# FACULTY OF ENGINEERING &TECHNOLOGY

## SYLLABUS FOR

# B.TECH.

# (MECHANICAL ENGINEERING)

**(Credit Based Evaluation and Grading System)**

## (SEMESTER: I-VIII)

## Batch From Year 2020 to Year 2024

# GURU NANAK DEV UNIVERSITY

# AMRITSAR

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# SCHEME

***B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | CYL197 | Engineering Chemistry | 3 | 0 | 1 | 4 |
| **2.** | MTL101 | Mathematics-I | 3 | 1 | 0 | 4 |
| **3.** | ECL119 | Basic Electrical &Electronics Engineering | 4 | 0 | 1 | 5 |
| **4.** | CSL126 | Fundamentals of IT & Programming using Python | 2 | 1 | 1 | 4 |
| **5.** | ENL101 | Communicative English | 2 | 0 | 0 | 2 |
| **6.** | | Elective-I | 2 | 0 | 0 | 2 |
| **7.** | MEP101 | Workshop Practices | 0 | 0 | 2 | 2 |
| **List of Electives–I:** | | | | | | |
| **1.** | PBL121 | Punjabi (Compulsory)**OR** | 2 | 0 | 0 | 2 |
| **2.** | PBL122* | ਮੁੱਢਲੀ ਪੰਜਾਬੀ | 2 | 0 | 0 | |
| **3.** | HSL101* | Punjab History & Culture (1450-1716) **OR** | 2 | 0 | 0 | |
| | | **Total Credits:** | **16** | **2** | **5** | **23** |

**Note:**

1. *** Special Paper in lieu of Punjabi Compulsory, For those students who are not domicile of Punjab.**
2. **Students are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.**

*B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester*

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | CEL120 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| **2.** | MEL120 | Engineering Graphics & Drafting | 2 | 0 | 2 | 4 |
| **3** | MTL102 | Mathematics-II | 3 | 1 | 0 | 4 |
| **4.** | PHL183 | Physics | 3 | 1 | 1 | 5 |
| **5.** | MEL110 | Introduction to Engg. Materials | 3 | 0 | 0 | 3 |
| **6.** | | Elective-II | 2 | 0 | 0 | 2 |
| **7.** | SOA101 | Drug Abuse: Problem, Management and Prevention(Compulsory Paper)) | 2 | 0 | 0 | 2 |
| **List of Electives–II:** | | | | | | |
| **1.** | PBL131 | Punjabi (Compulsory)**OR** | 2 | 0 | 0 | 2 |
| **2.** | PBL132* | ਮੁੱਢਲੀ ਪੰਜਾਬੀ | 2 | 0 | 0 | |
| **3.** | HSL102* | Punjab History & Culture (1717-1947) **OR** | 2 | 0 | 0 | |
| | | **Total Credits:** | **18** | **3** | **3** | **24** |

**Note:**

1. *** Special Paper in lieu of Punjabi Compulsory, For those students who are not domicile of Punjab**
2. **Students are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.**

***B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MTL201 | Mathematics-III | 3 | 1 | 0 | 4 |
| **2.** | MEL 211 | Solid Mechanics | 3 | 1 | 0 | 4 |
| **3.** | MEL 213 | Thermodynamics- I | 3 | 1 | 0 | 4 |
| **4.** | MEL 214 | Engineering Materials | 3 | 0 | 0 | 3 |
| **5.** | MEL 215 | Machine Drawing | 3 | 1 | 1 | 5 |
| **6.** | ESL 220 | Environmental Studies (Compulsory Paper) | 2 | 0 | 0 | 2 |
| **7.** | | | | | | |
| **List of Practicals** | | | | | | |
| **1.** | MEP 211 | Solid Mechanics Lab | 0 | 0 | 1 | 1 |
| **2.** | MEP 214 | Engineering Materials Lab | 0 | 0 | 1 | 1 |
| **3.** | MEP 216 | Summer Training***** | - | - | - | S/US |
| **4.** | MEP 218 | Basic Simulation Lab | 0 | 0 | 1 | 1 |
| **5.** | MEP 219 | Computer Graphics Lab | 0 | 0 | 1 | 1 |
| | | **Total Credits:** | **17** | **4** | **5** | **26** |

*** The student should undergo summer training at the end of 2nd Semester .The result will be satisfactory (S) or unsatisfactory (US).**

