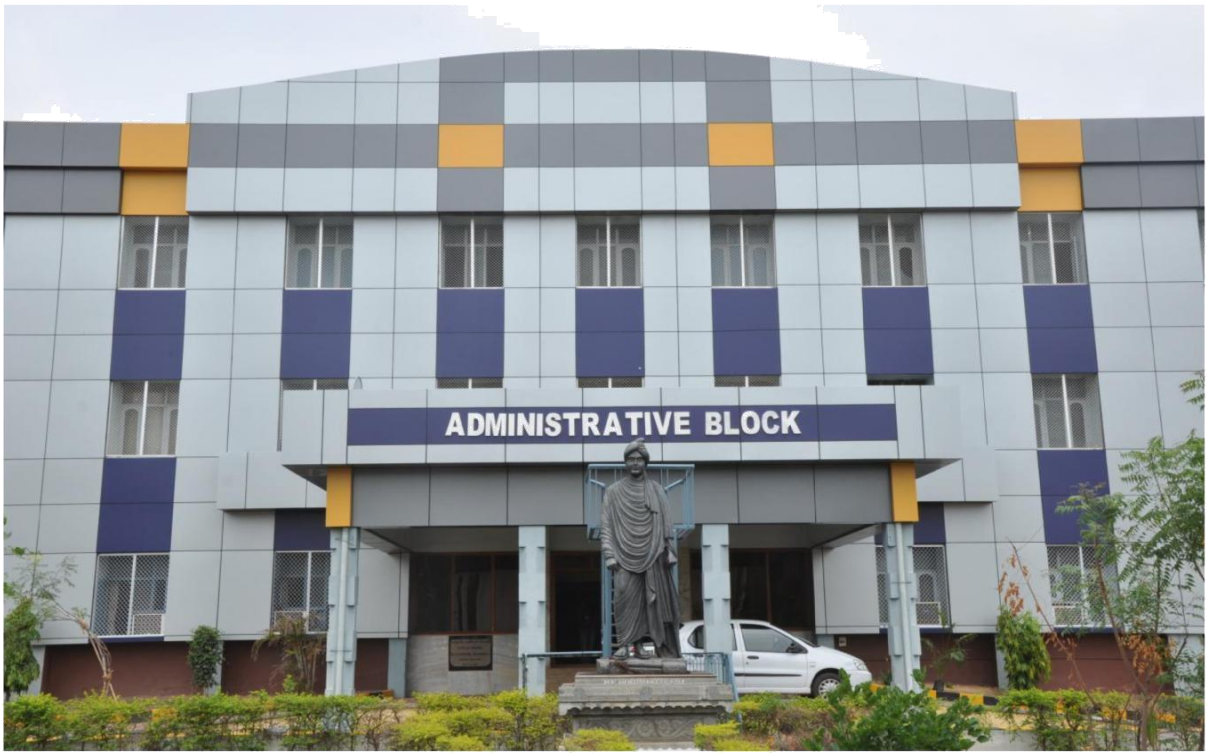


# Scheme – 2023

## Department of Mechanical Engineering

### G. Pulla Reddy Engineering College (Autonomous): Kurnool

## Accredited by NBA of AICTE and NAAC of UGC

## Affiliated to JNTUA, Anantapuramu

# SCHEME AND SYLLABUS
# for
# II Year B.Tech. Degree Course
# in
# MECHANICAL ENGINEERING

**(Effective from the students admitted from the academic year 2023-24 onwards)**

# G. PULLA REDDY ENGINEERING COLLEGE (Autonomous): KURNOOL

## MECHANICAL ENGINEERING
## FOUR YEAR B.TECH. DEGREE COURSE
**(Effective for the students admitted from the academic year 2023-2024 onwards)**

## SCHEME OF INSTRUCTION AND EXAMINATION

**III Semester** **Scheme 2023**

| S. No. | Category | Title | L/D | T | P | Credits | CIA | End Exam Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BS & H | Numerical Methods, Probability and Statistics | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 2 | BS & H | Universal Human Values | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 3 | ES | Thermodynamics | 2 | 0 | 0 | 2 | 30 | 70 | 100 |
| 4 | PC | Mechanics of Solids | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 5 | PC | Material Science and Metallurgy | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6 | PC | Mechanics of Solids and Materials Science Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC | Computer-Aided Machine Drawing | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | ES | Design Thinking & Innovation | 1 | 0 | 2 | 2 | 30 | 70 | 100 |
| 9 | SEC | Python programming | 0 | 1 | 2 | 2 | 30 | 70 | 100 |
| | | **Total** | **12** | **4** | **10** | **21** | | | |

**IV Semester** **Scheme 2023**

| S. No. | Category | Title | L/D | T | P | Credits | CIA | End Exam Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BS & H | Production Economics and Financial Management | 2 | 0 | 0 | 2 | 30 | 70 | 100 |
| 2 | PC | Thermal Engineering | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 3 | PC | Manufacturing processes | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4 | PC | Fluid Mechanics & Hydraulic Machines | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 5 | PC | Theory of Machines | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| 6 | PC | Fluid Mechanics & Hydraulic Machines Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 7 | PC | Manufacturing processes Lab | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| 8 | SEC | Soft Skills | 0 | 1 | 2 | 2 | 30 | 70 | 100 |
| 9 | ES | Embedded Systems and IoT | 0 | 0 | 2 | 1 | 30 | 70 | 100 |
| 10. | AC | Environmental Science | 2 | 0 | 0 | 0 | - | - | - |
| | | **Total** | **13** | **4** | **10** | **20** | | | |
| Mandatory Community Service Project Internship of 08 weeks duration during Summer Vacation | | | | | | | | | |

**Category:**

L/D : Lecture/Design/Drawing T/P : Tutorial / Practical CIA : Continuous Internal Assessment

BS&H : Basic Sciences & Humanities ES : Engineering Sciences PC : Professional Core

SEC : Skill Enhancement Course AC : Audit Course

## NUMERICAL METHODS, PROBABILITY AND STATISTICS (NMPS)

| **III Semester: Mechanical Engineering** | | | | | | **Scheme: 2023** | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **BS206** | **BS&H** | **2** | **1** | **0** | **3** | **30** | **70** | **100** |
| **Sessional Exam Duration: 2 Hrs** | | | | | | **End Exam Duration: 3 Hrs** | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Utilize numerical methods and interpolation |
| **CO2:** | Solve ordinary differential equations by numerical methods |
| **CO3:** | Identify discrete and continuous probability distributions |
| **CO4:** | Apply the test of hypothesis for large samples. |
| **CO5:** | Analyze the test of hypothesis for small samples. |

### UNIT – I

**Solution of Algebraic & Transcendental Equations:** Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method.

**Interpolation:** Finite differences, Operators, relation between the operators; Newton's forward and backward interpolation formulae and Lagrange's interpolation formula.

### UNIT – II

**Numerical Integration:** Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

**Numerical solution of Ordinary Differential equations:** Solution by Taylor's series-Picard's Method of successive Approximations- Euler's and Modified Euler's Methods – Runge – Kutta methods of second and forth order.

### UNIT – III

**Random variables & Probability Distributions:** Random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

Probability distributions - Binomial, Poisson approximation to the Binomial distribution and Normal distribution.

### UNIT – IV

**Test of Hypothesis for large samples:** Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, types of errors. Test for single proportion, difference of proportions, Test for single mean and difference of means.

### UNIT – V

**Test of significance for small samples:** Student t-test – test for single mean, difference of means and paired t-test, Testing of equality of variances (F – test), Chi-square ($\chi^2$) - test for goodness of fit, Chi-square ($\chi^2$)- test for independence of attributes.

