring.

**Course Outcomes (COs):** At the end of the course, the student shall be able:

CO1: Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.
CO2: Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.
CO3: Analyse the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composites.
CO4: Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project.

Mapping of Paper No. MTME-231

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | S | S | S | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | M | S | S | S | S | S | S |
| CO3 | S | S | M | S | S | S | S | S | S | S | W | S | S | S | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | M | S | S |

**Books:**


1. Engineering Tribology by Choudhary
2. Maintenance planning and control- Kelly, A. Buttersworth & Co. 1984
3. Maintenance and spare parts Management – Krishanan G, Prentice Hall – 1991

## MTME234 TRIBOLOGY & MAINTENANCE ENGINEERING LAB

| T | P | CREDIT | SESSIONAL:50 Marks |
|---|---|---|---|
| 0 | 3 | 1.5 | THEORY :100 Marks |
| | | | TOTAL :100 Marks |
| | | | DURATION OF EXAM. :3 Hrs. |

***Objectives of the course:***

- The objective of the course is to impart knowledge of maintenance audit of plants and machineries to students in order to help industries solve associated expenses and improvement

**List of Experiments.**

1. To study the introduction to maintenance techniques. preventive and predictive Maintenance
2. To study and perform Non-Destructive Testing techniques , liquid dye penetrant and leak testing.
3. To study and perform Eddy current testing & Ultrasonic testing .
4. To study and perform Magnetic particle detection and Particle counter.
5. To study wear Analysis through thermography and Ferrography.
6. To study and perform Pin on wear disc apparatus.
7. To study wear, lubricants and bearings
8. To study and perform on Journal bearing apparatus, hydro dynamic and hydrostatic bearing apparatus.

**Course Outcomes (COs):** At the end of the course, the student will:

CO1: Be able to know the computational models to the field maintenance engineering and tribology.
CO2: Be able to know the lubrication models using MATLAB.
CO3: Be able to know the computational modelling of different Wears.
CO4: Be able to understand simulation of failure analysis.
CO5: Be able to learn computer simulation for different case studies related to maintenance engineering and tribology.

Mapping of Paper No. MTME-234

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | S | S | S | M | S | S | S |
| CO3 | M | S | S | S | S | S | S | M | S | S | S | S | S | M | S |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |
| CO5 | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S |

## MTME232 ROBOTICS AND AUTOMATION

| L | T | P | CREDIT |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**SESSIONAL:50 Marks**
**THEORY :100 Marks**
**TOTAL :150 Marks**
**DURATION OF EXAM. :3 Hrs.**

***Objectives of the course:***

- To create machines which can perform specific complex tasks, often at least semi-autonomously.
- To develop the student's knowledge in various robot structures and their workspace.
- To develop student's skills in performing spatial transformations associated with rigid body motions.
- To develop student's skills in perform kinematics analysis of robot systems.

**UNIT-1**

Introduction to Robot Technology: Robot Physical configuration, basic Robot motions. Types of Manipulators: Constructional features, advantages and disadvantages of various kinematic structures, servo and Non- servo manipulator. Actuators and Transmission System: Pneumatic, Hydraulic and Electrical actuators and their characteristics and Control systems. Feed Back Systems and Sensors: Encoders and other feed back systems, vision, ranging systems, textile sensors.

**UNIT-2**

Programming Languages: Description of VAN, RAII and other Languages. Artificial Intelligence: Logged Locomotion, Export system. Concept of spatial description and transformations, manipulator Kinematics; Inverse manipulator, Kinematics Jacobians; velocities and static forces; manipulator dynamics, position control of manipulators, force control of manipulators, robot programming languages and systems. Concept of automation in Industry, mechanization and automation classification of automation systems.

**UNIT-3**

Air Cylinders- their design and mountings, pneumatic and hydraulic valves, flow control valves metering valves, direction control valves, hydraulic servo systems, pneumatic safety and remote control circuits.

**UNIT-4**

Basis of Automated work piece handling: Working principles and techniques, job orienting and feeding devices. Transfer mechanisms automated feed out of components, performance analysis.
Assembly automation, automatic packaging and automatic Inspection.

**Course Outcomes (COs):** At the end of the course, the student will:

CO1: Demonstrate an ability to solve inverse kinematics of simple robot manipulators.
CO2: Demonstrate an ability to generate joint trajectory for motion planning.
CO3: Demonstrate an ability to solve inverse kinematics of simple robot manipulators.
CO4: Demonstrate an ability to obtain the Jacobian matrix and use it to identify singularities.

Mapping of Paper No. MTME-232

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | S | S | S | S | S | S | M | S | S | S | S | S |
| CO2 | S | S | S | S | S | M | S | S | S | S | S | M | S | S | S |
| CO3 | M | S | S | S | S | S | S | S | S | S | S | S | S | S | M |
| CO4 | S | S | S | S | M | S | S | S | S | S | S | S | S | S | S |

**Books:**


1. CAD/CAM by Groover and Elimmers (Jr.) CAD/CAM Handbook, Bed ford Masschusettes. Automation Production Systems & Computer Aided Manufacturing. Robotics for Engineers by Royen MIT Press.
2. Robot Manipulators by Paul MIT Press. Robotics by Hall & Hall.
3. Robot Motion by Brady MIT Press.
4. Numerical Controlled Computer Aided manufacturing by Press man and Elimmers, John Wiley & sons. New York.

## MTME205- MAJOR PROJECT
### (DISSERTATION STAGE-1)

| L | T | P | CREDIT | SESSIONAL:100 Marks |
|---|---|---|---|---|
| 0 | 0 | 4 | 4 | |

A candidate has to prepare a report covering identification of research topic, literature review, planning of research scheme and systematic documentation. The marks will be given on the basis of a report prepared and presentation given by the candidate covering the above said contents, contents of the presentation, communication and presentation skills.