***B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL 221 | Mechanisms & Machines | 3 | 1 | 0 | 4 |
| **2.** | MEL 224 | Design of Machine Elements | 3 | 1 | 0 | 4 |
| **3.** | MEL 225 | Fluid Mechanics | 3 | 1 | 0 | 4 |
| **4.** | MEL 226 | Mechanical Measurement and Metrology | 3 | 0 | 0 | 3 |
| **5.** | MEL 227 | Primary Manufacturing | 3 | 0 | 0 | 3 |
| **6.** | PSL055 | Interdisciplinary Course – II Human Rights and Constitutional Duties ( Compulsory Paper) | 2 | 0 | 0 | 2 |
| **List of Practicals** | | | | | | |
| **1.** | MEP 221 | Mechanisms & Machines Lab | 0 | 0 | 1 | 1 |
| **2.** | MEP 224 | Design of Machine Elements Lab | 0 | 0 | 1 | 1 |
| **3.** | MEP 225 | Fluid Mechanics Lab | 0 | 0 | 1 | 1 |
| **4.** | MEP 226 | Mechanical Measurement and Metrology Lab | 0 | 0 | 1 | 1 |
| **5.** | MEP 227 | Primary Manufacturing Lab | 0 | 0 | 1 | 1 |
| | | **Total Credits:** | **17** | **3** | **5** | **25** |

**NOTE:**
The students of B. Tech. (Mech. Engg.) 4thSemester are required to under go Industrial Training four to six weeks after their major examination of 4thSemester in any Industry/ Institute of repute. The viva voce will be held along with the viva voce of 5th Semester.

***B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL 310 | Computer Aided Design | 3 | 0 | 0 | 3 |
| **2.** | MEL 312 | Vibration & Noise Control | 3 | 1 | 0 | 4 |
| **3.** | MEL 313 | Heat Transfer | 4 | 1 | 0 | 5 |
| **4.** | | Deptt. Elective Course – I (D.E.-I) | 3 | 0 | 0 | 3 |
| **5.** | | Deptt. Elective Course – II (D.E.-II) | 3 | 0 | 0 | 3 |
| **6.** | | Inter disciplinary Course – III: | 4 | 0 | 0 | 4 |
| **List of Practicals** | | | | | | |
| **1.** | MEP 310 | Computer Aided Design Lab | 0 | 0 | 1 | 1 |
| **2.** | MEP 312 | Vibration & Noise Control Lab | 0 | 0 | 1 | 1 |
| **3.** | MEP 313 | Heat Transfer Lab | 0 | 0 | 1 | 1 |
| **4.** | MEP 314 | Industrial Training ** | - | - | - | S/US |
| **5.** | | Lab Elective – II | 0 | 0 | 1 | 1 |
| | | **Total Credits:** | **20** | **2** | **4** | **26** |

** The result will be satisfactory (S) or unsatisfactory (US).

List of Elective-I

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL351 | Advanced Mechanics of Solids | 3 | 0 | 0 | 3 |
| **2.** | MEL355 | Sensors and Actuators | 3 | 0 | 0 | 3 |

List of Elective-II

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL353 | Welding Technology | 3 | 0 | 0 | 3 |
| **2.** | MEL354 | Automobile Engineering | 3 | 0 | 0 | 3 |
| **List of Practicals** | | | | | | |
| **1.** | MEP353 | Welding Technology Lab | 0 | 0 | 1 | 1 |
| **2.** | MEP354 | Automobile Engineering Lab | 0 | 0 | 1 | 1 |

***B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL 320 | Thermodynamics - II | 4 | 1 | 0 | 5 |
| **2.** | MEL 323 | Refrigeration and Air Conditioning | 4 | 1 | 0 | 5 |
| **3.** | MEL 324 | Mechatronics | 3 | 0 | 0 | 3 |
| **4.** | MEL 325 | Fluid Machinery | 3 | 0 | 0 | 3 |
| **5.** | MEL 326 | Machinery Fault Diagnostics | 3 | 0 | 0 | 3 |
| **6.** | | Deptt. Elective Course – III (D.E.-III) | 3 | 1 | 0 | 4 |
| **List of Practicals** | | | | | | |
| **1.** | MEP 320 | Thermodynamics - II Lab | 0 | 0 | 1 | 1 |
| **2.** | MEP 323 | Refrigeration and Air Conditioning Lab | 0 | 0 | 1 | 1 |
| **3.** | MEP 325 | Fluid Machinery Lab | 0 | 0 | 1 | 1 |
| **4.** | MEP 326 | Machinery Fault Diagnostics Lab | 0 | 0 | 1 | 1 |
| **5.** | | Deptt. Elective Course – III (D.E.-III) Lab | 0 | 0 | 1 | 1 |
| | | **Total Credits:** | **20** | **3** | **5** | **28** |

List of Elective-III

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL361 | Finite Element Methods in Engineering | 3 | 1 | 0 | 4 |
| **2.** | MEL364 | Robotics: Mechanics and Control | 3 | 1 | 0 | 4 |
| **List of Practicals** | | | | | | |
| **1.** | MEP 361 | Finite Element Methods in Engineering Lab | 0 | 0 | 1 | 1 |
| **2.** | MEP 364 | Robotics: Mechanics and Control Lab | 0 | 0 | 1 | 1 |