**Text Books:**


**1.** B.S.Grewal [2012], Higher Engineering Mathematics, Khanna Publishers, New Delhi

**2.** K.V Iyengar and others [2013], Engineering Mathematics Vol-3, S.Chand & Co. New Delhi

| **Reference Books:** |
|---|
| **1.** S.C.Gupta & V.K.Kapoor [1987], Elements of Mathematical Statistics, S.Chand Publishers, New Delhi.. |
| **2.** N.P.Bali and others [2009], A Text book of Engineering Mathematics, Laxmi Publishers, New Delhi. |
| **Online Resources:** |
| **1.** https://onlinecourses.nptel.ac.in/noc24_ma54/preview |
| **2.** https://onlinecourses.nptel.ac.in/noc24_ma05/preview |
| **3.** https://nptel.ac.in/courses/111105090 |
| **Question Paper Pattern:** |
| **Sessional Exam:**<br>The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.<br>**End Examination:**<br>The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions. |

## UNIVERSAL HUMAN VALUES (UHV)

| **III Semester:** Common for all Branches | | | | | | **Scheme:** 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **HSM201** | **BS&H** | **2** | **1** | **0** | **3** | **30** | **70** | **100** |
| **Sessional Exam Duration:** 2 Hrs | | | | | | **End Exam Duration:** 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Define the terms like Natural Acceptance, Happiness and Prosperity |
| **CO2:** | Identify one's self, and one's surroundings (family, society nature) |
| **CO3:** | Apply what they have learnt to their own self in different day-to-day settings in real life |
| **CO4:** | Relate human values with human relationship and human society. |
| **CO5:** | Justify the need for universal human values and harmonious existence |
| **CO6:** | Develop as socially and eco logically responsible engineers |

### UNIT – I

**Introduction to Value Education (6 lectures and 3 tutorials for practice session)**

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity–the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

### UNIT – II

**Harmony in the Human Being (6 lectures and 3 tutorials for practice session)**

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

### UNIT – III

**Harmony in the Family and Society (6 lectures and 3tutorials for practice session)**

Lecture 13: Harmony in the Family–the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfill Human Goal

| UNIT – IV |
|---|
| **Harmony in the Nature/Existence (4lectures and 2 tutorials for practice session)**<br>Lecture 19: Understanding Harmony in the Nature<br>Lecture 20: Inter connectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature<br>Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature<br>Lecture 21: Realizing Existence as Co-existence at All Levels<br>Lecture 22: The Holistic Perception of Harmony in Existence<br>Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence |
| **UNIT – V** |
| **Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)**<br>Lecture 23: Natural Acceptance of Human Values<br>Lecture 24: Definitiveness of (Ethical) Human Conduct<br>Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct<br>Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order<br>Lecture 26: Competence in Professional Ethics<br>Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education<br>Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies<br>Lecture 28: Strategies for Transition towards Value-based Life and Profession<br>Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order |
| **Text Books:** |
| **1.** R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 |
| **2.** R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 |
| **Reference Books:** |
| **1.** Jeevan Vidya: Ek Parichaya, ANagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. |
| **2.** Human Values, A.N.Tripathi, New Age Intl. Publishers, NewDelhi,2004. |
| **3.** The Story of Stuff (Book). |
| **4.** The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi |
| **Online Resources:** |
| **1.** https://fdp-si.aicte-india.org/UHV II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf |
| **2.** https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf |
| **3.** https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf |
| **4.** https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf |
| **5.** https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf |

**Question Paper Pattern:**

**Sessional Exam:**

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

**End Examination:**

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

## THERMODYNAMICS (TD)

| III Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| ME201 | ES | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| | | 2 | 0 | 0 | 2 | 30 | 70 | 100 |
| Sessional Exam Duration: 2 Hrs | | | | | | End Exam Duration: 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Understand the importance of thermodynamic properties related to conversion of Heat energy into work. |
| CO2: | Apply the Zeroth and First Law of Thermodynamics. |
| CO3: | Apply Second Law of Thermodynamics. |
| CO4: | Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations |
| CO5: | Evaluate the COP of refrigerating systems and properties, processes of Psychrometry and sensible and latent heat loads. |

### UNIT – I

**Introduction:** Thermodynamic System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility.

### UNIT – II

**Work and Heat Transfer:** Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – PMM-I.

**First Law of Thermodynamics:** Joule's Experiment – Applications of First law of Thermodynamics, Enthalpy, Limitations of the First Law.

### UNIT – III

**Second Law of Thermodynamics:** Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance. Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality.

**Entropy and Availability:** Principle of Entropy, Increase – Energy Equation, Availability and Irreversibility –Gibbs and Helmholtz Functions, Maxwell Relations.

### UNIT – IV

**Properties of Pure Substances:** P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

### UNIT – V

**Refrigeration:** Introduction, Vapour compression refrigeration system, Functions of components, Simple vapour absorption system, COP - Introduction to Refrigerants, Properties.

**Psychrometry:** Properties of atmospheric air, Psychometric chart, Psychometric processes, Simple problems, Simple air flow diagram for an Air-Conditioning system.

| **Text Books:** |
|---|
| **1.** P. K. Nag, Engineering Thermodynamics, 5th Edition, Tata Mc.Graw Hill, 2013. |
| **2.** Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7th Edition, Wiley, 2009. |
| **Reference Books:** |
| **1.** J.B.Jones, and R.E.Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, 1995. |
| **2.** Y.A.Cenge l& M.A.Boles, Thermodynamics–An Engineering Approach,7/e, McGraw Hill, 2010 |
| **3.** P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011 |
| **4.** CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021. |
| **Data Hand Book:** |
| **1.** Sreenivasa Reddy, B. and Hemachandra Reddy, K, Thermal Data Handbook, IK International Publishers, Bangalore |
| **Online Resources:** |
| **1.** https://www.edx.org/learn/thermodynamics. |
| **2.** https://archive.nptel.ac.in/courses/112/106/112106310. |
| **3.** https://www.youtube.com/watch?v=7NI5P4KqrAs&t=1s |
| **4.** https://kp.kiit.ac.in/pdf_files/02/Study-Material_3rd-Semester_Winter_2021_Mechanical-Engg.-_Thermal-Engineering-1_Abhijit-Samant.pdf |
| **5.** https://www.coursera.org/learn/thermodynamics-intro |
| **Question Paper Pattern:** |
| **Sessional Exam:**<br>The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.<br>**End Examination:**<br>The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions. |

# MECHANICS OF SOLIDS (MOS)

| **III Semester:** Mechanical Engineering | | | | | | **Scheme:** 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| **ME202** | **PC** | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| | | **2** | **1** | **0** | **3** | **30** | **70** | **100** |
| **Sessional Exam Duration:** 2 Hrs | | | | | | **End Exam Duration:** 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Compute the stresses and strains of axially loaded members and elastic constants. |
| **CO2:** | Construct shear force and bending moment diagrams for simply supported beam, cantilever beam and overhanging beam under point load, uniformly distributed and uniformly varying load. |
| **CO3:** | Calculate the bending stress and shear stresses in a beam. |
| **CO4:** | Calculate deflection for simply supported beam, cantilever beam and overhanging beam under point load, Uniformly distributed and uniformly varying loads using Macaulay's method and double integration method and Compute the shear stress and twist of a shaft under torsional loading. |
| **CO5:** | Determine stresses in thin cylinders, thick cylinders, compound cylinders, buckling load for a column. |

## UNIT – I

**SIMPLE STRESSES & STRAINS :** Elasticity and plasticity – Types of stresses & strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uni axial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

## UNIT – II

**SHEAR FORCE AND BENDING MOMENT:** Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads– Point of contra flexure– Relation between S.F., B.M and rate of loading at a section of a beam.

