INSTITUTE OF ENGINEERING & MANAGEMENT
Good Education, Good Jobs

UNIVERSITY OF ENGINEERING & MANAGEMENT
Good Education, Good Jobs

# IEM Salt Lake Campus, IEM Newtown Campus & IEM Jaipur Campus

## New Syllabus Outline Structure

## For

## 3rd SEMESTER (B.Tech in Mechanical Engineering)

*Effective for Academic Year 2025-2026*

# DEPARTMENT OF MECHANICAL ENGINEERING

# Index

# 3rd SEMESTER

| Sl. No. | Category | Code | Course Title | Hours per week | | | Total contact hours | Credits |
|---|---|---|---|---|---|---|---|---|
| **Theory Papers** | | | | L | T | P | | |
| 1 | BSC | BSM301 | Mathematics - III | 3 | 0 | 0 | 3 | 3 |
| 2 | ESC | ESCME302 | Engineering Thermodynamics | 3 | 1 | 0 | 4 | 4 |
| 3 | PCC | PCCME301 | Engineering Materials & Applications | 2 | 1 | 0 | 3 | 3 |
| 4 | PCC | PCCME302 | Mechanics of Deformable Solids | 2 | 1 | 0 | 3 | 3 |
| 5 | PCC | PCCME303 | Manufacturing Process- I | 2 | 1 | 0 | 3 | 3 |
| 6 | HSMC | ESP301 | Essentials Studies for Professionals – III | 2 | 0 | 0 | 2 | 0.5 |
| **Practical / Sessional Papers** | | | | | | | | |
| 7 | ESC | ESCME381 | Basic Electronics Engineering | 0 | 1 | 2 | 3 | 2 |
| 8 | PCC | PCCME391 | Mechanical Engg Lab IA (Materials Testing) | 0 | 0 | 2 | 2 | 1 |
| 9 | PCC | PCCME392 | Mechanical Engg Lab IIA (Manufacturing Process) | 0 | 0 | 2 | 2 | 1 |
| 10 | PRJ | PRJME381 | Project I (CAD Based) | 0 | 0 | 2 | 2 | 1 |
| 11 | HSMC | SDP381 | Skill Development for Professionals –III | 0 | 0 | 2 | 2 | 0.5 |
| **TOTAL** | | | | | | | **29** | **22** |
| **For B.Tech Honours Degree** | | | | | | | | |
| 12 | MOOCs | MOOCS | MOOCs Certificate Courses (NPTEL/SWAYAM) | - | - | - | - | - |
| **For B.Tech with Minor Degree in Robotics** | | | | | | | | |
| 13 | MD | MINOR301R | Introduction to Robotics | 3 | 1 | 0 | 4 | 4 |
| **For B.Tech with Minor Degree in Sustainable Energy Engineering** | | | | | | | | |
| 14 | MD | MINOR301S | Energy and its Resources | 1 | 1 | 2 | 3 | 3 |
| **For B.Tech with Minor Degree in Artificial intelligence and Machine learning** | | | | | | | | |
| 15 | Minor | MINOR301A | Introduction to AI & Machine Learning | 3 | 0 | 2 | 5 | 4 |
| **Mandatory Courses** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 16 | MC | IFC | Industry and Foreign Certification (IFC) | - | - | - | - | - |
| 17 | MC | MAR | Mandatory Additional Requirements (MAR) | - | - | - | - | - |

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Mathematics - III** **Credit: 3**

**Subject Code: BSM301** **Lecture Hours: 42**

**Pre-Requisites:** Permutation & Combination, Concept of Basic Probability, Evaluation of definite, improper and infinite integrals, Concept of $\beta$ & $\Gamma$ functions.

**Relevant Links:**

Coursera: Probability & Statistics https://www.coursera.org/learn/machine-learning-probability-and-statistics

NPTEL Advanced Engineering Mathematics https://onlinecourses.nptel.ac.in/noc24_ma03/preview

***Study Material Link (BL 4, 5,6)***

https://drive.google.com/drive/folders/19umqy3stib1-wuHy0h-p0arM0NkIzdxC?usp=sharing

## COURSE OBJECTIVES:

1. The syllabus will prepare the learners for Engineering Exit Examinations, ESE and campus placements.
2. Students will apply concepts of various probability distributions to find probabilities.
3. Students will make estimations for a mean, variance, standard deviation and proportions for big data.
4. Students will be eligible to work in the Data domain which is the emerging technology of the future and create more opportunities for creative work.
5. Students will be able to describe and quantify the uncertainty inherent in predictions made by machine learning models.

## COURSE OUTCOMES:

| CO | Course Outcomes |
|---|---|
| **CO 1** | Illustrate the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment that will make a bridge between elementary statistical tools and probability theory. |
| **CO 2** | Find the inter-relation between two or more phenomena with the help of curve fitting. |
| **CO 3** | Understand the basic components of sampling and have the knowledge on exact sampling distributions which are essential for estimating and testing hypothetical statements. Know the various sampling methodologies and their efficiencies in theoretical and practical aspects. |
| **CO 4** | Estimate and test the parameters associated with the relevant areas for forecasting and verification of economic theory |
| **CO 5** | Apply the statistical tools in business, economical and commercial areas for analyzing problems and to make better decisions for future in their fields. |

## Detailed Syllabus:

| Module No. | Topic | Sub-topics | Mapping with Chapters of the Text Book | Mapping with Industry & International Academia | Lecture hour | Corresponding Lab Assignment |
|---|---|---|---|---|---|---|
| **1** | **Random Variables** | ***Discrete Random Variable:*** Discrete Probability Distribution, | Chapters 2 | https://ocw.mit.edu/c | **12** | "R" |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **and Probability Distributions** | Expectation and Variance of random variables; Binomial and Poisson Distributions; Mean, Variance and Moment Generating Functions of Binomial and Poisson Variates; Convergence of Binomial to Poisson Variate.<br>***Continuous Random Variable;*** Continuous Probability Distributions, Expectation and Variance of random variables, Exponential, Normal Distributions; Mean, Variance and Moment Generating Functions of the corresponding variates. | and 3/Text Book 1<br>Chapter 12 /Text Book 2 | ourses/18-05-introduction-to-probability-and-statistics-spring-2022/ | | software for statistical computing |
| **2** | **Method of Least Squares and Curve Fitting** | Principle of Least Squares, Curve fitting by the method of Least Squares - fitting of straight lines, second degree parabolas and exponential curves. | Chapter 9/Text Book 1<br>Chapter 8 /Text Book 2 | https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/ | **4** | "stata": statistical software for data science |
| **3** | **Sampling and Sampling Distributions** | Population and Sample, Sampling With and Without Replacement (SRSWR and SRSWOR); Random Samples, Population Parameters, Sample Statistics, Sampling Distributions, Standard Error and Probable Error; Sample Mean, Sampling Distribution of Means; Sample Proportion, Sampling Distribution of Proportions, Sample Variances, Sampling Distribution of Variances; Case where Population Variance is unknown; Central Limit Theorem (Statement only); Degrees of freedom, Chi-square distribution, Mean | Chapter 11 /Text Book 1<br>Chapter 13/Text Book 2 | https://www.cl.cam.ac.uk/teaching/2021/IntroProb/materials.html | **8** | "stata": statistical software for data science |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | & Variance of Chi-square variate. | | | | |
| **4** | **Estimation of Parameters** | Point and Interval estimations, Biased and Unbiased estimators, Minimum Variance Unbiased Estimator (MVUE), Consistent Estimator, Maximum Likelihood Estimation of Parameters, Applications in populations following theoretical distributions (Binomial, Poisson and Normal), Calculation of confidence limits for population mean and population proportions. | Chapter 12 /Text Book 1<br>Chapters 14/ Text Book 2 | https://ocw.mit.edu/courses/1-010-uncertainty-in-engineering-fall-2008/ | **6** | "R" software for statistical computing |
| **5** | **Testing of Hypothesis** | ***Large Sample Test*:** Statistical Hypotheses, Test Statistic, Best Critical Region, Test for single mean, difference of means, single proportion, difference of proportions, and difference of standard deviations.<br>***Small Sample Test:*** Test for single mean, difference of means and correlation coefficients, Test for ratio of variances, Chi-square test for goodness of fit and independence of attributes. | Chapter 13/ Text Book 1<br>Chapter 14?Text Book 2 | https://ocw.mit.edu/courses/6-041-probabilistic-systems-analysis-and-applied-probability-fall-2010/ | **12** | "R" software for statistical computing |

TEXT BOOK:


**1. Saktipada Nanda and Sibashis Nanda ",** A Course on Probability & Statistics", 2nd Edition (2024), Mindprobooks

**2. N.G.Das,** "Statistical Methods", Combined Edition Vol. 1 &2 (2017) McGraw Hill Education


REFERENCE BOOKS:


**1. Sheldon M. Ross,** "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition (2020), Academic

**2. N.G.Das,** "Statistical Methods", Combined Edition Vol. 1 &2 (2017) McGraw Hill Education

**3. Douglas C, Montgomery and George C. Runger,** Applied Statistics and Probability for Engineers, 7th edition (2018), John Wiley & Sons.

**4. Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan,** "Schaum's Outline of Probability & Statistics", 4th Edition (2012), McGraw Hill Education.

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Engineering Thermodynamics** **Credit: 4**

**Subject Code: ESCME302** **Lecture Hours: 40**

**Pre-requisite:** BSC M101, BSC CH101

**Relevant Links:** STUDY MATERIAL NPTEL

## COURSE OBJECTIVES:

The purpose of learning this course is to:

1. To learn about work and heat interactions, and balance of energy between system and its surroundings
2. To learn about application of first law of thermodynamics to various energy conversion devices
3. To evaluate the changes in properties of substances in various processes
4. To understand the difference between high grade and low-grade energies and second law limitations on energy conversion.