***B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL 411 | Non-Traditional & Computer Aided Manufacturing | 3 | 0 | 0 | 3 |
| **2.** | MEL 412 | Optimization Techniques | 3 | 1 | 0 | 4 |
| **3.** | MEL 413 | Surface Engineering | 3 | 0 | 0 | 3 |
| **4.** | | Deptt. Elective Course – IV (D.E.- IV) | 4 | 0 | 0 | 4 |
| **5.** | | Deptt. Elective Course – V (D.E.- V) | 4 | 0 | 0 | 4 |
| **6.** | | Genrral Electives ** | 4 | 0 | 0 | 4 |
| **List of Practicals** | | | | | | |
| **1.** | MEP 411 | Non-Traditional & Computer Aided Manufacturing | 0 | 0 | 1 | 1 |
| **2.** | MEP 413 | Surface Engineering Lab | 0 | 0 | 1 | 1 |
| **3.** | MEP 416 | Major Project | 0 | 0 | 3 | 3 |
| | | **Total Credits:** | **21** | **1** | **5** | **27** |

List of Elective-IV

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL451 | Non-destructive evaluation and testing | 4 | 0 | 0 | 4 |
| **2.** | MEL455 | Machine tools and machining | 4 | 0 | 0 | 4 |

List of Elective-V

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEL457 | Mechanical Handling Systems & Equipment | 4 | 0 | 0 | 4 |
| **2.** | MEL458 | Simulation of Mechanical Systems | 4 | 0 | 0 | 4 |

***** Relevant to the subject and to be decided by the Board of Control***

***B.Tech. (Mechanical Engineering) (CBEGS) 8th Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEP- 421 | Industrial Training / In-Campus Training | 0 | 0 | 20 | 20 |
| | | **Total Credits:** | **0** | **0** | **20** | **20** |

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Engineering Chemistry** |
| **Course Code** | **:** | **CYL-197** |
| **Credits (L-T-P)** | **:** | **4 (3-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

At the end of this course, the student should be able to understand the water quality requirement for human consumption, different treatment process for municipal water treatment, application of glass, ceramics, composites, magnetic materials, Role of refractories for synthesis of high performance materials. Polymer, rubber and silicone material uses in daily life. Introduction to electrochemistry. Application of CNT and graphene in electronics industry.

**Total No. of Lectures –45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Water hardness:** Common impurities of water, Hardness: Introduction, EDTA method for determination of hardness, degree of hardness. Numerical based on hardness and EDTA method. | 4 |
| **2** | **Water hardness related problems:** Boiler troubles, their causes, disadvantages and prevention: Formation of solids (scale and sludge), carry over (priming and foaming), corrosion and caustic embrittlement. | 2 |
| **3** | **Water treatment techniques**: Introduction, water purification techniques, steps involved in purification of water, sedimentation, coagulation, filtration and sterilization, chlorination. | 3 |
| **4** | **Softening of water:** Lime-Soda method, Zeolite method, Deionization/Demin-eralization methods. Numerical problems based on Lime-Soda and Zeolite softening methods. | 3 |
| | **SECTION - B** | |
| **5** | **Glasses, Ceramics, Composites** Glassy state, glass formers and modifiers, types of glasses, manufacturing, applications. Ceramic structures, types of ceramics and their properties. Composites; types, properties and applications. | 6 |
| **6** | **Magnetic Materials:** Introduction, types of magnetic material, hard and soft ferrites, magnetic properties and applications. | 3 |
| **7** | **Refractories:** Definition, classification, properties, requisites of good refractory, manufacturing of refractory, silica and fire clay refractory and their uses. Seger's (Pyrometric) Cone Test and RUL Test. | 3 |

| | | |
|---|---|---|
| | **SECTION - C** | |
| **8** | **Polymers:** Introduction, classification and constituents of polymers, polymer structure and properties, glass transition temperature ($T_g$), melting point ($T_m$), structure-property relations (general), synthesis, properties and application of commercial polymers (Bakelite, Polyethylene, Polypropylene, Polystyrene, Polycarbonate, Polytetrafluoroethylene, Polyester and Nylon) | 6 |
| **9** | **Polymer processing methods**: Introduction, compounding, moulding (Injection, Compression, Blow film and Extrusion). Application of polymers such as contact lenses, bulletproof vest, etc. | 3 |
| **10** | **Rubber:** Introduction, natural rubber, vulcanization, different types of rubber, synthesis of rubbers viz. Buna-S, Buna-N, Buty1 and neoprene rubbers, properties and application. | 3 |
| | **SECTION - D** | |
| **12** | **Silicone based compounds:** Introduction, properties, preparation of silicones, cross-linked silicones, silicon fluids or oils, silicon elastomers and their applications. | 2 |
| **13** | **Electrochemistry:** Introduction, Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, Arrhenius theory of ionization, specific conductance, molar conductance, Faraday's Law of electrolysis, Chemical cells, distinguish between electrolytic and galvanic cell, reversible and irreversible cells with examples. Standard electrode (reduction) potential of half-cells. Applications of electrochemistry in daily life. | 4 |
| **14** | **Nanomaterial:** Introduction, properties, general methods of preparation. Applications of fullerenes, CNTs and graphene. | 3 |