## UNIT – III

**FLEXURAL STRESSES:** Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections– Design of simple beam sections.

**SHEAR STRESSES:** Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I and T sections.

## UNIT – IV

**DEFLECTION OF BEAMS**: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, UDL and UVL.

**TORSION:** Introduction – Derivation - Torsion of Circular shafts - Pure Shear - Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

## UNIT – V

**THIN AND THICK CYLINDERS:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

**COLUMNS:** Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula

**Text Books:**


1. S.S. Bhavikatti , Strength of materials, Third Edition, Vikas Publishing House Pvt. Ltd., New Delhi
2. B.C. Punmia, Ashok. K. Jain and Arun. K. Jain, Mechanics of Materials, Lakshmi Publishers, New Delhi
3. S.S. Rattan, Strength of materials, Tata Mc Graw Hill Publishing Company Ltd., New Delhi
4. G H Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.
5. R.K. Banasal, A Text book of Strength of materials, Laxmi Publications, Chennai, 2018


**Reference Books:**


**1**. U.C. Jindal, Strength of Materials, Pearson Education, 2017.

**2.** Gere & Timoshenko, Mechanics of materials, CBS publications, 2004.

**3.** Timoshenko, Strength of Materials Part–I & II, CBS Publishers, 2004.

**4.** Andrew Pyteland Ferdinand L. Singer, Strength of Materials, Longman Publications, 1990.

**5.** Popov, Mechanics of Solids, New Pearson Education, 2015.


**Online Resources:**

**1.** https://onlinecourses.nptel.ac.in/noc19_ce18/preview.

**2.** https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6

**3.** https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s

**4.** https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204

**5.** https://www.coursera.org/learn/mechanics-1

**6.** https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior

**7.** https://archive.nptel.ac.in/courses/112/107/112107146/

**Question Paper Pattern:**

**Sessional Exam:**

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

**End Examination:**

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

## MATERIAL SCIENCE AND METALLURGY (MSM)

| **III Semester:** Mechanical Engineering | | | | | | **Scheme:** 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **ME203** | **PC** | **3** | **0** | **0** | **3** | **30** | **70** | **100** |
| **Sessional Exam Duration:** 2 Hrs | | | | | | **End Exam Duration:** 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Understand concepts of crystal structures, characteristics of crystal structures, Crystallographic Directions, Miller Indices for Planes and crystal imperfections of Materials. |
| **CO2:** | Demonstrate the deformation processes of metals and the concept of pure metal, alloys and solid solutions. |
| **CO3:** | Interpreting the phase diagrams, those are important to Select Alloys for Engineering Applications and Understand the Iron –Iron Carbide Phase Diagram and to improve Mechanical properties of materials for applications in Engineering Industries. |
| **CO4:** | Understand the general characteristics, composition, response to heat treatments and Describe the Ferrous and Non-Ferrous metals and their applications in view of Environment and Safety |
| **CO5:** | Demonstrate the concepts of composites, methods of metal Powder Production, Powder Metallurgy Processes and their Applications. |

### UNIT – I

**Structure of Metals:** Introduction to Material Science and Engineering, Classification of Materials. Crystal Structures, Space lattice, Unit cell, Seven crystal structures and Bravies lattices, Principal Metallic Crystal structures (SC,BCC,FCC,HCP) and properties (Coordination number, Effective number of atoms, Atomic packing factor) Crystallographic directions in cubic unit cells, Miller indices for Crystallographic planes in cubic cells, Planar atomic density, Linear atomic density. Crystal Imperfections – Point imperfections (point defect), line imperfections (Dislocations) Dislocation types and surface imperfections.

### UNIT – II

**Slip and Twinning:** Classification of deformations, Elastic and plastic deformation, Mechanism of plastic deformations - Slip and Twinning, Hot working and cold working, Recovery, Re crystallization and grain growth, Creep, Stages of creep, Factors influencing creep.

**Pure metal, alloy and Solid solutions:** Notion of pure metal and alloy, types of solid solutions, Substitutional and Interstitial solid solutions, Hume Rothery's rules.

### UNIT – III

**Equilibrium Phase Diagrams:** Introduction, Interpretation of Binary equilibrium Phase diagrams. Gibbs Phase rule. Binary Isomorphous alloy system (Cu-NI Phase Diagram), Lever Rule, Binary Eutectic alloy system (Lead-Tin Phase Diagram), Binary Eutectoid, Peritectic, Peritectoid systems, Binary monotectic system, Simple problems on Binary phase diagrams.

**Iron Carbon Equilibrium Diagram:** Cooling curve of pure iron, construction and interpretation of Fe-Fe3C diagram, Effect of alloying elements on Fe-Fe3C diagram.

### UNIT – IV

**Heat Treatment of Steels:** Purpose of heat treatment, different heat treatment processes, Annealing, Normalizing, Hardening, and Tempering, TTT diagrams, Hardenability, factors affecting hardenability, determination of hardenability. Surface hardening methods (Carburizing, Flame hardening, Induction Hardening), Cryogenic treatment.

**Ferrous metals and Alloys:** Purpose of alloying, classification of steels- Plain Carbon steels, High carbon steels - Stainless steels and its types, Tool steels (High speed steels). Properties and applications of various types of Cast irons viz Grey cast iron, White cast iron, Nodular (or)Ductile iron, Malleable iron and Spheroidal graphite cast iron.

**Non Ferrous Metals and Alloys:** Properties and applications of important non ferrous metals and alloys like Copper, Aluminum, Nickel, Titanium, Magnesium, Lead, Tin and Super alloys.

**UNIT – V**

**Composites and Advanced materials:** Definition, Classification of Composites, types of matrix materials and reinforcements, applications of Composites. Smart materials.

**Powder Metallurgy:** Introduction, Methods of producing metal powders (Milling, Atomization - stages of Powder metallurgy -Mixing, Blending, Compacting, Sintering. Other compaction methods: Cold Isostatic pressing, Hot isostatic pressing. Applications of powder metallurgy, advantages of Powder Metallurgy, examples of typical components produced by Powder Metallurgy.

**Text Books:**


**1.** William D Callister, Material science and Engineering adopted by R. Bala Subramaniam Wiley India Pvt Ltd New Delhi

**2.** William F. Smith, Foundations of Material Science and Engineering, McGraw Hill, New York

**3.** V. Raghavan, Material Science and Engineering, PHI Publishers, New Delhi


**Reference Books:**


**1.** Sidney H. Avner, Introduction to Physical Metallurgy. TMH Publications, New Delhi

**2.** Donald R. Askel Pradeep P. Fulay, Essentials of Material Science Engineering, CENGAGE Learning

**3.** Dr. V.D. Kodgire, S.V. Kodgire, Material Science and Metallurgy, Everest Publications, New Delhi

4**.** U.C.Jindal, Material Science and Metallurgy, Pearson Publications.


**Online Resources:**

**1.** https://archive.nptel.ac.in/courses/113/106/113106032/

**2.** https://www.edx.org/learn/mechanics/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-3-time-dependent-behavior.