## COURSE OUTCOMES:

After completion of this course, the learner will be able to:

**CO1.** Apply energy balance to systems and control volumes, in situations involving heat and work interactions.

**CO2.** Evaluate changes in thermodynamic properties of substances.

**CO3.** Evaluate the performance of energy conversion devices.

**CO4.** Differentiate between high grade and low-grade energies.

| Module number | Topic | Sub-topics | Textbook & Chapter No. | Mapping with Industry and International Academia | Lecture Hours | Corresponding Assignment |
|---|---|---|---|---|---|---|
| 1 | **Fundamentals** | System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes. | Engineering Thermodynamics- Nag, P.K. Chapter- 1 and Chapter 3 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | 4 | 1. Calculate Boundary Work using Matlab |
| 2 | **First law of thermodynamics** | Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Definition of heat; examples of heat/work interaction in systems-First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Internal energy and Enthalpy. First Law for Flow Processes - Steady state steady flow processes; Examples of steady flow devices; Unsteady processes. | Engineering Thermodynamics- Nag, P.K. Chapter- 4 and Chapter- 5 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | 5 | 1. Using Matlab, do the first law analysis of a compressor and a turbine. |
| 3 | **Pure substances** | Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables; Saturation tables; Superheated tables; Identification of states & determination of properties, | Engineering Thermodynamics- Nag, P.K. Chapter- 9 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** *https://www.aicte-* | 5 | 1. Create a Matlab code to calculate enthalpy and entropy of a pure substance at a given |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Mollier's chart. | | *india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | | temperature and pressure. |
| 4 | **Second law of thermodynamics** | Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale. | Thermodynamics - An Engineering Approach by Yunus A. Cengel- Chapter- 6 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | 4 | 1. Using Matlab, do the second law analysis of a compressor and a turbine. |
| 5 | **Entropy** | Clausius inequality; Definition of entropy S; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in Ts coordinates; Second law analysis for a control volume. Exergy. Reversible work and irreversibility, 2nd Law efficiency. | Thermodynamics - An Engineering Approach by Yunus A. Cengel- Chapter- 7 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | 4 | 1. Using Matlab, calculate the entropy destroyed in a compressor and a turbine. |
| 6 | **Thermodynamic cycles** | Thermodynamic cycles; comparison with Carnot cycle. Refrigeration cycles, reversed Carnot cycle; components and analysis of simple vapour compression Refrigeration cycle, Actual Refrigeration cycles, | Engineering Thermodynamics- Nag, P.K. Chapter- 14 and Chapter- 15 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** | 6 | 1. Using Matlab, calculate the Otto cycle and the Diesel cycle |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Vapour Absorption Refrigeration cycle. Properties of dry and wet air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point. | | *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | | efficiencies, and power output. |
| 7 | **Maxwell relations** | Maxwell relations; Clapeyron Equation, Joule Thompson coefficient. | Engineering Thermodynamics- Nag, P.K. Chapter- 11 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | 3 | 1. Using Matlab, calculate the Joule Thompson coefficient for a given input pressure and temperature of a gas. |
| 8 | **Compressors** | Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. | Engineering Thermodynamics (Principles & Practices)- Dr. D.S. Kumar- Chapter- 21 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | 4 | 1. Using Matlab, do the exergy analysis of a compressor. |
| 9. | **Compressible flow** | Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for | Engineering Thermodynamics- Nag, P.K. Chapter- 17 | ***International Standard:*** *https://ocw.mit.edu/courses/16-050-thermal-energy-fall-2002/pages/syllabus/*<br><br>***AICTE-prescribed syllabus:*** | 5 | 1. Using Matlab, Calculate the normal shock relations for |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation- compressible flow in diffusers, efficiency of nozzle and diffuser. | | *https://www.aicte-india.org/downloads/MODEL_SYLLABI_FOR_UG_%20Mech_%20Engg.pdf*<br><br>***Industry Mapping: MATLAB*** | | air ($\gamma = 1.4$) for total pressure ratio of 0.61. |

## TEXT BOOK:


1. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co.Ltd.
2. Thermodynamics - An Engineering Approach by Yunus A. Cengel, Michael A. Boles
3. Engineering Thermodynamics (Principles & Practices)- Dr. D.S. Kumar, S K Kataria & Sons Publication


## REFERENCE BOOKS:


4. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
5. Pokrovskii, Vladimir (2020). Thermodynamics of Complex Systems: Principles and applications. IOP Publishing, Bristol, UK. ISBN 978-0-7503-3451-8
6. Zemansky, Mark W.; Dittman, Richard (1996). Heat and Thermodynamics (7th ed.). McGraw-Hill. ISBN 978-0070170599


## ONLINE RESOURCES:

**COURSERA**

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Engineering Materials & Applications** **Credit: 3**

**Subject Code: PCCME301** **Lecture Hours: 36**

**Prerequisites:** Basic Knowledge of structure of materials

## COURSE OBJECTIVES:

1. Broad understanding of different types of engineering materials and their applications.
2. Correlation between the internal structure of materials and their mechanical properties.
3. Various methods to quantify the mechanical integrity of materials and their failure criteria.
4. Interpretation of equilibrium phase diagrams of alloys.
5. Different heat treatment methods to tailor the properties of Fe-C alloys.

## COURSE OUTCOMES:

CO1: Student will be able to identify crystal structures for various materials.

CO2: Student will be able to understand defects in crystal structures.

CO3: Understand how to tailor material properties of ferrous and non-ferrous alloys.

CO4: How to quantify mechanical integrity and failure in materials.

**Relevant Links:** Study Material ( PCCME301)

**NPTEL course link:** https://onlinecourses.nptel.ac.in/noc22_me90/preview

| Module number | Topic | Sub-topics | Mapping with Industry and International Academia | Textbook & Chapter No. | Lecture Hours | Corresponding Lab Assignment |
|---|---|---|---|---|---|---|
| 1 | **Engineering Materials and Classification** | Metals, plastics, ceramics and composites; Relevant properties (physical, mechanical, thermal, electrical, chemical), cost; Range of applications; Material designation and standards; Ashby diagrams; Selection criteria and process | ***International Standard:*** https://ocw.mit.edu/courses/3-40j-physical-metallurgy-fall-2009/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br>***Industry Mapping:*** ANSYS/ MINITAB | W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India Chapter 1 & 2 | 4 | Tension Test and Compression Test of ductile and brittle materials |
| 2 | **Mechanical Properties and Testing** | Tensile, compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength; ductility, resilience, toughness and elastic recovery; Hardness measurement their relation to strength; SN curve, endurance and fatigue limits; Introduction to non-destructive testing (NDT). | ***International Standard:*** https://ocw.mit.edu/courses/3-40j-physical-metallurgy-fall-2009/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***Industry Mapping:*** ANSYS/ MINITAB | W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India Chapter 6 | 6 | stress-strain diagram, determination of yield strength, ultimate strength, modulus of elasticity, percentage elongation and percentage reduction in areas, observation of fractured surfaces |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | **Metal and Alloys** | Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze & cupro-nickel; Aluminium & Al-Cu-Mg alloys; Nickel based superalloys & Titanium alloys; Phase diagrams and interpretation of microstructure; Iron Iron-carbide phase diagram and cooling (TTT) diagrams. | ***International Standard***: https://ocw.mit.edu/courses/3-40j-physical-metallurgy-fall-2009/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br>***Industry Mapping:*** ANSYS/ MINITAB | W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India Chapter 9, 10 & 11 | 7 | Brinnell/ Vickers and Rockwell hardness tests on metallic specimens |
| 4 | **Heat Treatment** | Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening | ***International Standard***: https://ocw.mit.edu/courses/3-40j-physical-metallurgy-fall-2009/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***Industry Mapping:*** ANSYS/ MINITAB | W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India Chapter 11 | 6 | Experiments on heat treatment of carbon steels under different rates of cooling including quenching, and testing for the change in hardness and observing its microstructural changes through metallographic studies |
| 5 | **Polymers, Ceramics and Composites** | Polymers – Classification and applications; Polymerization techniques; Ceramics – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; Composites – Reinforcement, matrix, metal matrix composites, ceramic composites, polymer | ***International Standard***: https://ocw.mit.edu/courses/3-40j-physical-metallurgy-fall-2009/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pd | W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India Chapter 12,13,14 ,15 & 16 | 7 | Sample preparation and etching of ferrous and non-ferrous metals and alloys for |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | composites; Other advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nano materials. | f<br><br>***Industry Mapping:*** ANSYS/ MINITAB | | | metallographic observation |
| 6 | **Electrical and Magnetic Materials** | Conducting and resisting materials – types, properties and applications; Semiconducting materials – properties and applications; Magnetic materials – Soft and hard magnetic materials and applications; Superconductors and dielectric materials – properties and applications; Smart materials; Sensors and actuators; Piezoelectric, magnetostrictive and electrostrictive materials. | ***International Standard***: https://ocw.mit.edu/courses/3-40j-physical-metallurgy-fall-2009/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***Industry Mapping:*** ANSYS/ MINITAB | W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India Chapter 18 & 20 | 6 | |

**Learning Resources**

**Text Book:**

1. R.K.Rajput, "Material Science and Engineering", 5th Edition, Katson Publications.

2. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
3. William F Smith, Hashemi, Prakash, "Materials Science and Engineering" Mc Graw Hill

**Reference Book:**

1. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
2. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.
3.. M.F. Ashby and D.R.H. Jones, Engineering Materials 1 - An Introduction to Properties, Applications and Design, Butterworth-Heinemann, USA, 2011.