**List of Practicals:**

1. Determination of total hardness of Water.
2. Determination of temporary and permanent hardness of water.
3. To determine the strength of sodium carbonate in given sample of washing soda.
4. To determine the strength of sodium carbonate and sodium hydroxide in caustic soda solution.
5. To determine the strength of acetic acid in vinegar
6. Find the strength of KMnO4 solution with oxalic acid
7. Find the strength of KMnO4 solution with Mohr's salt.
8. To determine the number of water molecules in Mohr's salt by titration method.
9. Determination of relative viscosity of a given liquid with respect to water by viscometer.
10. Determination of surface tension of a given liquid by drop number method by stalagmometer.
11. To determine the strength of strong and weak acid conductometry
12. To determine the critical micelle concentration of a soap (sodium laurate) by surfacetension measurements.

| **Course Outcomes:** | |
|---|---|
| **1** | Develop new methods to produce soft water for industrial use and potable water at low cost. |
| **2** | Replace metals with polymer in different application areas. |
| **3** | Develop low cost and new methods for synthesis of Nano materials. |
| **4** | Apply their knowledge for development of new application of electrochemistry. |
| **5** | Demonstrate the knowledge of polymer materials for advance engineering applications. |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Engineering Chemistry by P.C. Jain & Monica Jain Dhanpat Rai Publishers, NewDelhi.2014. |
| **2** | Physical Chemistry by A. Peter and J.de. Paula 10$^{th}$ Edition Oxford University Press, 2014. |
| **3** | Inorganic Polymers by P.B. Saxena, Discovery Publishing House, 2007. |
| **4** | Ferrite materials by V.R.K. Murthy & B. Viswanathan, SpringerVerlag, Berlin, 1990 |
| **5** | Advanced practical physical chemistry by J.B Yadav by Krishna's educational publishers. |

E-learning resource: https://nptel.ac.in/courses.php

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Mathematics-I** |
| **Course Code** | **:** | **MTL-101** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

The aim of the course is to introduce the different topics of calculus. The approximation of complex functions in term of power series, by using Taylor and Maclaurin's expansion is to be discussed. The power series approximation of functions makes its study simple as it is easy to do algebraic manipulation with series. The theory of convergence of infinite series will help in identifying whether the power series approximate the given function. The theory of vector calculus along with its applications in study of electric field and magnetic field etc. will be introduced.

**Total No. of Lectures –**

| | **Lecture wise breakup** | **Number of Lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | Infinite Series: Sequences and sub sequences and their convergence, Cauchy sequence, Infinite series and their convergence, Standard tests for convergence including p–test, Ratio test, Comparison test, Raabe's test, Cauchy Integral test, Cauchy root test, Gauss's test, Absolute convergence, Alternating series and its convergence, Power series. | |
| | **SECTION - B** | |
| **2** | Calculus-I: Partial derivatives, Euler's theorem on homogeneous functions, Maclaurin's and Taylor's expansions of single and two variables, Maxima and minima of functions of several variables, Lagrangian method of multipliers. | |
| | **SECTION - C** | |
| **3** | Calculus-II: Multiple integrals and their use in obtaining surface areas and volumes of solids. | |

| SECTION - D | | |
|---|---|---|
| **4** | Vector Calculus: Scalar and Vector point functions, Differentiation of vectors, Gradient of a scalar field, Divergence and Curl of a vector field and their physical interpretations, Line integral of a vector field, Surface integral of a vector field, Volume integral of a scalar field, Green's theorem, Stokes theorem, Gauss divergence theorem (without proofs) and their applications. | |

| **Course Outcomes:** | |
|---|---|
| **1** | It will help in the study of complex mathematical functions by approximating them with power series expansions. |
| **2** | Electric field, magnetic field can be studied using vector calculus techniques. |
| **3** | It will equipped the students in determining whether the given function can be approximated with the power series. |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Louis A. Pipes: Applied Mathematics for Engineers and Physicists, McGraw Hill Book Company. |
| **2** | Kreyszig: Engineering Mathematics, Wiley Eastern Ltd. |
| **3** | B.S. Grewal: Higher Engineering Mathematics, Khanna Publisher, New Delhi. |

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Basic Electrical & Electronics Engineering** |
| **Course Code** | **:** | **ECL-119** |
| **Credits (L-T-P)** | **:** | **5 (4-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

This course is aimed to introduce important initial understanding of electrical and electronics engineering to the 1st year students, this will act as the foundation for the advanced electronics courses. The aim of this course is to familiarize the students to the basics of electricity, electrical machines and the basics of electronic devices. so that they can use this knowledge in relevant applications.