**3.** https://www.youtube.com/watch?v=9Sf278j1GTU

**4.** https://www.coursera.org/learn/fundamentals-of-materials-science

**5.** https://www.coursera.org/learn/material-behavior.

**Sessional Exam:**

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

**End Examination:**

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

## MECHANICS OF SOLIDS & MATERIAL SCIENCE LAB (MSMS (P))

| **III Semester:** Mechanical Engineering | | | | | | **Scheme:** 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **ME204** | **PC** | **0** | **0** | **3** | **1.5** | **30** | **70** | **100** |

**End Exam Duration:** 3 Hrs

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Understand the stress strain behavior of different materials. |
| **CO2:** | Evaluate the hardness of different materials |
| **CO3:** | Explain the relation between elastic constants and hardness of materials. |
| **CO4:** | Identify various microstructures of steels and cast irons |
| **CO5:** | Evaluate hardness of heat treated steels. |

### LIST OF EXPERIMENTS

**MECHANICS OF SOLIDS LAB**

1. Tensile test
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brinell's hardness test
   b) Rock well hardness test
5. Test on springs
6. Impact test
   a) Charpy test
   b) Izod test

**MATERIAL SCIENCE LAB**

7. Preparation and study of the Microstructure of pure metals.
8. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.
9. Study of the Microstructures of Cast Irons.
10. Study of the Micro structures of Non-Ferrous alloys.
11. Study of the Microstructures of Heat treated steels
12. Harden ability of steels by Jominy End Quench Test.
13. To determine hardness of a given metal after various heat treatment process

**Virtual lab:**

1. To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)
2. To find the impact resistance of mild steel and cast iron. (https://sm-nitk.vlabs.ac.in/exp/izod-impact-test).
3. To find the impact resistance of mild steel. (https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test)

## COMPUTER AIDED MACHINE DRAWING (CAMD (P))

| **III Semester:** Mechanical Engineering | | | | | | **Scheme:** 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **ME205** | **PC** | **0** | **0** | **3** | **1.5** | **30** | **70** | **100** |

**End Exam Duration:** 3 Hrs

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Demonstrate the conventional representations of materials and machine components. |
| **CO2:** | Model riveted, couplings and key joints using CAD system. |
| **CO3:** | Create solid models and sectional views of machine components. |
| **CO4:** | Generate solid models of machine parts and assemble them. |
| **CO5:** | Translate 3D assemblies into 2D drawings. |

### LIST OF EXPERIMENTS

**The following are to be done by any 2D software package**

**Conventional representation of materials and components:**

**Detachable joints:** Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

**Riveted joints:** Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

**Welded joints:** Lap joint and T joint with fillet, butt joint with conventions.

**Keys:** Taper key, sunk taper key, round key, saddle key, feather key, wood ruffkey.

**Couplings:** rigid–Muff, flange; flexible–bushed pin-type flange coupling, universal coupling, Oldham's' coupling.

**The following exercises are to be done by any 3D software package**

**Sectional views:**
Creating solid models of complex machine parts and sectional views.

**Assembly drawings: (Any four of the following using solid model software)**

**Steam Engine parts** – Stuffing box, Cross head eccentric, carburetor, piston, connecting rod
**Machine Tool Parts** - Lathe tool post, tool head of shaping machine, tail-stock,
**Other parts -** machine vice, gate valve, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling.

**Production drawing:**
Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

| **Text books:** |
|---|
| **1.** Machine Drawing by K.L.Narayana, P. Kannaiah and K. Venkat Reddy, New Age International Publishers, 3/e, 2014 |
| **2.** Machine drawing by N.Sideshwar, P.Kannaiah, V.V.S.Sastry, TMH Publishers. 2014. |
| **3.** Machine drawing with Auto CAD, Goutham Pohit & Goutham Ghosh 1st Indian Printing Pearson Education, 2005 |
| **4.** Computer Aided Machine Drawing, by S. Trymbaka Murthy, CBS Publishers, New Delhi – 2008. |
| **5.** Machine Drawing includes AutoCAD , Ajeet Singh, TMH Publishers, 2017. |
| **Reference Books:** |
| **1.** Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000. |
| **2.** James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003. |
| **3.** N. D. Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014. |
| **Online Resources:** |
| **1.** https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf |
| **2.** https://archive.nptel.ac.in/courses/112/105/112105294/ |

## DESIGN THINKING & INNOVATION (DTI)

| **III/IV Semester: Common for all Branches** | | | | | | **Scheme: 2023** | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **ESCM01** | **ES** | **1** | **0** | **2** | **2** | **30** | **70** | **100** |

**End Exam Duration: 3 Hrs**

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Define the concepts related to Design thinking |
| **CO2:** | Explain the fundamentals of Design Thinking and innovation |
| **CO3:** | Apply the design thinking techniques for solving problems in various sectors |
| **CO4:** | Analyse to work in a multidisciplinary environment |
| **CO5:** | Formulate specific problem statements of real time issues |

### UNIT – I

**Introduction to Design Thinking:** Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

### UNIT – II

**Design Thinking Process:** Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

**Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

### UNIT – III

**Innovation:** Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.
**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

### UNIT – IV

**Product Design:** Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

**Activity:** Importance of modelling, how to set specifications, Explaining their own product design.

### UNIT – V

**Design Thinking in Business Processes:** Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

**Activity:** How to market our own product, About maintenance, Reliability and plan for startup.

| |
|---|
| **Text Books:** |
| **1.** Tim Brown, Change by design, Harper Bollins (2009) |
| **2.** Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons |
| **Reference Books:** |
| **1.** David Lee, Design Thinking in the Classroom, Ulysses press |
| **2.** Shrutin N Shetty, Design the Future, Norton Press |
| **3.** William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter. |
| **4.** Chesbrough.H, The Era of Open Innovation – 2013 |
| **Online Resources:** |
| **1.** https://nptel.ac.in/courses/110/106/110106124/ |
| **2.** https://nptel.ac.in/courses/109/104/109104109/ |
| **3.** https://swayam.gov.in/nd1_noc19_mg60/preview |

## PYTHON PROGRAMMING (PYP)

| **III/IV Semester:** Common for all Branches except CE | | | | | | **Scheme:** 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **SCCM02** | **SEC** | **0** | **1** | **2** | **2** | **30** | **70** | **100** |

**End Exam Duration:** 3 Hrs

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Apply the concepts of Python syntax, variables, data types, control structures, functions, modules and exception handling to solve given problems |
| **CO2:** | Develop programs using Python functions, strings and lists. |
| **CO3:** | Identify the applications of dictionaries, tuples and sets in python programming. |
| **CO4:** | Implement files and object oriented programming concepts. |
| **CO5:** | Implement commonly used Python libraries and frameworks such as JSON, XML, NumPy, and pandas |

### UNIT – I

**Introduction:** History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook. Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

**Control Flow Statements:** if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements,

**Exception Handling:** Catching Exceptions Using try and except Statement.

**Sample Experiments:**

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bitwise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print a multiplication table of a given number.

### UNIT – II

**Functions:** Built-in functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

**Strings:** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, and Formatting Strings.

**Lists:** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statements.

**Sample Experiments:**

7. Write a program to define a function with multiple return values.

**8.** Write a program to define a function using default arguments
**9.** Write a program to find the length of the string without using any library functions.
**10.** Write a program to check if the substring is present in a given string or not.
**11.** Write a program to perform the given operations on a list: a) Addition b). Insertion c). Slicing
**12.** Write a program to perform any 5 built-in functions by taking any list.

## UNIT – III

**Dictionaries:** Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

**Tuples and Sets:** Creating Tuples, Basic Tuple Operations, tuple () Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozen set

**Sample Experiments:**

**13.** Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples, and print the concatenated tuples.
**14.** Write a program to count the number of vowels in a string (No control flow allowed).
**15.** Write a program to check if a given key exists in a dictionary or not.
**16.** Write a program to add a new key-value pair to an existing dictionary.
**17.** Write a program to sum all the items in a given dictionary.