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

Subject Name: Mechanics of Deformable Solids
Subject Code: PCCME302
Prerequisite: No Prerequisite

Credit: 3
Lecture Hours: 36

**Relevant Links:** STUDY MATERIALS

| Module No. | Topic | Sub-topics | Books and Chapters | Mapping with Industry and International Academia | Lecture Hours | Corresponding Lab Assignment |
|---|---|---|---|---|---|---|
| **1** | **Concept of Stress and Strain** | Deformation of bars: Hooke's law, stress, strain, and elongation; Tensile, compressive and shear stresses in 2D solids; Elastic constants and their relations; Volumetric, linear and shear strains; Principal stresses and strain; Principal planes; Mohr's circle | Strength of Materials, S.S. Rattan – Chapter 1<br><br>Mechanics of Materials, Beer, Johnston et al. – Chapter 7 | ***AICTE prescribed syllabus:***<br>https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***International Standards:***<br>https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/syllabus/<br><br>https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/<br><br>https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=ME%2080:%20Mechanics%20of%20Materials&academicYear=20172018<br><br>***Industry Mapping:***<br>ANSYS<br>https://www.ansys.com/en-in/academic/students | 8 | Analysing stress and deformation behaviour under tensile loading in ANSYS Mechanical |

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|---|---|---|---|---|---|---|
| **2** | **Mechanics of Beams** | Transverse loading on beams, point and distributed loads; Shear force and bend moment diagrams; Types of beam supports – simply supported, over-hanging, cantilevers, fixed and guided beams; Static determinacy and indeterminacy; Theory of bending of beams, pure bending stress distribution and neutral plane, second moment of area; Different cross-sections of beams; Shear stress distribution. | Strength of Materials, S.S. Rattan – Chapter 4, 5 | ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***International Standards*** : https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/syllabus/<br><br>https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/<br><br>https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=ME%2080:%20Mechanics%20of%20Materials&academicYear=20172018<br><br>***Industry Mapping:***<br>ANSYS<br>https://www.ansys.com/en-in/academic/students | 6 | Determining the shear force, bending moment and bending stress distribution of beams under transverse loading using ANSYS Mechanical. |
| **3** | **Deflection of Beams** | Deflection of a beam using the double integration method; Computation of slopes and deflection in beams; Myosotis method for computing deflections and slopes. | Strength of Materials, S.S. Rattan – Chapter 7 | ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***International Standards*** : https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/syllabus/<br><br>https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/<br><br>https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=ME%2080:%20Mechanics%20of%2 | 7 | Determining the deflection of different types of beams under different transverse loading using ANSYS Mechanical. |

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| | | | | 0Materials&academicYear=20172018<br><br>***Industry Mapping:***<br>ANSYS<br>https://www.ansys.com/en-in/academic/students | | |
| **4** | **Column Buckling** | Critical loads using Euler's theory; Different boundary conditions; Eccentric columns. | Strength of Materials, S.S. Rattan – Chapter 12<br><br>(Excluding beam-column with transverse loads) | ***AICTE prescribed syllabus:***<br>https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***International Standards*** :<br>https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/syllabus/<br><br>https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/<br><br>https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=ME%2080:%20Mechanics%20of%20Materials&academicYear=20172018<br><br>***Industry Mapping:***<br>ANSYS<br>https://www.ansys.com/en-in/academic/students | 4 | Carrying out Eigenvalue buckling analysis of columns using ANSYS Mechanical. |
| **5** | **Torsion of Shafts** | Torsion stresses and deformation of circular and hollow shafts; Polar moment of area, stepped shafts; Deflection of shafts fixed at both ends; Stresses and deflection of helical springs | Strength of Materials, S.S. Rattan – Chapter 10 | ***AICTE prescribed syllabus:***<br>https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***International Standards:***<br>https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/syllabus/<br><br>https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/ | 3 | Carrying out stress and deformation analysis of shafts under torsional loading using ANSYS Mechanical. |

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| | | | | https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/<br><br>https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=ME%2080:%20Mechanics%20of%20Materials&academicYear=20172018<br><br>***Industry Mapping:***<br>ANSYS<br>https://www.ansys.com/en-in/academic/students | | |
| **6** | **Energy Theorem** | Principle of virtual work; Minimum potential energy theorem; Castigliano's theorems; Maxwell reciprocity theorem. | Strength of Materials, S.S. Rattan – Chapter 7 | ***AICTE prescribed syllabus:***<br>https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***International Standards:***<br>https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/syllabus/<br><br>https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/<br><br>https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=ME%2080:%20Mechanics%20of%20Materials&academicYear=20172018<br><br>***Industry Mapping:***<br>ANSYS<br>https://www.ansys.com/en-in/academic/students | 4 | Determining the deformation of different structural elements using ANSYS Mechanical and validating the solutions obtained from energy method. |
| **7** | **Pressure Vessels** | Axial and hoop stresses in cylinders subjected to internal pressure; Deformation of thin and thick cylinders; Deformation in spherical shells | Strength of Materials, S.S. Rattan – Chapter 13 | ***AICTE prescribed syllabus:***<br>https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***International Standards:***<br>https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/syllabus/ | 4 | Carrying out stress and deformation analysis of pressure vessels using ANSYS Mechanical. |

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| | | subjected to internal pressure; Combined thermo- mechanical stress; Examples and case studies (boilers). | | https://ocw.mit.edu/courses/2-002-mechanics-and-materials-ii-spring-2004/<br><br>https://explorecourses.stanford.edu/search?view=catalog&filter-coursestatus-Active=on&q=ME%2080:%20Mechanics%20of%20Materials&academicYear=20172018<br><br>***Industry Mapping:***<br>ANSYS<br>https://www.ansys.com/en-in/academic/students | | |

**Course Outcomes:**

After completing this course,

1. They can recognize various types of loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.
2. They can evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
3. They will have a clear idea regarding selection of correct materials in different Cases like resisting bending stresses, deflection, torsion etc.
4. They can analyse different mechanical structures from strength and deformation point of view.

**Learning Resources:**

**Text Books**

1. Mechanics of Materials, F P Beer & E Russel Johnston, J T Dewolf, D F Mazurek,.Mc Graw Hill
2. Strength of Materials, S.S. Rattan, McGraw Hill
3. Strength of Materials, S.S. Bhavikatti, Vikas Publishing House

**Reference Books**

1. S Timoshenko 'Strength of Materials', CBS Publishers, 2011.
2. S. Ramamrutham & R. Narayanan, 'Strength of Materials', Dhanpat Rai Publishing Company, 2020.

**Online Learning Materials:**

1. Coursera: https://www.coursera.org/learn/mechanics-1
   https://www.coursera.org/learn/mechanics2
   https://www.coursera.org/learn/beam-bending
   https://www.coursera.org/learn/materials-structures

2. NPTEL: https://archive.nptel.ac.in/courses/112/107/112107147/#
   https://archive.nptel.ac.in/courses/105/105/105105108/
   https://nptel.ac.in/courses/105106172

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Manufacturing Processes I** **Credit: 3**

**Subject Code: PCCME303** **Lecture Hours: 36**

**Prerequisites:** Workshop Technology

**Relevant Links:** STUDY MATERIALS NPTEL

**Course Objective(s):**

The purpose of learning this course is to:

1. Motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties.
2. Impart through knowledge of casting, molding and forming which change the shape, size and form of the raw materials into the desirable product by conventional manufacturing methods.
3. Impart indepth learning on welding, welding defects and inspection.

| Module number | Topic | Sub-topics | TextBook & Chapter | Mapping with Industry and International Academia | Lecture Hours | Corresponding Lab Assignment |
|---|---|---|---|---|---|---|
| **1** | **Introduction** | History, Primary manufacturing processes, and classification Additive, subtractive and shaping processes; Relative | *Manufacturing Technolgy Vol 1- Foundry, Forming & Welding- P N* | ***International Standard:*** https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/pages/lecture-notes/ | 1 | |

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| | | advantages and limitations. | *Rao Chapter-1* | ***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf* | | |
| **2** | **Material Shaping Processes: Casting** | **Casting** Types of foundries, steps in making a casting; cast metals; casting types (sand, die, centrifugal, and investment casting), Heat transfer, Melting, pouring and solidification. Casting defects and residual stresses.<br><br>Moulding processes and their characteristics; shell moulding; moulding materials (Moulding sands: types, composition, properties); gating and risering (sprue, runner, gate & riser); melting furnaces;<br><br>Pattern material and type, allowances of patterns | ***Manufacturing Technolgy Vol 1-Foundry, Forming & Welding- P N Rao Chapter-3, 4***<br><br>***Manufacting science, Amitabha Ghosh and Asok Kumar Mallik, Chapter - 2*** | ***International Standard:*** https://ocw.mit.edu/courses/3-a04-modern-blacksmithing-and-physical-metallurgy-fall-2008/resources/mit3_a04f08_lec_casting/<br><br>https://ocw.mit.edu/courses/3-044-materials-processing-spring-2013/resources/mit3_044s13_lec09/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf*<br><br>https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf<br>***Industry Mapping:*** AutoCAD, Solidworks, ANSYS | 3<br><br>3<br><br>1 | 1. Design of product by solid work which will manufacture by casting.<br>2. derive an equation for the solidification time for the droplet in vacuum (an analog of Chvornikov's rule).<br>3. Using Solidworks optimize the gating and riser system design for a complex automotive engine block casting to minimize defects such as shrinkage porosity and ensure uniform solidification |

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| | | | | | | throughout the component |
| **3** | **Material Shaping Processes: Forming** | **Forming** Basic metal working concepts and plasticity; yield criterion; instability and anisotropy slip line fields; estimation of force and energy requirements and power calculation; technology of bulk and sheet metal forming processes; precision forming processes; various features of different types of metal forming dies; springback calculation;<br><br>Hot, and cold working, recrystallization, grain structure and lubrication principles of powder forming.<br><br>Basic principles, Classification, characteristics, equipment & tools, and applications of metal forming processes; Forging, Wire and tube drawing, deep drawing; Rolling; | *Manufacturing Technolgy Vol 1- Foundry, Forming & Welding- P N Rao Chapter-7, 8*<br><br>*Manufacting science, Amitabha Ghosh and Asok Kumar Mallik, Chapter - 2* | ***International Standard:*** https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf*<br><br>https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf<br>***Industry Mapping:*** AutoCAD, Solidworks, ANSYS | 4<br><br>2<br><br>4 | 1. Utilizing AutoForm simulate and optimize the progressive die stamping process for a high-strength steel automotive chassis component, considering factors such as material flow, springback, and die wear, to achieve improved part quality and production efficiency.<br>2. simulate and optimize the roll forming process for manufacturing complex structural profiles, such as those used in the construction industry, while ensuring precise dimensional accuracy, uniform |