**Total No. of Lectures –48**

| | **Lecture wise breakup** | **Number of Lectur** |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Electricity and power supply**: Features of the power supply system, power station, transmission, distribution lines, difference between AC and DC, voltage, current and resistance, concept of electromagnetic induction and production of alternating e.m.f - single phase and 3 phase, 3-phase star and delta connections, voltage and current relations.<br><br>**Electrical Machinery:** Transformer, its working principle, types of transformers and their applications, performance losses, efficiency and voltage regulation, open circuit and short circuit tests on transformer, auto transformers. | 12 |
| | **SECTION – B** | |
| **2** | **Circuit Analysis**: A brief review of DC and single phase AC circuits. , Star-delta load transformation, concept of balanced and unbalanced three phase circuits, measurement of power and power factor in three phase balanced circuits.<br>**Semiconductors:** Introduction to semiconductors, Intrinsic Semiconductor, n-type and p-type semiconductors, Effect of Doping, Fermi levels, Charge flow in semiconductors. | 12 |

| | | |
|---|---|---|
| | **SECTION – C** | |
| **3** | **PN junction diode**: Theory of PN junction diode, depletion layer, barrier potential, Volt-Ampere Characteristics, Current Components, Storage Capacitance and transition capacitance, Junction diode switching times, Zener diode, LED, Photodiode, Varactor diode, Schottky diode<br><br>**Bipolar Junction Transistors**: Junction Transistor, Current components, transistor as an amplifier, CB, CE and CC configurations and characteristics. | 12 |
| | **SECTION – D** | |
| **4** | **Fundamentals of DC & AC Motors:** Working principle, construction, types & characteristics of DC motor, Working principle of Single-Phase & Three-Phase Induction motor, Three phase synchronous motor.<br><br>**Control and Protection**: Control mechanism, principle and applications of protection devices: Fuses, MCB, LCB, relays. Need& types of earthing and grounding, Cables, Construction of LT & HT cables. | 12 |

| **Course Outcomes:** After study of this subject the student will become | |
|---|---|
| **1** | Familiar with the electricity production, distribution and the use of control/protection devices. |
| **2** | Able to understand the working and applications of electrical machines. |
| **3** | Able to understand the basics of semiconductor devices and their applications. |
| **4** | Familiar to the concept of rectification and filtration circuits. |
| **5** | Able to analyze the basic DC and AC circuits and to solve related circuit problems. |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Principles of Electrical Engineering by Gupta BR; S. Chand and Company, New Delhi. |
| **2** | Electrical Technology by Hughes Edward; The English Language Book Society and Longmans.Group Limited, London |
| **3** | Electrical Machines by Bhattacharya SK; Tata McGraw Hill, Delhi. |
| **4** | Basic Electrical Engineering by T.K. Naggarkar& Ms. Sakhija Seventh Edition 2008, Oxford University Press. |
| **5** | Electronic Devices and Circuit Theory, Boylestad R.L. VIII Edition, Pearson Education, 2008. |
| **6** | Electronic Fundamentals & Application, J.D. Ryder, PHI, 2006. |
| **7** | Experiments in Electrical Engineering by Bhatnagar US; Asia Publishing House, Bombay. |

**PRACTICAL:**

1. Study of VI characteristics of PN junction
2. Study of Half wave, full wave & Bridge rectifiers.
3. Study of simple capacitive, T & II filters.
4. Study of zener as a voltage regulator.
5. Study of transistor characteristics in CC, CB and CE configuration
6. To study the performance characteristic of clipper circuit
7. To study the performance characteristic of clamper circuit

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Fundamentals of information technology and programming using python** |
| **Course Code** | **:** | **CSL 126** |
| **Credits (L-T-P)** | **:** | **4 (2-1-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

At the end of this course, the student should be able to understand the basics of computer as well as programming. The students are able to write programs. This course introduces computer programming using the Python programming language. Emphasis is placed on common algorithms and programming principles utilizing the standard library with Python.

**Total No. of Lectures –**

| | **Lecture wise breakup** | **Number of Lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | Block diagram of Computer, Associated peripherals, Memories – RAM, ROM, Secondary Storage Devices, Classification of Computers and Languages, Introduction to Compilers, Interpreter and Assemblers, Introduction of various operating system with their file system. | |
| | **SECTION - B** | |
| **2** | Algorithm and Flowchart, Introduction to Python and Setting up the Python development environment, Basic syntax, interactive shell, editing, saving, and running a script, Concept of data types, Random number, Real numbers, immutable variables, Python console Input / Output. Arithmetic operators and expressions, Conditions, Comparison operators, Logical Operators, Is and In operators, Control statements: if-else, Nested If-Else, Loops (for, while) | |
| | **SECTION - C** | |
| **3** | Built in function and modules in python, user defined functions, passing parameters, arguments and return values; formal vs actual arguments, Recursion, lists, Common List operations | |
| | **SECTION - D** | |
| **4** | String Handling, Unicode strings, Strings Manipulation:-compare strings, concatenation of strings, Slicing strings in python, converting strings to numbers and vice versa. Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). | |

| **Course Outcomes:** | |
|---|---|
| 1 | Implement a given algorithm as a computer program in python language with the understanding of hardware components and memory utilization. |
| 2 | Able to use standard programming constructs: repetition, selection, functions, composition, modules and different data types |
| 3 | Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms) and to debug the program written in python language |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Computers Today by Sanders. |
| **2** | Fundamentals of Computers TTTI Publication. |
| **3** | Learning Python by Mark Lutz, 5th edition |
| **4** | Python cookbook, by David Beazley , 3rd Edition |
| **5** | Python Essential Reference, by David Beazley , 4th edition |
| **6** | Python in a Nutshell, by Alex Mortelli, 2nd Edition. |
| **7** | Python programming: An Introduction to computer science, by John Zelle, 2nd Edition. |