## UNIT – IV

**Files:** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python OS and os.path Modules.

**Object-Oriented Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

**Sample Experiments:**

**18.** Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
**19.** Python program to print each line of a file in reverse order.
**20.** Python program to compute the number of characters, words and lines in a file.
**21.** Write a program to create, display, append, insert and reverse the order of the items in the array.
**22.** Write a program to add, transpose and multiply two matrices. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

## UNIT – V

**Introduction to Data Science:** Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

**Sample Experiments:**

**23.** Python program to check whether a JSON string contains complex object or not.
**24.** Python Program to demonstrate NumPy arrays creation using array () function.
**25.** Python program to demonstrate use of ndim, shape, size, dtype.
**26.** Python program to demonstrate basic slicing, integer and Boolean indexing.
**27.** Python program to find min, max, sum, cumulative sum of array
**28.** Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
a) Apply head () function to the pandas data frame
b) Perform various data selection operations on Data Frame
**29.** Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

| **Text Books:** |
|---|
| **1.** Gowri Shankar S, Veena A., Introduction to Python Programming, CRC Press |
| **2.** Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024 |
| **3.** Introduction to Programming Using Python, Y. Daniel Liang, Pearson. |
| **Reference Books:** |
| **1.** Python 3 for Absolute Beginners, Tim Hall and J-P Stacey, Apress. |
| **2.** Python -The Ultimate Beginner's Guide! , Andrew Johansen. |
| **Online Resources:** |
| **1.** https://www.coursera.org/learn/python-for-applied-data-science-ai |
| **2.** https://www.coursera.org/learn/python?specialization=python#syllabus |

## PRODUCTION ECONOMICS AND FINANCIAL MANAGEMENT (PEFM)

| IV Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| | | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| HSM203 | BS&H | 2 | 0 | 0 | 2 | 30 | 70 | 100 |
| Sessional Exam Duration: 2 Hrs | | | | | | End Exam Duration: 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Understand the demand and its nature |
| CO2: | Understand elements of costs and depreciation used in industry practices to manufacture a product |
| CO3: | Analyze transactions and prepare final accounts of profit and loss, balance sheet |
| CO4: | Understand financial management tools like time value of money and ratio analysis |
| CO5: | Understand the capital budgeting and evaluation techniques |

### UNIT – I

**Introduction to Economics:** Definition, Nature of economics, Methods of economics, Demand analysis, Types of demand, Factors determining demand, law of demand- Assumptions & exceptions, law of diminishing marginal utility, Elasticity of demand, Factors governing elasticity of demand

### UNIT – II

**Elements of Cost:** Elements of cost - Material cost, Labour cost, Overheads (Factory overheads, Administrative overheads, Selling and distribution overheads), Methods of allocation of overheads

**Depreciation:** Definition, Causes of depreciation, Methods of calculating depreciation - Straight line method of depreciation, Diminishing balance method of depreciation, Sinking fund method of depreciation

### UNIT – III

**Accountancy:** Introduction, Double entry Book keeping, preparation of Journal, Ledger, Trial balance

**Final Accounts:** Preparation of Trading, Profit & loss account, and Balance sheet with simple adjustments pertaining to closing stock, depreciation, income & expenses

### UNIT – IV

**Financial Management:** Time value of money, Present value of - single cash flow, multiple cash flows and Annuity, Future value of - single cash flow, multiple cash flows and Annuity Financial Statement Analysis - Ratio analysis, Liquidity ratios (current ratio, & quick ratio), Profitability ratios (Gross profit ratio, Net profit ratio, ROE, ROCE, P/E ratio & EPS), Activity ratios (Inventory turnover ratio, Debtors turnover ratio), Solvency ratios (Dept- Equity ratio, Interest coverage ratio)

### UNIT – V

**Capital budgeting:** Capital budgeting & its significance, capital budgeting evaluation techniques- Payback period method, Accounting rate of return (ARR) method, Net present value (NPV) method, Profitability index method, Internal Rate of Return (IRR) method- (Simple problems)

**Text Books:**

**1.** K.K. Dewatt, Modern Economic Theory, Shyamlal Charitable Trust, New Delhi

| |
|---|
| **2.** Prasanna Chandra, Fundamentals of Financial Management, TMH Publishers, New Delhi |
| **3.** S.P. Jain and K.L. Narang, Financial Accounting, Kalyani Publications, Ludhiana |
| **4.** Banga and Sharma, Mechanical Estimation and Costing, Khanna Publishers, New Delhi |
| **Reference Books:** |
| **1.** M.Y Khan and P.K Jain, Financial Management, TMH Publishers, New Delhi |
| **Online Resources:** |
| **1.** Financial management for managers: https://nptel.ac.in/courses/110/107/110107144/# |
| **2.** Managerial accounting :https://nptel.ac.in/courses/110/101/110101003/ |
| **3.** Financial Accounting :https://nptel.ac.in/courses/110/101/110101131/ |
| **4.** Financial statement analysis and reporting: https://nptel.ac.in/courses/110/107/110107073/ |
| **5.** Financial accounting: https://nptel.ac.in/courses/110/106/110106147/ |
| **6.** Engineering economic analysis: https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-me35/ |
| **7.** Introduction to managerial Economics: https://nptel.ac.in/courses/110/101/110101005/ |
| **8.** Introduction to microeconomics: https://onlinecourses.nptel.ac.in/noc21_hs52/preview |
| **Sessional Exam:**<br>The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.<br>**End Examination:**<br>The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions. |

## THERMAL ENGINEERING (TE)

| IV Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| ME206 | PC | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| | | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| Sessional Exam Duration: 2 Hrs | | | | | | End Exam Duration: 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Analyze the air standard cycles and I.C. engines to evaluate the thermodynamic performance |
| CO2: | Analyze the vapour power cycles and describe the operation principles of fire tube and water tube boilers |
| CO3: | Analyze the performance of steam nozzles and steam condensers |
| CO4: | Solve the problems on impulse and reaction turbines using velocity triangles |
| CO5: | Analyze the performance of reciprocating compressors using parameters such as efficiency and pressure ratio |

### UNIT – I

**Air Standard Cycles:** Stirling cycle, Ericsson cycle, and Brayton cycle. Analysis of Otto, Diesel and Dual cycles, Comparison of Otto, Diesel and Dual cycles

**Basics of I.C. Engines:** Engine components, Working principle of engines- two stroke and four stroke engines, SI and CI Engines, valve and port timing diagrams, First law analysis of engine cycle

### UNIT – II

**Vapour Power Cycles:** Rankine cycle, Comparison of Rankine and Carnot cycles, Modified Rankine cycle, Methods of increasing the efficiency of Rankine cycle - Reheat and Regenerative Rankine cycles

**Steam Generators:** Introduction, Classification of boilers, Fire tube boilers - Cochran boiler, Lancashire and Locomotive boiler, Water tube boilers - Babcock, Wilcox and Stirling boilers, Comparison between fire tube and water tube boilers, High pressure boilers - Lamont, Loeffler, Benson boilers, Advantages of high pressure boilers, functions of Boiler mountings and Accessories.

### UNIT – III

**Steam Nozzles:** Isentropic flow through Nozzles, Velocity and Discharge of steam through Nozzle, Condition for maximum discharge through Nozzle, Critical pressure ratio, Effect of friction in Nozzle, Efficiency of Nozzle

**Steam Condensers:** Introduction, Classification of condensers, Jet condensers, Surface condensers, Comparison between Jet and Surface condensers, Determination of mass of cooling water in a condenser, Vacuum efficiency and Condenser efficiency.

### UNIT – IV

**Steam Turbines:**

**Impulse type-** Principle of operation of impulse turbine, De-laval Turbine – its features, compounding of impulse turbine, Velocity diagram for single stage impulse turbines, Effect of friction, power developed, axial thrust, diagram efficiency, condition for maximum efficiency.