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| | | Extrusion, bending, Shearing, parting, blanking, piercing & notching, Cupping (drawing), Spinning & deep drawing, Coining & embossing. | | | | material flow, and minimizing springback effects |
| **4** | **Joining and Fastening Processes:** | **Welding:** Physics of welding, welding energy sources, and their characteristics; arc characteristics; fluxes and coatings; weldability and welding of various metals and alloys; metallurgical characteristics of welded joints; Weld testing and inspection.<br><br>Welding processes, types, principles, equipments, characteristics & applications – arc welding, gas welding, MIG, TIG, SMAW, ESW, EBW, PAW, USW, Resistance welding; | *Manufacturing Technolgy Vol 1- Foundry, Forming & Welding- P N Rao Chapter-9 & 10* | ***International Standard:*** https://ocw.mit.edu/courses/3-37-welding-and-joining-processes-fall-2002/pages/syllabus/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf*<br><br>https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf<br>***Industry Mapping:*** AutoCAD, Solidworks, ANSYS | 3<br><br>4 | Using ANSYS or other software simulate and optimize the MIG/TIG/laser welding process for joining dissimilar materials, such as aluminum and steel, in automotive manufacturing, ensuring minimal distortion, maximum joint strength, and reduced heat-affected zone for enhanced structural integrity |
| | | Total | | | 25 | |

**Course Outcome(s) (COs):**

After completion of this course, the learners will be able to:

CO1. Understand the selection suitable manufacturing processes employed for making different products

CO2. Students can change the shape, size and form of the raw materials into the desirable product by conventional manufacturing methods.

CO3. Recommend the appropriate design of gating systems, forming processes, welding process.

CO4. Identify/control the appropriate process parameters, and possible defects of manufacturing processes so as to remove them.

**Learning Resources:**

**Text Book:**

1. Manufacturing Science-A Ghosh & A Mullick.
2. Manufacturing technology, Foundry, Forming & Welding-P.N Rao.

**Reference Book:**

1. Kalpakjian and Schmid, Manufacturing Processes for Engineering Materials (5thEdition)- Pearson India,2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley Publication.
3. Degarmo, Black&Kohser, Materials and Processes Manufacturing, Wiley Publication.
4. Mehta Gaira, Manufacturing Process, VivaBooks.
5. Principles of manufacturing materials &Processes-James & Campbell.
6. Manufacturing engineering &Technology-K Jain.

**Online resources**

1. https://archive.nptel.ac.in/courses/112/107/112107144/
2. https://archive.nptel.ac.in/courses/112/107/112107219/
3. https://archive.nptel.ac.in/courses/112/104/112104301/
4. https://onlinecourses-archive.nptel.ac.in/noc19_me20/preview
5. https://www.coursera.org/learn/advanced-manufacturing-process-analysis
6. https://www.coursera.org/specializations/digital-manufacturing-design-technology
7. https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/pages/lecture-notes/
8. https://ocw.mit.edu/courses/3-a04-modern-blacksmithing-and-physical-metallurgy-fall-2008/resources/mit3_a04f08_lec_casting/

9. https://ocw.mit.edu/courses/3-044-materials-processing-spring-2013/resources/mit3_044s13_lec09/
10. https://ocw.mit.edu/courses/3-044-materials-processing-spring-2013/pages/syllabus/
11. https://ocw.mit.edu/courses/3-37-welding-and-joining-processes-fall-2002/pages/syllabus/
12. https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes
13. https://web.mit.edu/course/2/2.810/www/files/lectures/lec3-mfg-processes-2018.pdf
14. https://web.mit.edu/2.810/www/files/lectures/2015_lectures/lec6-sheet-metal-forming-2015.pdf
15. https://web.mit.edu/course/2/2.810/www/files/lectures/lec9-sheet-metal-2019.pdf
16. https://web.mit.edu/2.810/www/files/lectures/lec3-mfg-processes-2019.pdf

University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

**Subject Name: Essential Studies for Professionals-IV**
**Subject Code: ESP301 Credit: 0.5 Lecture Hours:48**

| Module number | Topic | Sub- topics | Mapping with International/National/ State Level Exams | Lecture Hours | Corresponding Assignment |
|---|---|---|---|---|---|
| 1 | **Laws of Society** | Textbook:<br>IGNOU-Block 2<br>**BPSC- 102**<br><br>1. Union Executive- Composition, Powers and Functions Relationship with Parliament (Unit-8) https://egyankosh.ac.in/handle/123456789/57910<br><br>2. President & Vice President - Election, Power, Roles, Impeachment (Unit-8) | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf ), pg 25-26***<br>***2. UPSC Combined DefenceServices (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf ), pg20-21***<br>***3. Combined Graduate Levelconducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304 2023.pdf ) pg. 20-22***<br>***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf )State Level Exams:***<br>***1. Civil Services ExecutiveExam (WBCS) (https://wbpsc.gov.in/Download*** | 10 | Assignment: Compare the roles and powers of the President of India with those of other heads of state in different countries.<br><br>Class Discussion: Presidential vs. Parliamentary Systems: Pros and Cons<br><br>Debate: Reasons behind cabinet reshuffles and whether they are driven |

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| | | https://egyankosh.ac.in/handle/123456789/57910<br><br>PM and Council of Ministers- Appointment, Power, Roles, Formationof Council, Relationship with President. (Unit-8)<br>https://egyankosh.ac.in/handle/123456789/57910<br>3. (In Capsule Form) | *?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1*<br>*2.* **Miscellaneous ServicesRecruitment Examination**(https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf ***) pg 1*** | | by necessity or political considerations.<br>** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination |
| 2 | **Our Freedom Struggle** | **Textbook:**<br>**IGNOU- History of India1707-1950**<br>**BHIC-134**<br><br>1. Establishment of Colonial Power and Bengal Conquest by East India Company. (Unit- 3)<br>https://egyankosh.ac.in/handle/123456789/73867<br>2. Revolt of 1857(Unit-5) | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf ), pg 25-26***<br>***2. UPSC Combined DefenceServices (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf ), pg20-21***<br>***3. Combined Graduate Levelconducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304 2023.pdf ) pg. 20-22***<br>***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf ) State Level Exams:***<br>***1. Civil Services ExecutiveExam*** | 12 | 1. **Assignment:** Discuss the significance of Mangal Pandey's actions in Barrackpore and their impact on the outbreak of the revolt. "Exploring the Enduring Legacy of European Colonization in Indian Society, Politics, and Economy."<br><br>2. **Debate:** "Economic |

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| | | https://egyankosh.ac.in/handle/123456789/73867<br><br>(In Capsule Form) | ***(WBCS)*** ***(https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1***<br>***2.*** **Miscellaneous ServicesRecruitment Examination(*file:///C:/Users/UEMK/Downloads/2707970_2019.pdf*) *pg1*** | | Policies of the East India Company: Did Bengal Bear the Brunt of Wealth Drain?"<br><br>3. **Discussion:**<br>"Analyze the significance of the Battle of Plassey and Battle of Buxar in the Context of British Expansion in India."<br><br>4. **Assignment:**<br>"Military Tactics of the Marathas: Analyzing the Effectiveness of Guerrilla Warfare and Fortifications."<br><br>** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination. |
| | | **Textbook:**<br>**IGNOU-Block 1**<br>**BGGET- 141**<br>Egyankosh URL for subjectmatter:<br><br>1. Insights about Climate | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26***<br>***2. UPSC Combined DefenceServices (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg20-21***<br>***3. Combined Graduate Levelconducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/Uploa*** | | 1.Climate change Disasters and Disaster management of India<br>Assignment on: Innovative technologies and solutions being used or developed in India to mitigate the impacts of climate change and |

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| 3 | **Know Our Country** | of India and Climate change (Unit http://egyankosh.ac.in//handle/123456789/80897<br><br>2. Disasters and Disastermanagement of India (Unit4) http://egyankosh.ac.in//handle/123456789/80897<br><br>(In brief and Capsule Form) | ***dedFiles/notice_CGLE_0304 2023.pdf ) pg. 20-22***<br>***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023- Notification-Emp-News.pdf )***<br>***State Level Exams:***<br>***Civil Services Executive Exam(WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1***<br>***2.*** **Miscellaneous ServicesRecruitment Examination**(https://adda247jobs-wp- assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***) pg 1*** | 12 | enhance disaster preparedness and response.<br><br>** All the assignments are in line of GSPaper I of UPSC CSE Mains Examination. |
| 4 | **RBI, Bankingof India** | **1.** Banking System of Indiawith reference to RBI **(Textbook: IGNOU BECC-113, Unit-1)** http://egyankosh.ac.in//handle/123456789/89589<br><br>2.Capital Market **(Textbook: S.Y.B.A)** https://www.icsi.edu/media/webmodules/publications/CapitalMarketandSecuritesLaw.pdf | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf ), pg 25-26***<br>***2. UPSC Combined DefenceServices (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf ), pg20-21***<br>***3. Combined Graduate Levelconducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304 2023.pdf ) pg. 20-22***<br>***1. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment- 2023-Notification-Emp-News.pdf )***<br>***2. RBI Grade B (https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADV*** | | 1. Banking System of India with referenceto RBI<br>A debate on "recent monetary policy decision or financial regulation implemented by the RBI, thereby defending or criticizing the policy, and considering its impact on the economy, inflation, and banking stability."<br><br>2. Capital Market |