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

## ENL-101: COMMUNICATIVE ENGLISH –I

**Credits: 2-0-0**
**Total Marks-50**
**Mid Semester Examination: 20% weightage**
**End Semester Examination: 80% weightage**

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Objective:** To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas. This course will prepare students to read a variety of texts and also to communicate more effectively through writing. The course will also pay special attention to vocabulary building.

**Prescribed Text books:**

- *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.
- *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.

### SECTION–A

"Word List", "Correct Usage of Commonly used words and Phrases" from the chapter "Vocabulary" given in ***The Written Word*** by Vandana R. Singh.

### SECTION–B

Letter- writing as prescribed in ***The Written Word*** by Vandana R. Singh.
Report writing as prescribed in ***The Written Word*** by Vandana R. Singh.

### SECTION–C

Section 1 from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

### SECTION–D

Section 2 from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Workshop Practices** |
| **Course Code** | **:** | **MEP-101** |
| **Credits (L-T-P)** | **:** | **2 (0-0-2)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

At the end of this course, the student should be able to understand the

1. Understand applications of hand tools and power tools.
2. Understand the operations of machine tools.
3. Select the appropriate tools required for specific operation.
4. Comprehend the safety measures required to be taken while using the tools.

**Total No. of Practicals – 48**

| | **Lecture wise breakup** | **Number of Practicals** |
|---|---|---|
| | **SECTION - A** | |
| **1** | Carpentry Shop:<br>(a) Study of tools & operations and carpentry joints.<br>(b) Simple exercise using jackplane.<br>(c) To prepare half-lap corner joint, mortise &tennon joints.<br>(d) Simple exercise on wood working lathe. | 6 |
| **2** | Fitting (Bench Working) Shop:<br>(a) Study of tools & operations<br>(b) Simple exercises involving fitting work.<br>(c) Make perfect male-female joint.<br>(d) Simple exercises involving drilling / tapping / dieing. | 6 |
| | **SECTION - B** | |
| **3** | Black Smithy Shop:<br>(a) Study of tools & operations<br>(b) Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering& swaging. | 6 |
| **4** | Welding Shop:<br>(a) Study of tools & operations of Gas welding & Arc welding.<br>(b) Simple butt and Lap welded joints.<br>(c) Oxy-acetylene flame cutting. | 6 |

| | | |
|---|---|---|
| **SECTION - C** | | |
| **5** | Sheet-metal Shop:<br>(a) Study of tools & operations.<br>(b) Making Funnel complete with soldering.<br>(c) Fabrication of tool-box, tray, electric panel box etc. | 6 |
| **6** | Machine Shop:<br>(a) Study of Single point cutting tool, machine tools and operations.<br>(b) Plane turning.<br>(c) Step turning.<br>(d) Taper turning.<br>(e) Threading. | 6 |
| **SECTION - D** | | |
| **7** | Foundry Shop:<br>(a) Study of tools & operations<br>(b) Pattern making.<br>(c) Mould making with the use of a core.<br>(d) Casting | 6 |
| **8** | Electrical and Electronics Shop: | 6 |

| **CourseOutcomes:** | |
|---|---|
| **1** | To acquire skills in basic engineering practice, measuring skills and practical skills in the trades. |
| **2** | To provides the knowledge of job materials in various shops. |
| **3** | To identify the hand tools and instruments. |
| **4** | To provides the knowledge of core technical subjects for making and working ofany type of project. |
| **5** | Understand modern manufacturing operations, including their capabilities,limitations, and how to design economically. |
| **6** | Gain insight into how designers influence manufacturing schedule and cost, andcost of different components. |
| **7** | Learn how to analyze products and be able to improve their manufacturability andmake the cost effectively. |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Lab Manual to be provided by Department of Mechanical Engineering |
| **2** | Work shop technology by Hajra and Chaudhary |
| **3** | Work shop technology by Chapmen |

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

## PBL 121 : ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ - ।

ਸਮਾਂ : 3 ਘੰਟੇ ਕਰੈਡਿਟ : 2

ਕੁਲ ਅੰਕ : 50

**Mid Semester Examination: 20% weightage**
**End Semester Examination: 80% weightage**

### ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

### ਸੈਕਸ਼ਨ-ਏ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਵਿਤਾ ਭਾਗ : 1-4 ਕਵੀ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਗੁਰਮੁਖੀ ਔਰਥੋਗਰਾਫੀ ਦੀ ਜੁਗਤ (ਪੈਂਤੀ, ਮੁਹਾਰਨੀ, ਬਿੰਦੀ, ਟਿੱਪੀ ਤੇ ਅੱਧਕ); ਵਿਸ਼ਰਾਮ ਚਿੰਨ੍ਹ, ਸ਼ਬਦ ਜੋੜ (ਸ਼ੁਧ-ਅਸ਼ੁਧ)