**Reaction Type-** Principle of operation, Velocity diagram, Degree of reaction, Parson's reaction turbine – its features, Comparison of reaction and impulse turbines

**UNIT – V**

**Reciprocating Compressors:** Classification of compressors, working principle of reciprocating compressors single stage and multi stage compressors with and without clearance, Advantages of multistage compression, inter cooling, minimum work condition for two stage compression, various efficiencies of multi stage compressors, simple problems on reciprocating compressors

**Text Books:**


**1.** Rajput, R. K., Thermal Engineering, Lakshmi Publications, New Delhi.

**2.** Nag, P. K., Engineering Thermodynamics, TMH Publishers, New Delhi

**3.** Ganeshan, V., Internal Combustion Engines, TMH Publishers, New Delhi

**4.** Rajput, R.K., Applied Thermodynamics, Lakshmi Publications, New Delhi.


**Reference Books:**


**1.** Ballaney, P. L. Thermal Engineering, Khanna Publishers, New Delhi

**2.** Mahesh. M. Rathore, Thermal Engineering, McGraw Hill Pubishers, New Delhi

**3.** Vasandhani, V. P. and Kumar, D. S. Heat Engineering, Metropolitan Books, New Delhi

**4.** Gupta, S. C, Thermal Engineering, Pearson Education, New Delhi


**Data Hand Book:**


**1.** Sreenivasa Reddy, B. and Hemachandra Reddy, K, Thermal Data Handbook, IK International Publishers, Bangalore


**Online Resources:**

1. https://onlinecourses.nptel.ac.in/noc23_me31/preview
2. https://onlinecourses.nptel.ac.in/noc22_me113/preview
3. https://onlinecourses.nptel.ac.in/noc24_me03/preview

**Sessional Exam:**

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

**End Examination:**

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

## MANUFACTURING PROCESSES (MFP)

| IV Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| | | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| ME207 | PC | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| Sessional Exam Duration: 2 Hrs | | | | | | End Exam Duration: 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Apply the fundamental principles of casting in practical applications and explain different special casting methods |
| CO2: | Identify suitable bulk forming technique for making a component |
| CO3: | Classify different welding methods with brief introduction to brazing and soldering |
| CO4: | Identify the applications of sheet metal forming and additive manufacturing processes |
| CO5: | Illustrate the applications of plastic processing techniques |

### UNIT – I

**Casting:** Steps involved in making a casting – Advantages of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores, Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

### UNIT – II

Plastic deformation in metals. Hot working and Cold working.

**Bulk forming processes:** Rolling–fundamentals, types of rolling mills and products, Forces in rolling. Forging-Types of Forging, forging defects and remedies; Extrusion: Types of extrusion – Forward extrusion, backward extrusion, Impact extrusion, Hydrostatic extrusion; Drawing - Wire drawing and Tube drawing.

### UNIT – III

**Welding:** Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, Manual metal arc welding, submerged arc welding, TIG & MIG welding. Electro–slag welding. Resistance welding, Friction welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing. Introduction to heat affected zones in welding, welding defects – causes and remedies

### UNIT – IV

**Sheet metal forming** - Blanking and piercing, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools.

**Additive manufacturing** - Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages and Applications

### UNIT – V

**Processing of Plastics:** Classification of plastics, thermoplastics, thermosetting plastics and applications, injection, blow molding, calendaring, thermoforming, compression molding and Transfer Molding.

**Text Books:**


**1.** P. N. Rao, Manufacturing Technology –Vol I, 5/e, McGraw Hill Education, 2018.

**2.** Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014


**Reference Books:**


**1.** A.Ghosh & A.K. Malik, Manufacturing Science, East West Press Pvt. Ltd, 2010.

**2.** Kalpak jain S and Steven RS chmid, Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.

**3.** R.K.Jain, Production Technology, Khanna Publishers, 2022.

**4.** Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited, 1990.

**5.** H.S.Shaun, Manufacturing Processes, 1/e, Pearson Publishers, 2012.

**6.** W AJ Chapman, Workshop Technology, 5/e, CBS Publishers & Distributors Pvt. Ltd, 2001.

**7.** Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers, 2017.

**8.** Ian Gibson, David W Rosen, Brent Stucker., Additive Manufacturing Technologies: 3DPrinting, Rapid Prototyping, and Direct Digital Manufacturing, 2/e, Springer, 2015.


**Online Resources:**

1. https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes
2. https://onlinecourses.nptel.ac.in/noc21_me81/preview
3. www.coursera.org/learn/introduction-to-additive-manufacturing-processessera
4. https://archive.nptel.ac.in/courses/112/103/112103263/
5. https://elearn.nptel.ac.in/shop/nptel/principles-of-metal-forming-technology/?v=c86ee0d9d7ed

**Sessional Exam:**

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

**End Examination:**

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

## FLUID MECHANICS & HYDRAULIC MACHINES (FMHM)

| **IV Semester:** Mechanical Engineering | | | | | | **Scheme:** 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **ME208** | **PC** | **2** | **1** | **0** | **3** | **30** | **70** | **100** |
| **Sessional Exam Duration:** 2 Hrs | | | | | | **End Exam Duration:** 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Understand the basic concepts of fluid properties. |
| **CO2:** | Estimate the mechanics of fluids in static and Dynamic conditions. |
| **CO3:** | Calculate loss in fluid flows and Apply the Boundary layer theory |
| **CO4:** | Estimate the hydro dynamic forces of jet on vanes in different positions. |
| **CO5:** | Understand the working Principles and performance evaluation of hydraulic pump and turbines. |

### UNIT – I

**Fluid statics:** Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

### UNIT – II

**Fluid kinematics:** Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them.

**Fluid dynamics:** surface and body forces–Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

### UNIT – III

**Closed conduit flow:** Reynold's experiment - Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel-total energy line – hydraulic gradient line.

**Boundary Layer Flow:** Laminar boundary layer, Turbulent boundary layer, Displacement thickness, momentum thickness and energy thickness

### UNIT – IV

**Basics of turbo machinery:** hydro dynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow Over radial vanes.

**Hydraulic Turbines:** classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, draft tube-theory.

### UNIT – V

**Centrifugal pumps:** classification, working, work done – manometric head- losses and efficiencies-specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

**Reciprocating pumps**: Working, Discharge, slip, indicator diagrams.

| **Text Books:** |
|---|
| **1.** RKBansal, Fluid Mechanics and Hydraulic Machines, 10/e, Laxmi Publications (P)Ltd, 2019 |
| **2.** Rajput, Fluid Mechanics and Hydraulic Machines, S Chand & Company, 2016 |
| **3.** Y.A. Cengel, J.M. Cimbala, Fluid Mechanics, Fundamentals and Applications, 6/e, McGraw Hill Publications, 2019. |
| |
| **Reference Books:** |
| **1.** P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017. |
| **2.** Dixon, Fluid Mechanics and Thermodynamics of Turbomachinery, 7/e, Elsevier Publishers, 2014. |
| **3.** D.S.Kumar,FluidMechanicsandFluidPowerEngineering,SKKataria&Sons,2013 |
| **4.** D.RamaDurgaiah,FluidMechanicsandMachinery,1/e,NewAgeInternational,2002 |
| **Online Resources:** |
| **1.** https://archive.nptel.ac.in/courses/112/105/112105206/ |
| **2.** https://archive.nptel.ac.in/courses/112/104/112104118/ |
| **3.** https://www.edx.org/learn/fluid-mechanics |
| **4.** https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in |
| **5.** www.coursera.org/learn/fluid-powerera |

**Sessional Exam:**

The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

**End Examination:**

The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

## THEORY OF MACHINES (TOM)

| IV Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| | | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| ME209 | PC | 2 | 1 | 0 | 3 | 30 | 70 | 100 |
| Sessional Exam Duration: 2 Hrs | | | | | | End Exam Duration: 3 Hrs | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Understand four bar mechanism, single slider crank mechanism, double slider crank mechanism and their inversions and solve problems on Universal joint. |
| CO2: | Determine Velocity and acceleration of points in - four bar mechanism, single slider crank mechanism and quick return motion mechanism by drawing velocity and acceleration diagrams. |
| CO3: | Find the effect of gyroscopic couple on aero-plane, ship, car and two wheeler and Solve problems on gears and gear trains. |
| CO4: | Understand the concept of balancing of rotating masses, and Construct cam profile for knife edge, roller, flat faced follower with different machines. |
| CO5: | Solve problems on free, forced, undamped, damped vibrations and calculate fluctuation of speed in flywheel. |

### UNIT – I

**Simple Mechanisms:** Classification of mechanisms – Basic kinematic concepts and definitions, Degree of freedom, mobility, Grashof's law, kinematic inversions of four bar chain and slider crank chains, Quick return mechanism, Universal Joint.