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| | | (In brief and Capsule Form) | ***TGRB09052023FA65E4F B1C2CF473396B4FD7E5 F69CDDE.PDF ), pg 22- 23***<br><br>***State Level Exams:***<br>***1. Civil Services ExecutiveExam (WBCS) (https://wbpsc.gov.in/Downlo ad?param1=20230225142430 _Syllabus.pdf&param2=advertisement ), pg 1***<br>***2.*** **Miscellaneous ServicesRecruitment Examination** (https://adda247jobs-wp- assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***) pg 1*** | | News analysis writing: Financial news analysis on current events in the capital market, and its impact on stock prices, and provide insights into market trends.<br><br>** All the assignments are in line of GSPaper I of UPSC CSE Mains Examination. |
| 5 | **Current Affairs andStatic GK:** | National News, International News, MOU's and agreements, Summits and Conclaves, Obituaries, Awards and Events, Sports, Important Days, Banking and Economic Awareness | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/defa ult/files/Notif-CSP-23-engl- 010223.pdf ), pg 25-26***<br>***2. UPSC Combined DefenceServices (https://upsc.gov.in/sites/defa ult/files/Notif-CDS-I-Exam- 2023-Engl-211222.pdf ), pg20-21***<br>***3. RBI Grade B (https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DA DVTGR B09052023FA65E4FB1C2C F473396B4FD7E5F69CDDE .PDF ), pg 22-23***<br>***4. IBPS Probationary officer(https://www.ibps.in/w p-content/uploads/Detailed- Advt.-CRP-PO-XII.pdf ) , Pg7.***<br>***5. Combined Graduate Levelconducted by SSC (https://ssc.nic.in/SSCFileSer ver/PortalManagement/Uploa dedFiles/notice_CGLE_0304 2023.pdf ) pg. 20-22*** | | 1. Discussion on National and International affairs<br>2. Discussion on MOU's and agreements, Summits and Conclaves<br>3. Discussion on recent Awards andEvents, Sports.<br>Discussion on EconomicAwareness |

| | | | | | |
|---|---|---|---|---|---|
| | | | ***6. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023- Notification-Emp-News.pdf )***<br>***State Level Exams:***<br>***1. Civil Services ExecutiveExam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1***<br>***2.*** **Miscellaneous ServicesRecruitment Examination**(https://adda247jobs-wp- assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***), pg 1*** | | |

**Reference Books:**

1. Current Affairs Magazine of IEM-UEM
2. Lucent GK

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Basic Electronic Engineering** **Credit: 2**

**Subject Code: ESCME381** **Lecture Hours: 36**

**Pre-requisite:** No Pre-requisite

**Objectives:**

To provide an overview of electronic device components to Mechanical engineering students

**Contents**

| Module & Topic | Sub-topics | Mapping with Industry and International Academia |
|---|---|---|
| **Module I: Semiconductor Devices and Applications** | Introduction to P-N Junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. IC based on 78XX and 79XX series, Introduction to BJT, it's input-output and transfer characteristics. | **NPTEL**<br>https://onlinecourses.nptel.ac.in/noc21_ee55/preview<br><br>**Linkedin**<br>https://www.linkedin.com/learning/electronics-foundations-basic-circuits/principles-of-basic-electronic-circuits?u=229219690<br><br>**Coursera**<br>https://www.coursera.org/learn/electronics |

| | | |
|---|---|---|
| **Module II: Operational amplifier and its applications** | Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non- inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator. | **NPTEL**<br>https://onlinecourses.nptel.ac.in/noc21_ee55/preview<br><br>**Linkedin**<br>https://www.linkedin.com/learning/electronics-foundations-basic-circuits/principles-of-basic-electronic-circuits?u=229219690<br><br>**Coursera**<br>https://www.coursera.org/learn/electronics |
| **Module III: Oscillators** | Positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator. | **NPTEL**<br>https://onlinecourses.nptel.ac.in/noc21_ee55/preview<br><br>**Linkedin**<br>https://www.linkedin.com/learning/electronics-foundations-basic-circuits/principles-of-basic-electronic-circuits?u=229219690<br><br>**Coursera**<br>https://www.coursera.org/learn/electronics |
| **Module IV: Digital Electronics Fundamentals** | Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic ICs, flip-flops, Block diagram of microprocessor/microcontroller and their applications. | **NPTEL**<br>https://onlinecourses.nptel.ac.in/noc21_ee55/preview<br><br>**Linkedin**<br>https://www.linkedin.com/learning/electronics-foundations-basic-circuits/principles-of-basic-electronic-circuits?u=229219690<br><br>**Coursera**<br>https://www.coursera.org/learn/electronics |
| **Module V: Electronic Communication Systems** | The elements of communication system, Transmission media: wired and wireless, | **NPTEL**<br>https://onlinecourses.nptel.ac.in/noc21_ee55/preview |

| | | |
|---|---|---|
| | need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system. | **Linkedin**<br>https://www.linkedin.com/learning/electronics-foundations-basic-circuits/principles-of-basic-electronic-circuits?u=229219690<br><br>**Coursera**<br>https://www.coursera.org/learn/electronics |

**Text Books:**


1. Floyd, Electronic Devices‖ Pearson Education 9th edition, 2012.


**Reference Books:**


2. R.P. Jain, ―Modern Digital Electronics‖, Tata Mc Graw Hill, 3rd Edition, 2007.
3. A.K. Maini & Nakul Maini - All-in-One Electronics Simplified, Khanna Book Publishing, 2021.
4. Frenzel, ―Communication Electronics: Principles and Applications‖, Tata Mc Graw Hill, 3rd Edition, 2001
5. Mittel, Basic Electrical Engineering, Tata McGraw Hill.


**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier and oscillators.
3. Understand logic gates, flip flop as a building block of digital systems.
4. Learn the basics of electronic communication system.

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Materials Testing Lab** **Credit: 1**

**Subject Code: PCCME391** **Lecture Hours: 24**

## Course Objective (s):

The purpose of learning this course is to:

1. Understand the relationship between microstructure & mechanical properties.
2. Understanding the uses of stiffness, friction, speed ratio using different testing machines.
3. Understand of different testing machines in the practical manufacturing field.
4. Understanding and apply knowledge of different destructive & nondestructive testing machines.

## Course Outcomes(s) (COs)

After completion of this course, learner will be able to:

CO1: Characterize different properties of materials and establish enhanced knowledge related to material properties and testing methods.
CO2: Understand and perform different types of testing methods and apply the same knowledge to perform the material related project works.
CO3: Improve skills related to manufacturing & material engineering field.
CO4: Create new abilities in manufacturing & material engineering field using the same knowledge & skill.

**Contents**

| Details of Experiments | Mapping |
|---|---|
| 1. Determining spring stiffness under tension and compressive loads; Strain gauge-based strain/ deflection/ force measurement of a cantilever beam<br>2. Tension Test and Compression Test of ductile and brittle materials: stress-strain diagram, determination of yield strength, ultimate strength, modulus of elasticity, percentage elongation and percentage reduction in areas, observation of fractured surfaces<br>3. Brinnell/ Vickers and Rockwell hardness tests on metallic specimens<br>4. Test for draw ability of sheet metals through cupping test Venturimeter Apparatus<br>5. Fatigue test of a typical sample<br>6. Sample preparation and etching of ferrous and non-ferrous metals and alloys for metallographic observation Friction In pipes<br>7. Experiments on heat treatment of carbon steels under different rates of cooling including quenching, and testing for the change in hardness and observing its microstructural changes through metallographic studies<br>8. Observation of presence of surface/ subsurface cracks using different non-destructive techniques, such as dye penetration (DP), ultrasonic test.<br>9. Impact test on a metallic specimen<br>10. Experiments on friction: determination of coefficient of friction/Moment of inertia of flywheel<br>11. Torsion test on ferrous material<br>12. Bending deflection test on beams | ***International Academia:*** https://ocw.mit.edu/courses/1-103-civil-engineering-materials-laboratory-spring-2004/pages/syllabus/<br><br>***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf<br><br>***Industry Mapping***: Minitab, ANSYS |

## Learning Resources:

**Text Book:**

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
3. R.K.Bansal, “Material Science and Engineering”, 5th Edition, Katson Publications

**Reference Book:**

4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Mechanical Engg Lab IIA (Manufacturing Process)** **Credit: 1**

**Subject Code: PCCME392** **Lecture Hours: 24**

**Prerequisites:** Workshop Technology

**Course Objective (s):** The purpose of learning this course is to:

1. To teach the process-level dependence of manufacturing systems through tolerances.
2. To expose the students to a variety of manufacturing processes including their typical use and capabilities.
3. To teach the important effects that manufacturing processes may have on the material properties of the processed part with a focus on the most common processes.
4. To teach the thermal and mechanical aspects, such as force, stress, strain, and Temperature, of the most common processes.

| Module number | Topic | Sub-topics | Mapping with Industry and International Academia | Lecture Hours | Corresponding Lab Assignment |
|---|---|---|---|---|---|
| 1 | **Metal Casting Lab:** | Pattern Design and making – for one casting drawing, Sand properties testing- Preparation of sand specimens and | ***International Standard:*** https://ocw.mit.edu/courses/3-a04-modern-blacksmithing-and-physical-metallurgy-fall-2008/resources/mit3_a04f08_lec_casting/ https://ocw.mit.edu/courses/3-044-materials-processing-spring- | 6 | 1. Use CAD software such as SolidWorks or AutoCAD to create a 3D model of the casting part based on the drawing. 2. Design a pattern based on the 3D model, considering factors such |