### ਸੈਕਸ਼ਨ-ਬੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਵਿਤਾ ਭਾਗ : 5-8 ਕਵੀ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਲੇਖ ਰਚਨਾ (ਜੀਵਨੀ-ਪਰਕ, ਸਮਾਜਕ ਅਤੇ ਚਲੰਤ ਵਿਸ਼ਿਆਂ ਉੱਤੇ) : 10 ਲੇਖ ਲਿਖਵਾਉਣੇ
(ਕਲਾਸ ਵਿਚ ਅਤੇ ਘਰ ਲਈ ਅਭਿਆਸ)

### ਸੈਕਸ਼ਨ-ਸੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਹਾਣੀ ਭਾਗ : 1-4 ਕਹਾਣੀਆਂ
(ਕਹਾਣੀ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ, ਸਾਰ, ਕਹਾਣੀ-ਕਲਾ)

II. ਸ਼ੁੱਧ, ਅਸ਼ੁੱਧ : ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦਾਂ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ
(15 ਪੈਰ੍ਹਿਆਂ ਦੇ ਸ਼ੁੱਧ ਅਸ਼ੁੱਧ ਅਭਿਆਸ ਕਰਵਾਉਣੇ)

### ਸੈਕਸ਼ਨ-ਡੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਹਾਣੀ ਭਾਗ : 5-8 ਕਹਾਣੀਆਂ
(ਕਹਾਣੀ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ, ਸਾਰ, ਕਹਾਣੀ-ਕਲਾ)

II. ਅਖ਼ਬਾਰੀ ਇਸ਼ਤਿਹਾਰ : ਨਿੱਜੀ, ਦਫ਼ਤਰੀ ਤੇ ਸਮਾਜਕ ਗਤੀਵਿਧੀਆਂ ਨਾਲ ਸੰਬੰਧਤ

**ਸਹਾਇਕ ਪੁਸਤਕਾਂ**


1. ਰਾਜਿੰਦਰਪਾਲ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਕਵਿਤਾ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
2. ਬ੍ਰਹਮਜਗਦੀਸ਼ ਸਿੰਘ, **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਾਵਿ ਸਿਧਾਂਤ, ਇਤਿਹਾਸ ਅਤੇ ਪ੍ਰਵਿਰਤੀਆਂ**, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਉਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
3. ਬਲਦੇਵ ਸਿੰਘ ਧਾਲੀਵਾਲ, **ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
4. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, **ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਸਫ਼ਰ ਤੇ ਸ਼ਾਸਤ੍ਰ ਭਾਗ-**, ਸਿੰਘ ਬ੍ਰਦਰਜ਼, ਅੰਮ੍ਰਿਤਸਰ।
5. ਹਰਕੀਰਤ ਸਿੰਘ ਤੇ ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ, **ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ**, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।
6. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।
7. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ
8. **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਬੋਧ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਅੰਮ੍ਰਿਤਸਰ।

# PBL-122 : ਮੁੱਢਲੀ ਪੰਜਾਬੀ
# (In lieu of Compulsory Punjabi)

ਸਮਾਂ : 3 ਘੰਟੇ ਕਰੈਡਿਟ : 2

ਕੁਲ ਅੰਕ : 50

**Mid Semester Examination: 20% weightage**
**End Semester Examination: 80% weightage**

## ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

### ਸੈਕਸ਼ਨ-ਏ

ਪੈਂਤੀ ਅੱਖਰੀ : ਅੱਖਰ ਕ੍ਰਮ, ਮਾਤ੍ਰਾਵਾਂ
(ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ)
ਲਗਾਖਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) : ਪਛਾਣ ਤੇ ਵਰਤੋਂ

### ਸੈਕਸ਼ਨ-ਬੀ

ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ
ਸਾਧਾਰਨ ਸ਼ਬਦ, ਸੰਯੁਕਤ ਸ਼ਬਦ, ਮਿਸ਼ਰਤ ਸ਼ਬਦ
ਮੂਲ ਸ਼ਬਦ, ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ

### ਸੈਕਸ਼ਨ-ਸੀ

ਸ਼ੁੱਧ ਅਸ਼ੁੱਧ : ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦਾਂ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ
ਸਮਾਨਾਰਥਕ ਤੇ ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ

### ਸੈਕਸ਼ਨ-ਡੀ

ਹਫ਼ਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ, ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ, ਰੁੱਤਾਂ ਦੇ ਨਾਂ,
ਇਕ ਤੋਂ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ

## ਸਹਾਇਕ ਪੁਸਤਕਾਂ


1. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਅਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।
2. **ਮੁੱਢਲੀ ਪੰਜਾਬੀ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
3. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।

*B.Tech. (Mechanical Engineering) (CBEGS) 1st Semester*

**PUNJAB HISTORY & CULTURE**
**HSL-101 : HISTORY AND CULTURE OF THE PUNJAB (1450-1716)**
**(Special paper in lieu of Punjabi Compulsory)**

**Credits: 2-0-0**
**Mid Semester: 20 Marks**
**End Semester: 80 Marks**
**Mid Semester Examination: 20% Weightage**
**End Semester Examination: 80% Weightage**

**Instructions for the Paper Setters**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**SECTION-A**

1. Land and the People.
2. Bhakti Movement

**SECTION-B**

3. Life and Teaching of Guru Nanak Dev.
4. Contribution of Guru Angad Dev, Guru Arjun Dev ,Guru Amar Das and Guru Ram Das.