### UNIT – II

**Plane and motion analysis:** velocity and acceleration analysis of simple mechanisms using velocity and acceleration diagrams, graphical velocity analysis using instantaneous centers, Coriolis component of acceleration.

### UNIT – III

**Gyroscope:** Principle of gyroscope, gyroscopic effect in an aero plane, ship, car and two wheeler, simple problems

**Gear Profile:** Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack& pinion gears, epicyclic and regular gear train kinematics.

### UNIT – IV

**Balancing of Rotating masses:** Need for balancing, balancing of single mass and several masses in different planes using graphical method.

**Cams:** Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions, cam profile for knife edge, roller and flat face follower.

### UNIT – V

**Vibrations:** Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations without damping in single degree of freedom; Vibration isolation and transmissibility.

| |
|---|
| **Turning Moment Diagrams and Flywheels:** Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Functions of FlyWheel, size of FlyWheel |
| **Text Books:** |
| **1.** S. S. Rattan, Theory of Machines, TMH Publishers, New Delhi. |
| **2.** Sadhu Singh, Theory of Machines, Pearson Education, New Delhi. |
| **3.** R. K. Bansal and J. S. Brar, Theory of Machines, Laxmi Publications (P), Ltd., New Delhi. |
| **4.** P.L. Ballaney, Theory of Machines, Khanna Publishers, New Delhi. |
| **Reference Books:** |
| **1.** Farazdak Haideri, Dynamics of Machinery, Nirali Prakashan, Pune. |
| **2.** John J. Uicker Jr, Gordon R. Pennock , Joseph E. Shigley, Theory of Machines and Mechanisms, Oxford Higher Education. |
| **3.** G. K. Groover, Mechanical Vibrations, Nem Chand & Bros. |
| **4.** Robert L. Norton, Design of Machinery- An Introduction to Synthesis and Analysis of Mechanisms and Machines, Mc Graw Hill Higher Education, New York. |
| **5.** Willaim T. Thomson, Theory of Vibration with Applications, Prentice Hall. |
| **Online Resources:** |
| **1.** https://nptel.ac.in/courses/112/101/112101096/ |
| **2.** https://nptel.ac.in/courses/112/104/112104114/ |
| **Sessional Exam:**<br>The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.<br>**End Examination:**<br>The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions. |

## FLUID MECHANICS & HYDRAULIC MACHINES LAB (FMHM (P))

| IV Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| ME210 | PC | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| | | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| End Exam Duration: 3 Hrs | | | | | | | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Demonstrate the devices used for measuring flow. |
| CO2: | Compute major losses in pipes. |
| CO3: | Illustrate the operating parameters of turbines. |
| CO4: | Explain the working of different types of pumps. |
| CO5: | Explain the devices used for measuring flow. |

### LIST OF EXPERIMENTS

| | |
|---|---|
| **1.** | Impact of jets on Vanes. |
| **2.** | Performance Test on Pelton Wheel. |
| **3.** | Performance Test on Single Stage Centrifugal Pump. |
| **4.** | Performance Test on Multi Stage Centrifugal Pump. |
| **5.** | Performance Test on Reciprocating Pump. |
| **6.** | Calibration of Venturimeter. |
| **7.** | Calibration of Orificemeter. |
| **8.** | Determination of friction factor for a given pipeline. |
| **9.** | Determination of loss of head due to sudden contraction/enlargement in a pipeline. |
| **10.** | Turbine flow meter. |
| **11.** | Determination of loss of head due to Elbows and Bends in a pipeline |
| **12.** | Determination of coefficient of discharge for a small orifice by constant head method |
| **13.** | Demonstration on Kaplon Turbine |
| **14.** | Demonstration on Francis Turbine |

**Virtual lab:**

| | |
|---|---|
| **1.** | To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html) |
| **2.** | To calculate Total Energy at different points of venture meter. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html). |
| **3.** | To calculate the flow (or point) velocity at center of the given tube using different flow rates. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html) |
| **4.** | To determine the hydro static force on a plane surface under partial submerge and full submerge condition. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html). |
| **5.** | To determine the discharge coefficient of a triangular notch. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html) |
| **6.** | To determine the coefficient of impact of jet on vanes. (https://fm-nitk.vlabs.ac.in/exp/impact-of-jet). |
| **7.** | To determine friction in pipes. (https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html. |

## MANUFACTURING PROCESSES LAB (MFP (P))

| IV Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| | | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| ME211 | PC | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |

**End Exam Duration:** 3 Hrs

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Prepare sand mould for casting. |
| CO2: | Develop different Weld joints |
| CO3: | Fabricate the components using various manufacturing techniques. |
| CO4: | Explain the processes of 3d Printing. |

### LIST OF EXPERIMENTS

| | |
|---|---|
| 1. | Design and making of pattern<br>a) Single piece pattern<br>b) Split pattern |
| 2. | Sand properties testing<br>a) Sieve analysis (dry sand)<br>b) Clay content test<br>c) Moisture content test<br>d) Strength test (Compression test & Shear test)<br>e) Permeability test |
| 3. | Mould preparation<br>a) Dumble<br>b) Gear blank |
| 4. | Oxy acetylene Gas welding |
| 5. | Oxy acetylene Gas cutting |
| 6. | Manual metal arc welding<br>a) Lap joint<br>b) Butt joint |
| 7. | To make weldments using TIG/MIG welding |
| 8. | To weld thin sheets using Spot welding machine |
| 9. | Injection Molding |
| 10. | Blow Molding |
| 11. | Demonstration of metal casting |
| 12. | Demonstration of 3D printing |
| 13. | Study of deep drawing and extrusion operations |

**Virtual lab:**

| | |
|---|---|
| 1. | To study and observe various stages of casting through demonstration of casting process. (https://virtual-labs.github.io/exp-sand-casting-process-dei/theory.html) |
| 2. | To weld and cut metals using an oxyacetylene welding setup. (https://virtual-labs.github.io/exp-gas-cutting-processes-iitkgp/index.html). |
| 3. | To simulate Fused deposition modelling process (FDM) (https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process) |
| 4. | https://altair.com/inspire-mold/ |
| 5. | https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html |

## SOFT SKILLS (SS)

| III /IV Semester: Common for all Branches | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **SCCM01** | **SEC** | **0** | **1** | **2** | **2** | **30** | **70** | **100** |

**End Exam Duration:** 3 Hrs

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Enhance teamwork and professional growth in engineering and related fields through foundational soft skills and practical communication proficiency. |
| **CO2:** | Develop effective presentation skills to meet industry standards, enabling clear and professional communication of ideas and information. |
| **CO3:** | Develop the ability to identify and employ a variety of problem-solving and decision-making methods that is relevant and effective in real-world situations |
| **CO4:** | Develop and apply emotional intelligence and stress management techniques to enhance personal, professional well-being and emotional well-being |
| **CO5:** | Understand and develop the corporate etiquette necessary to present themselves in a professional setting. |

### UNIT – I

**Soft Skills & Communication Skills**

**Soft Skills** - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

**Activities:**

**Intrapersonal Skills**- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources) – Stake holders Management.

**Interpersonal Skills**- Group Discussion – Debate – Team Tasks - Book and film reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

**Verbal Communication**- Extempore- brief addresses and speeches convincing- negotiating- agreeing and disagreeing with professional grace.