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| | | conduction of the following tests: Compression, Shear and Tensile tests on Universal Sand Testing Machine, Permeability test, Sieve Analysis to find Grain Fineness Number (GFN) of Base Sand, Clay content determination in Base Sand, Moulding Melting and Casting. | 2013/resources/mit3_044s13_lec09/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf*<br><br>https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf<br><br>***Industry Mapping:*** SolidWorks Simulation, ProCAST | | as parting line, draft angles, shrinkage allowance, and gating system. |
| **2** | **Welding Lab:** | ARC Welding Lap Joint and Butt Joint (Demonstration), TIG Welding, Spot Welding, Plasma welding and Brazing (Water Plasma Device), Study and Analysis of microstructures of Welded Bead. Introduction of LASER welding | ***International Standard:*** https://ocw.mit.edu/courses/3-37-welding-and-joining-processes-fall-2002/pages/syllabus/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf*<br><br>https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf<br><br>***Industry Mapping:*** AWS Welding Handbook, ANSYS, ImageJ, MATLAB, Minitab | 6 | 1. Demonstrate Arc/ Laser Welding using a simulation software or virtual welding system, focusing on joint configurations such as Lap Joint and Butt Joint.<br>2. Analyze the welded bead microstructures using microscopy and image analysis software.<br>3. Record the welding process, focusing on parameters such as current, voltage, travel speed, and electrode angle.<br>Analyze the weld beads formed in terms of penetration depth, bead shape, and weld quality using Minitab software. |

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| **3** | **Machine shop** | Taper turning, drilling, boring, shaping and milling operations<br><br>Measurement of cutting forces in Milling/ Turning process | ***International Standard:*** https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf*<br><br>***Industry Mapping:*** Autodesk Fusion 360, SolidWorks CAM, Mastercam | 6 | 1. CNC machining simulations using software such as CNC Simulator Pro or G-code simulators.<br>2. Create a 3D model of the workpiece using CAD software such as SolidWorks or Autodesk Inventor. Import the 3D model into CAM software such as Mastercam or Fusion 360 CAM. Generate toolpaths for each machining operation, optimizing parameters such as tool selection, feeds, speeds, and cut depths.<br>2. Identify common machining issues such as tool chatter, tool wear, dimensional inaccuracies, surface finish defects, and chip evacuation problems |
| **4** | **Mechanical Press working Lab:** | Blanking & Piercing operation and study of simple, compound and progressive press tool, Hydraulic Press: Deep drawing and extrusion operation (Virtual Lab), Bending and other operations. | ***International Standard:*** https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf*<br><br>https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf | 6 | 1. Conduct a virtual study of blanking & piercing operations using simulation software like AutoForm or LS-DYNA.<br>2. Study the design and operation of die and simple, compound, and progressive press tools using 3D modeling software like SolidWorks or CATIA.<br>3. Study bending operations using 3D modeling software, focusing on various bending techniques |

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|---|---|---|---|---|---|
| | | | ***Industry Mapping:*** Simufact Forming, AutoForm | | such as air bending, coining, and bottoming. |
| **5** | **Smithy Lab:** | To familiarize with some of the basic practical skills required for Smithy work which is applied in applications like chisel, Bolts, Crane hooks. | ***International Standard:*** https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/pages/lecture-notes/<br><br>***AICTE-prescribed syllabus/IIT Syllabus:*** *https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf*<br><br>https://people.iitism.ac.in/~academics/assets/course_structure/new/cat/mech/MEI102.pdf<br><br>***Industry Mapping:*** SolidWorks, creo | 6 | 1. Use industry-relevant software tools such as Anvil or SolidWorks to create 3D models of the intended forged items, providing students with visual references for their projects.<br>2. design and fabricate functional items such as specialized chisels, custom bolts with unique heads, and crane hooks with enhanced load-bearing capabilities. Use industry-relevant software tools such as Autodesk Forge or Blender to facilitate the design process, allowing students to create detailed 3D models of their proposed forged items. |

**Course Outcome(s) (LOs):**

After completion of this course, learner will be able to:

CO1: Get practical idea about the suitable material and manufacturing processes employed for making particular products

CO2: Understand the working principle and application of manufacturing process to change the shape, size and form of the raw materials into the desirable product by conventional manufacturing methods.

CO3: Apply practical understanding for use of manufacturing tools and identify the effect of process variables to manufacture defect free products

CO4: Plan and create job using different manufacturing process.

**Learning Resources:**

**Text Book:**

3. Manufacturing Science-A Ghosh & A Mullick.
4. Kalpakjian and Schmid, Manufacturing Processes for Engineering Materials (5thEdition)- Pearson India,2014

**Reference Book:**

7. Manufacturing technology, Foundry, Forming & Welding-P.N Rao.
8. Manufacturing Engineering & Technology-S Kalpakjian; Pub:Addison Wesley.
9. Manufacturing engineering &Technology-K Jain.

**Online Learning Resources:**

https://web.mit.edu/course/other/machineshop/Physics/

**NPTEL**

1. https://onlinecourses.nptel.ac.in/noc24_me48/preview

**Subject Name: Project I (CAD Based)** **Credit: 1**

**Subject Code: PRJME381** **L-T-P : 0-0-2**

**Pre-Requisites: Engineering Graphics & Design, Workshop/Manufacturing Practices**

**Course Objective(s):**

The Purpose of learning of this course is to:

1. To provide profound / in depth knowledge of CAD software.
2. To acquire knowledge of steps involved in design and drawing activity.
3. To be efficient in drawing mechanical components from design data.
4. To be efficient enough to generate drawing from mechanical components in their physical form.
5. To provide basic knowledge of 3D printing/sheet metal/molding/forging/ CNC operation.
6. To create the ability to read, understand and execute the engineering drawing to manufacture a product, for a given mechanical project using 3D printing, molding/ forging/ CNC operation.

**Course Content**.

| Sl. No. | Contents | Hours |
|---|---|---|
| 1 | Recapitulation of basic AutoCAD commands. Introduction of advanced commands. | 4 |
| 2 | Uses of measuring tool for a given component/objects and converts it into production drawing. | 4 |
| 3 | Basics of 3D modeling software interface, sketching, basic editing commands and dimensioning concept. | 4 |
| 4 | Basic knowledge of 3D printing /sheet metal/molding/forging/CNC operation. | 6 |
| 5. | Report submission based on analysis of the model. | 4 |
| 6. | Presentation of the final project work. | 2 |

**Course Outcome:**

CO1. Understand the uses of CAD tools in production and research and apply them in research/ project work.

CO2. Apply knowledge of engineering graphics in 3D model design.

CO3. Analyze and evaluate the models to obtain its applicability.

CO4. Understand the importance of team work and create technical solution through delivery of the project goal.

**Learning Resources:**

1. A Text Book of Engineering Drawing, ND Bhatt, Charotar Publication, 2022.

2. AutoCAD 2023 Instructor, J. Leach, CRC Press, 2023.

3. The 3D Printing Handbook: Technologies, Design and Application – Ben Redwood, Filemon Schoffer, Brain Garret, Coers & Roest, 2017.

4. Manufacturing Technology, P. N. Rao, McGraw Hill Education, 2013.

**Subject Name: Skill Development for Professionals- III**
**Subject Code: SDP301 Credit: 0.5 Lecture Hours:48**

| Module number | Topic | Sub- topics | Mapping with International/National/ State Level Exams | Lecture Hours | Corresponding Assignment |
|---|---|---|---|---|---|
| 1 | **Quantitative Aptitude** | **Textbook:** Quantitative Aptitude for Competitive Examination **Author:** R.S Agarwal **Publishing House:** S. Chand<br><br>Simple & Compound Interest, Number System, Quadratic Equations | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf ), pg 25-26***<br>***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam- 2023-Engl-211222.pdf ), pg 20-21***<br>***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf ) pg. 20-22***<br>***4.Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf )*** | 12 | **1. Simple & Compound Interest:**<br>**• Simple Interest Applications:**<br>○Calculate the total interest and amount payable on a loan with simple interest.<br>○Determine the time required to double an investment with simple interest.<br>○Compare the simple interest earned on different principal amounts or at different interest rates.<br>**• Compound Interest Applications:**<br>○Calculate the compound interest and final amount of an investment over multiple years.<br>○Compare the growth of an investment with different compounding frequencies (annual, semi-annual, quarterly, monthly).<br>○Determine the time required to double or triple an investment with compound interest.<br>○Understand the concept of effective annual rate (EAR) and how it relates to nominal interest rates and compounding frequencies.<br><br>**2. Number System:**<br>**• Divisibility Rules:**<br>○Test the divisibility of numbers by 2, 3, 4, 5, 6, 8, 9, 10, and 11.<br>○Apply divisibility rules to simplify calculations and solve problems. |

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| | | | ***State Level Exams:***<br>***1. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1***<br>***2.* Miscellaneous Services Recruitment Examination** (https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf ***) pg 1*** | | • **Prime and Composite Numbers:**<br>○Identify prime and composite numbers.<br>○Find the prime factorization of composite numbers.<br>○Use prime factorization to find the highest common factor (HCF) and least common multiple (LCM) of numbers.<br>• **Number Properties:**<br>○Understand the concepts of even and odd numbers, natural numbers, whole numbers, integers, rational and irrational numbers.<br>○Solve problems involving the properties of these number types.<br><br>**3. Quadratic Equations:**<br>• **Solving Quadratic Equations:**<br>○Solve quadratic equations using factoring, completing the square, and the quadratic formula.<br>○Determine the nature of roots (real, equal, imaginary) of a quadratic equation.<br>**Word Problems:**<br>○Apply quadratic equations to solve real-world problems, such as finding the dimensions of a rectangle given its area and perimeter, or determining the trajectory of a projectile.<br>• **Quadratic Functions and Graphs:**<br>○Graph quadratic functions and interpret the graph to find the vertex, axis of symmetry, and intercepts.<br>Use the graph to solve quadratic equations and inequalities. |
| | | **Textbook:** Verbal and Non- Verbal reasoning<br>**Author:** R.S Agarwal | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf ), pg 25-26***<br>***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam- 2023-*** | | **2. Classification Based Puzzles:**<br>• **Grouping by Attributes:** Provide a list of items (e.g., animals, fruits, professions) and ask students to classify them into groups based on shared characteristics (e.g., habitat, color, skill set).<br>• **Identifying the Odd One Out:** Present a group of items where one does not belong and have students explain why it is different from the others.<br>• **Missing Item:** Give a set of items with a pattern and have students determine the missing item that fits the pattern. |

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| 2 | **Logical Reasoning** | **Publishing House:** S. Chand<br><br>Puzzle<br>Classification<br>Sequential<br>Selection<br>Ranking Based Puzzle<br>Blood Relation Based Puzzle<br>Inequality | ***Engl-211222.pdf ), pg 20-21***<br>***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf ) pg. 20-22***<br>***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf ) State Level Exams:***<br>***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1***<br>***2.* Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf ) pg 1*** | 12 | **3. Sequential Based Puzzles:**<br>• **Logical Sequencing:** Present a series of events or actions and have students arrange them in a logical order.<br>• **Number Series:** Give a series of numbers with a pattern and ask students to find the missing number or continue the series.<br>**4. Letter Series:** Provide a series of letters with a pattern and have students determine the missing letter or continue the series.<br>**5. Selection Based Puzzles:**<br>• **Team Selection:** Provide a set of candidates with different skills and have students select the best team for a specific task.<br>• **Item Selection:** Give a list of items with different attributes and ask students to choose the most suitable item for a given purpose.<br>• **Eligibility Criteria:** Present a set of rules or conditions and have students determine which candidates are eligible or ineligible based on those criteria.<br><br>**6. Ranking Based Puzzles:**<br>• **Height/Weight Arrangement:** Arrange a group of people in ascending or descending order based on their height or weight.<br>• **Marks/Scores:** Order students or players based on their marks, scores, or performance in a competition.<br>• **Preferences:** Determine the order of preference for a group of people based on their likes and dislikes.<br><br>**7. Blood Relation Based Puzzles:**<br>• **Family Tree:** Present a family tree with missing information and have students deduce the relationships between different members.<br>• **Coded Relationships:** Use codes or symbols to represent relationships and ask students to decode them.<br>**8. Puzzles with Statements:** Give a set of statements about the relationships between people |

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|---|---|---|---|---|---|
| | | | | | and have students draw a family tree or answer questions based on those statements.<br>**9. Inequality Puzzles:**<br><br>• **Coded form of Inequalities**<br>• **Either-Or Case**<br>• **Neither -Nor Case**<br>**10. Single Statement Inequalties** |
| 3 | **Verbal English** | **Textbook:** Objective General English<br>**Author:** R.S Agarwal<br>**Publishing house:** S. Chand<br><br>1. Application of Adjectives and Determiners<br>2. Conjunction and Connectors<br>3. Rearran gement of Sentenc es.<br>4. Multiple Fillers- Level 1 | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf ), pg 25-26***<br>***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam- 2023-Engl-211222.pdf ), pg 20-21***<br>***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_030420 23.pdf ) pg. 20-22***<br>***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf )***<br><br>***State Level Exams:***<br>***1. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430*** | 12 | **1. Application of Adjectives and Determiners:**<br>• Identification of Errors<br>• Comparative and Superlative Forms<br>• Types of Adjectives<br>• Determiners in Context<br><br>**2. Conjunctions and Connectors:**<br>• Sentence Combining<br>• Coordinating vs. Subordinating Conjunctions<br>• Transition Words and Phrases<br>• Connectors for Cause and Effect<br><br>**3. Rearrangement of Sentences:**<br>• Jumbled Sentences<br>• Paragraph Sequencing<br><br>**4. Multiple Fillers - Level 1:**<br>• Cloze Passages<br>• Sentence Completion<br><br>**5. Reading Comprehension:**<br>• Inference Questions<br>• Vocabulary in Context<br>• Main Idea and Supporting Details<br>• Critical Thinking Questions<br><br>**6. Precise Writing:**<br>• Summarizing<br>• Paraphrasing<br>• Editing for Conciseness |

| | | | | | |
|---|---|---|---|---|---|
| | | 5. Reading Comprehension<br>Precise Writing | ***Syllabus.pdf&param2=advertisement, pg 1***<br>**Miscellaneous Services Recruitment Examination** (https://adda247jobs-wp- assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***) pg 1*** | | |
| 4 | **Data Interpretation** | **Textbook:**<br>Quantitative Aptitude for Competitive Examination<br>**Author:** R.S Agarwal<br>**Publishing House:** S. Chand<br><br>Advanced Level:<br>Bar Graph | ***National Exams:***<br>***1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf ), pg 25-26***<br>***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam- 2023-Engl-211222.pdf ), pg 20-21***<br>***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_030420 23.pdf ) pg. 20-22***<br>***1. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment- 2023-Notification-Emp- News.pdf )***<br>***2. RBI Grade B (https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADVTGRB09052023FA65E4FB1C2CF473396B4FD7E5*** | 12 | **7.** Application of Data Analysis based on Bar Chart |

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|---|---|---|---|---|---|
| | | | ***F69CDDE.PDF ), pg 22-23***<br><br>***State Level Exams:***<br>***1. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement ), pg 1***<br>***2.* Miscellaneous Services Recruitment Examination** (https://adda247jobs-wp- assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***) pg 1*** | | |

# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

# Minor Degree

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **:** | **Introduction to Robotics** | **Credits** | **:** | **4 (L: 3; T: 1; P: 0)** |
| **Course Code** | **:** | **RBME301** | | | |
| **Course Category** | **:** | **MD** | | | |

**Course Objective:** This course aims to familiarize students with basic terminologies of the robotics sciences and essential knowledge required to get started in the field of Robotics.

## Course Contents:

**Module 1 : Introduction to robotics :** Brief History, Basic Concepts of Robotics such as Definition , Three laws, Elements of Robotic Systems i.e. Robot anatomy, DOF, Misunderstood devices etc., Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc., Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

**Module 2: Grippers and Sensors for Robotics:** Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system.
Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

**Module 3: Drives and Control for Robotics:** Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control

**Module 4: Programming and Languages for Robotics**: Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, Python, ROS etc., Development of languages since WAVE till ROS.

**Module 5: Related Topics in Robotics:** Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, New trends & recent updates in robotics.

**Text Books/References:**


1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014)
2. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006)
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019)
4. R. K. Mittal, I. J. Nagrath, Robotics and Control, TATA McGraw Hill Publishing Co Ltd, New Delhi (2003)
5. S. B. Niku, Introduction to Robotics – Analysis, Contro, Applications, 3rd edition, John Wiley & Sons Ltd., (2020)
6. J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms, Springer (1997)
7. Mikell Groover, Mitchell Weiss, Roger N. Nagel, Nicholas Odrey, Ashish Dutta, Industrial Robotics 2nd edition, SIE, McGraw Hill Education (India) Pvt Ltd (2012)
8. R. D. Klafter, Thomas A. Chmielewski, and Mechael Negin, Robotic Engineering – An Integrated Approach, EEE, Prentice Hall India, Pearson Education Inc. (2009)


**Alternative SWAYAM/NPTEL Course:**

| NPTEL Course Name | Instructor | Host Institute |
|---|---|---|
| Introduction to robotics | Dr. Krishna Vasudevan, Dr. Balaraman Ravindran, Dr. T Asokan | IIT Madras |
| Sensors and Actuators | Prof. Hardik Jeetendra Pandya | IISc Bangalore |

## Course Outcomes:

After completion of course, students would be able:

1. To express his views as per terminologies related to Robotics technology.
2. To apply logic for selection of robotic sub systems and systems.
3. To analyse basics of principals of robot system integration.
4. To understand ways to update knowledge in the required area of robotic technology.

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# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
Institute of Engineering & Management, Jaipur

**Subject Name: Energy and its Resources** **Credit: 3**

**Subject Code: SEEME301**

**Lecture Hours:** 40 [Lecture (15hours), Practical (10hours), Social (15hours)]

**Pre-requisite: None**

**Relevant Links:**

**STUDY MATERIAL** **NPTEL**

## COURSE OBJECTIVES:

This course will offer

- Understanding of energy units, unit conversion, unit magnitudes
- Description and quantification of various energy resources – renewable and nonrenewable
- Understanding energy needs of self, institution, country and world, energy consumption by sector
- Debate on advantages and disadvantages of energy sources
- Energy resources of India and World, Sankey diagrams
- Wind, biomass and solar energy resources
- Per capita energy consumption and impact on social and economic parameters ● Future scenarios of energy requirements

## COURSE OUTCOMES:

Possible outcome of course is ability to:

**CO1:** Quantify energy usage at various levels (individual, country, world)

**CO2:** Debate on use of renewable and non-renewable energy sources

**CO3:** Correlate energy consumption with social and economic parameters

**CO4:** Understand availability of renewable energy resources in a given region. Comment on possible future energy scenario