**Non-verbal communication** – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

### UNIT – II

**Presentation Skills**

Types of presentations-Delivery techniques – Engaging the audience – Handling Q&A and feedback – Research Content – Visual aids and materials.

**Activities:**

Poster Presentation

Power Point Presentation

Oral Presentation

### UNIT – III

**Problem Solving & Decision Making:** Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

**Activities:**

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

| UNIT – IV |
|---|
| **Stress Management**: Self-awareness –Self-Regulation – Stress factors – Controlling Stress – Tips<br>**Activities:**<br>Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates |
| **UNIT – V** |
| **Corporate Etiquette** – Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Email etiquette - Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges<br>**Activities**<br>Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games |
| **Text Books:** |
| **1.** Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012 |
| **2.** Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018 |
| **Reference Books:** |
| **1.** Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018. |
| **2.** Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition) |
| 3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013 |
| **4.** Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018 |
| **5.** Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press |
| **6.** Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher: Vayu Education of India, 2014 |
| **Online Resources:** |
| **1.** https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q |
| **2.** https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ |
| **3.** https://youtu.be/-Y-R9hDl7lU |
| **4.** https://youtu.be/gkLsn4ddmTs |
| **5.** https://youtu.be/2bf9K2rRWwo |
| **6.** https://onlinecourses.nptel.ac.in/noc24_hs15/preview |
| **7.** https://onlinecourses.nptel.ac.in/noc21_hs76/preview |

## EMBEDED SYSTEMS & IOT (ESI)

| IV Semester: Mechanical Engineering | | | | | | Scheme: 2023 | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Category | Hours/Week | | | Credits | Maximum Marks | | |
| | | L | T | P | C | Continuous Internal Assessment | End Exam | TOTAL |
| ME212 | PC | 0 | 0 | 2 | 1 | 30 | 70 | 100 |

**End Exam Duration:** 3 Hrs

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| CO1: | Comprehend Microcontroller-Transducers Interface techniques |
| CO2: | Establish Serial Communication link with Arduino |
| CO3: | Analyse basics of S P I interface. |
| CO4: | Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor. |
| CO5: | Realize the revolution of internet in mobile devices, cloud and sensor networks |

### LIST OF EXPERIMENTS

**Embedded Systems Experiments:** (Any 5 experiments from the following)

| | |
|---|---|
| 1. | Measure Analog signal from Temperature Sensor. |
| 2. | Generate P W M output. |
| 3. | Drive single character generation on Hyper Terminal |
| 4. | Drive a given string on Hyper Terminal. |
| 5. | Full dup lex Link establishment using Hyper terminal. |
| 6. | Drive a given value on a 8 bit DAC consisting of SPI. |
| 7. | Drive Stepper motor using Analog GPIOs. |

**Internet of Things Experiments:** (Any 5 experiments from the following)

| | |
|---|---|
| 1. | Getting started with Raspberry Pi, Install Raspian on your SD card. |
| 2. | Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device Using Raspberry Pi |
| 3. | a. Calculate the distance using distance sensor.<br>b. Basic LED functionality. |
| 4. | Raspberry Pi interact with online services through the use of public APIs and SDKs. |
| 5. | Study and Install IDE of Arduino and different types of Arduino. |
| 6. | Study and Implement Zigbee Protocol using Arduino / Raspberry Pi. |
| 7. | Calculate the distance using distance sensor Using Arduino. |
| 8. | Basic LED functionality Using Arduino and Node MCU. |
| 9. | Calculate the moisture content in the soil using Arduino and Node MCU. |
| 10. | Calculate the distance using distance sensor Using Node MCU. |
| 11. | Basic LED functionality Using Node MCU. |

**Text Books:**


| | |
|---|---|
| 1. | Embedded Systems Architecture –By Tammy Noergaard, Elsevier Publications, 2013. |
| 2. | Embedded Systems- By Shibu. K.V-Tata Mc Graw Hill Education Private Limited, 2013. |
| 3. | Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013. |
| 4. | Embedded Systems – Lyla B.Das-Pearson Publications, 2013. |

## ENVIRONMENTAL SCIENCE (ES)

| III /IV Semester: Common for all Branches | | | | | Scheme: 2023 | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **Continuous Internal Assessment** | **End Exam** | **TOTAL** |
| **AC201** | **AC** | **2** | **0** | **0** | **0** | | | |

**Course Outcomes:** At the end of the course, students will be able to

| | |
|---|---|
| **CO1:** | Apply the knowledge of environmental issues in his area of work. Understand the need for the conservation of Natural resources for sustainable development. |
| **CO2:** | Understand the importance of Ecosystem and conservation of biodiversity |
| **CO3:** | Understand the problems due to environmental pollution with remedial measures and issues related to environment. |
| **CO4:** | Understand about sustainable development and acts to address environmental issues |
| **CO5:** | Appreciate the use of IT & related technology to conserve environment & human health. |

### UNIT – I

**Multidisciplinary Nature of Environmental Studies:** Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems. Forest resources – Use and over-exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people. Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems. Food resources – World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer, pesticide problems, water logging, salinity, case studies. Energy resources – solar, wind and nuclear energy resources.

### UNIT – II

**Ecosystems:** Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers. Energy flow in the ecosystem – Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and functions of the forest and aquatic (pond and ocean) ecosystems.

**Biodiversity and its Conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation– Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### UNIT – III

**Environmental Pollution:** Definition, cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Noise pollution
d. Nuclea rhazards

**Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution – Pollution case studies. Disaster management: floods, earth quake and cyclone.

| UNIT – IV |
|---|
| **Social Issues and the Environment:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting – Environmental ethics. Global issues and possible solutions – Climate change, global warming, acid rain and ozone layer depletion – Case Studies. Consumerism and waste products. Environment Protection Acts –Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act. Issues involved in enforcement of environmental legislation – Public awareness. |
| **UNIT – V** |
| **Human Population and the Environment:** Population growth, Population explosion – Family Welfare Programmes – Environment and human health. Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health.<br><br>**Field Work:** Visit to a local area to document environmental assets River/forest/grassland/ hill/mountain – Visit to a local polluted site – Urban/Rural/Industrial/Agricultural study of common plants, insects, and birds – river, hill slopes, etc. |
| **Text Books:** |
| **1.** C. P. Kaushik and Anubha Kaushik, "Environmental Studies" New Age International (P) Ltd., New Delhi. |
| **2.** Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses" University Grants Commission, Universities Press. |
| **3.** Y. Anjaneyulu "Introduction to Environmental Sciences", BS Publications, Hyderabad. |
| **4.** R. Rajagopalan, "Environmental Studies", Oxford University Press, Chennai. |
| **5.** S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company. |
| **Reference Books:** |
| **1.** Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi. |
| **2.** Decksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications. |
| **3.** M. Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication. |
| **4.** Palaniswamy, "Environmental Studies", Pearson Education. |
| **5.** J. P. Sharma, "Comprehensive Environmental Studies", Laxmi Publications. |
| **6.** Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science", Prentice Hall of India Private limited. |