# Course Content

### A. Theoretical Learning

Each lecture is assumed to be of one hour. In content column, if possible breakdown the content of 1 hour in sub-topics

| Lecture No. | Contents |
|---|---|
| 1 | **Energy and its units:** discussion on role of energy in our lives, various sources of energy that we use, units of energy, small and large units of energy, magnitude of energy units, units for energy consumption of individual, institution and country |
| 2 | **Renewable and Non-renewable energy:** difference, characteristics of resources, advantages and disadvantages, discussion in class on which type of resources to be used by individual, by a country, reason out why? |
| 3 | **Understanding individual energy requirements:** take a case of any student, discuss what energy resources he/she uses, differentiate between energy and power, estimating electrical energy needs, estimating fuel energy needs (petrol/diesel), estimating cooking energy needs, convert all energy sources in single energy units, estimate total energy needs of a person, discussion on possible growth on energy demand, should it grow or not? |
| 4 | **Energy requirements of a country:** evolution of energy consumption, population of country, number of demands for energy, per demand energy, estimating energy consumption of country, discussion on possible growth on energy demand, should it grow or not? |

| | |
|---|---|
| 5 | **World energy scenario- consumption:** energy consumption of world, by resources, by sector, per capita electricity and total energy consumption, comparison among countries and between continents, relationship between Human Development Index (HDI) and energy consumption, discussion in the class on disparity in energy consumption |
| 6 | **World's energy resources – non-renewable:** fossil fuels like coal, oil gas as energy resources, difference between reserves and resource, current production and consumption rates of fossil fuels, peak oil, first and second oil shock, discussion on limited nature of the fossil fuels, whether peak oil would ever come? |
| 7 | **World energy flows:** world energy consumption, total primary energy supply (TPES), total final consumption (TFC), Sankey diagram for depicting energy flow, draw Sankey diagram for world energy flow and few selected countries, |
| 8 | **India's energy scenario – non-renewable:** India's energy consumption from all resources, consumption of oil, coal, gas, import of fossil resources, foreign exchange requirements, discussion on energy security of country and imports dependency. |
| 9 | **Renewable energy sources:** what are renewable energy sources? Why they are renewable? Summary of all RE resources, global scenario of these resources |
| 10 | **Wind and Biomass resources in India**: discussion on origin of these resources, potential of these resources in India, how these resources are converted into useful energy, |
| 11 | **Solar energy resources:** Sun as source of energy, solar energy reaching the Earth's surface, solar spectrum, photons of different energy, solar irradiation and solar radiation/insolation, extra-terrestrial solar radiation, global, direct and diffuse solar radiation |
| 12 | **Quantifying solar energy resources**: units of solar energy, air mass, AM1.5 and standard test conditions; hourly, daily, monthly and yearly solar radiation, solar radiation maps of India and world, variation of solar radiation at a given location within a day, over a season and reason behind it, significance of summer and winter solstice |
| 12 | **Finding solar radiation data**: measuring solar radiation data, meteorological stations, sources of solar radiation data for various cities of India |
| 13 | **Optimal collection of solar radiation:** apparent motion of sun and earth, apparent position of sun for an observer, optimal angle of solar collectors for maximum solar radiation collection, optimum angle for summer and winter |
| 14 | **Hydrogen energy:** source and storage medium, generation of hydrogen, storage of hydrogen, conversion of hydrogen into useful energy, future of hydrogen |

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|---|---|
| 15 | **Future energy scenarios:** summary of the class, students to summarize their experiences in the form of poster on any one topic, discussion on what are possible scenarios? |

## B. Practical Learning

In contents please provide as detailed titled of the experiments as possible, also break down experiments in sub experiments to give clear indication on what are the concepts/observations students are expected to learn in each experiment.

| Experiment No. | Contents |
|---|---|
| Note | Conduct any of the five experiments listed below |
| 1 | Measure instantaneous solar irradiation (W/m2) inside a classroom, under cloudy condition (if possible), and under clear sunny sky and compare.<br><br>Measure 8 to 10 readings of instantaneous solar irradiation over couple of hours and based on readings estimate the solar insolation ($kWh/m^2$) falling over duration of experiment day of experiment |
| 2 | On the day of experiment, take a solar panel out under the sunlight and measure its short circuit current under various orientation of solar panel with respect to the Sun. Note down reading, compare the variation in measured current values and compare and comment on variation in the values. |
| 3 | Measure energy consumption of a light and a fan (or any other appliance) in your lab using power meter / energy meter over the duration of experiment. Also do the theoretical estimation of possible energy consumption by the appliances over the same time. Compare both and comments. |
| 4 | Figure out from which point electricity is entering your campus, how it is being measured (visit the site), check if you can take any reading, discuss the electrical supervisor on daily, monthly electricity consumption of the campus, discuss the variation of electricity consumption with season and reason behind it. Make summary of your observations. |

| | |
|---|---|
| 6 | Visit canteen of your campus, make a list of all appliances used in campus, note down the hours of usage and estimate daily and monthly electricity consumption of canteen.<br><br>Also estimate how much energy is consumed in canteen through other fuels like LPG or coal or any other sources. |
| 7 | Debate on which energy sources to be promoted, students are to be divided in 4 or 5 groups, each group representing different source, each group presents their idea why that particular source should be promoted, the task of the whole class is to come to a conclusion on use of a particular source |

## C. Social Learning

This activity would be most crucial and needs careful design. This includes activities outside the classroom and outside the laboratory. Students must do something to apply their knowledge. This can also be exercise to apply the knowledge learned in classroom and laboratory and gather more information/data from society on a topic.

| **Social experiment No.** | **Contents** |
|---|---|
| Note | Conduct any of the three experiments / exercises |
| 1 | Estimate the monthly energy consumption of your own family, include energy consumption from electricity, petrol, diesel, LPG, public transportation, etc. Make a brief report on it. |
| 2 | Make a brief report on energy consumed for food production and consumption, collect the data on energy consumed on per meal basis |
| 3 | Estimate the energy consumption of an industry / start-up /institution in your area, include energy consumption from electricity, petrol, diesel, LPG, public transportation, etc. Make a brief report on it. |
| 4 | Write a brief 2-page report on total annual energy consumption of any country, other than India. Include energy consumed from all resources, and draw its Sankey diagram. |
| 5 | Write a brief 2-page report on annual renewably energy consumption of any country, other than India. Include energy consumed from all resources, and draw its Sankey diagram. |

| | |
|---|---|
| 6 | Measure instantaneous solar radiation at your location, collect reading every hour from 10am to 4pm. Use a pyranometer or solar cell. Prepare a report on it. Assuming similar radiation falling on entire city. How much total solar energy would be falling on your city/village over those three days? |

## TEXT BOOK AND OTHER REFERENCES:


- Energy flow of a country is presented using Sankey diagram. This link offers you to draw Sankey diagram for energy country, it also offers you to select a particularly timeline, a country, a region, etc.

  https://www.iea.org/sankey/
- World Energy report https://www.iea.org/reports/world-energy-outlook-2021
- Report- Statistical Review of World Energy -2021, 70th edition; https://www.bp.com/en/global/corporate/energy-economics/statistical-review-ofworld-energy.html
- Knowledge Centre, Ministry of New & Renewable Energy - Government of India https://mnre.gov.in/
- Ch. Pavan Kalyan and M. Pavan Das, Future Energy Scenario: A Better Planet with Renewable Energy, 2020
- Chapter 01 and 09, S. P. Sukhatme and J. K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw Hill, 2008
- Chapter 01 and 12, C. S. Solanki, Solar Photovoltaics – Fundamentals, Technologies and Applications, 3rd Ed. Prentice Hall of India, 2016
- Ankur Mathur, Non-Conventional Sources of Energy, Laxmi Publications Pvt. Ltd., 2015
- John Twidell, Tony Weir, Renewable Energy Resources, Taylor & Francis, 2005
- Andrew L. Simon, Energy Resources, Elsevier Science, 2013

## ONLINE RESOURCES:

COURSERA (course 1)  COURSERA (course 2)

**Subject Name:** Artificial Intelligence and Machine Learning

**Credit: 3**

**Subject Code:** AIML-01

**Course Objective:**

- To review and strengthen important mathematical concepts required for AI & ML.
- Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

**Course Contents:**

[Total Theory Duration: 42 Lectures] Module 1: [Duration: 12 Lectures]
Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.

Module 2: [Duration: 8 Lectures]
Idea of Machines learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.

Module 3: [Duration: 10 Lectures]
Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.

Module 4: [Duration: 7 Lectures]
Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multiclassification (One vs All), Problem of Overfitting.

Module 5: [Duration: 5 Lectures]
Discussion on clustering algorithms and use-cases cantered around clustering and classification. Lab Work:

1. Implementation of logical rules in Python.
2. Using any data apply the concept of:
    a. Liner regression
    b. Gradient decent
    c. Logistic regression

3. To add the missing value in any data set.
4. Perform and plot under fitting and overfitting in a data set.
5. Implementation of clustering and classification algorithms.

Text Books/References:


1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
3. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.
4. Jeeva Jose, Introduction to Machine Learning, Khanna Publishing House, Delhi.
5. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
6. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
7. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.


## Corresponding Online Resources:

1. Artificial Intelligence, https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Course Outcomes: After completion of course, students would be able to:

1. Design and implement machine learning solutions to classification, regression and clustering problems.
2. Evaluate and interpret the results of the different ML techniques.
3. Design and implement various machine learning algorithms in a range of Real-world applications.

# MANDATORY ADDITIONAL REQUIREMENT (MAR)

- Tech Fest/Fest/Teachers' Day/Fresher's Welcome
- Rural Reporting
- Tree Plantation
- Participation in Relief Camps (Collection of funds/materials for the Relief Camp)
- Animal Welfare Camp
- Participation in Debate/Group Discussion/Tech Quiz/Quiz
- Publication of Wall Magazine in institutional level (magazine/article/internet)
- Publication in Newspaper, Magazine and Blogs
- Research Publication
- Innovative Projects (other than course curriculum)
- Blood donation
- Participation in Sports/Games (College level /University level / District level / State level National/International Level)
- Cultural Programme (Dance, Drama, Elocution, Music etc.)
- Member of Professional Society /Student Chapter
- Relevant Industry Visit & Report
- Activities in different Clubs (Photography / dance/drama etc. Club)
- Participation in Yoga Camp
- Adventure Sports with Certification
- Training to under-privileged/differently able
- Community Service & Allied Activities

- Self-Entrepreneurship Programme (Organize Entrepreneurship Workshop /To take part in Entrepreneurship Workshop /Video Film-Making on Entrepreneurship /Submit Business Plan on any / To work for start-up/as entrepreneur)

## Massive open online course MOOCs

https://docs.google.com/spreadsheets/d/e/2PACX-1vSPMVrWoo0ZsAac7v1Cxx5bZ4qFUVTRpc5hjGr-krusAZcY_M70guTum2z7S2SmdsbpmgD7WbL_3aNU/pubhtml