**SECTION-C**

5. Guru Hargobind.
6. Martyrdom of Guru Teg Bahadur

**SECTION-D**

7. Guru Gobind Singh and the Khalsa.
8. Banda Singh Bahadur: Conquests and Execution.

**Suggested Reading**

1. Kirpal Singh(ed.), *History and Culture of the Punjab, Part-ii, Punjabi University,* Patiala. 1990.
2. Fauja Singh (ed.), *History of Punjab, Vol, III Punjabi University, Patiala, 1987.*
3. J.S. Grewal, *The Sikhs of the Punjab, Cup, Cambridge, 1991.*
4. Khushwant Singh, *A History of the Sikhs,* Vol. I, OUP, New Delhi, 1990

*B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Engineering Mechanics** |
| **Course Code** | **:** | **CEL-120** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

- To understand distributed force systems, centroid/ centre of gravity and method of finding centroids of composite figures and bodies.
- To understand moment of inertia and method of finding moment of inertia of areas and bodies.
- To understand dynamics of a particle.
- To understand the kinetics of rigid bodies and simple problems.

**Total No. of Lectures –**

| | **Lecture wise breakup** | **Number of Lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | Introduction: Force system, dimensions and units in mechanics, laws of mechanics,vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application. Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems. | |
| | **SECTION - B** | |
| **2** | Truss and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems. Centroid, Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems. | |
| | **SECTION - C** | |
| **3** | Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects. Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems. | |

| | | |
|---|---|---|
| **SECTION - D** | | |
| **4** | Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem. Shear Force and Bending Moment Diagram for statically determinant beams Classification of beams, types of loads, shear force and bending moment calculation and their graphical presentation, point of inflection, problem. | |

| | |
|---|---|
| **Course Outcomes:** | |
| **1** | Basic understanding of laws and principles of mechanics. |
| **2** | Ability to analyse and solve simple problems of mechanics. |
| **3** | An understanding of assumptions and limitations of approaches used. |
| **Suggested / Reference Books:** | |
| **1** | Engineering Mechanics – Irving H. Shames, PHI Publication. |
| **2** | Engineering Mechanics – U.C.Jindal, Galgotia Publication. |
| **3** | Mechanics–Berkeley Physics Course, Vol–I (Second Edition): C. Kittel, W.D. Knight, M.A. Ruderman, C.A. Helmholtz and R.J. Moyer–Tata McGraw Hill Publishing Company Ltd., New Delhi. |

*B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester*

## MEL120: ENGINEERING GRAPHICS & DRAFTING

**L T P**

**2 0 2**

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

### Course Objectives:

A. Increase ability to communicate with people

B. Learn to sketch and take field dimensions.

C. Learn to take data and transform it into graphic drawings.

D. Learn basic engineering drawing formats

E. Prepare the student for future Engineering positions

### Course Outcomes:

1. Student's ability to hand letter will improve.
2. Student's ability to perform basic sketching techniques will improve.
3. Students will be able to draw ortho graphic projections and sections.
4. Student's ability to use architectural and engineering scales will increase.
5. Students ability to produce engineered drawings will improve
6. Student's ability to convert sketches to engineered drawings will increase.
7. Students will become familiar with office practice and standards.
8. Students will develop good communication skills and teamwork.

## SECTION A

**Drawing Techniques:** Various types of lines, principles of dimensioning, size and location of dimensions, symbols, conventions scales (plane and diagonal) and lettering as per ISCodeSP-46 of practice for general engineering drawings. Practice of drawing various types of lines and dimensioning exercises. Drawing exercises pertaining to symbols, conventions. Exercise on lettering techniques: Freehand printing letters and numeral sin 3, 5, 8 and 12 mm sizes vertical and inclined; instrumental lettering in single stroke.

**Projection of Points, Lines and Planes :** First, second, third and fourth angle projections, concept of horizontal and vertical planes, Projection of point sand lines, True length, Horizontal and vertical traces, Projection of Planes, Traces of Planes, Auxiliary planes. Practice exercises on projection of points, lines and planes.

## SECTION B

**Projection and Section of Solids:** Projection of solids such as Prisms, Pyramids, Cylinders, Cones, Spheres, Auxiliary View. Principles of sectioning, types of sectioning, section lines, cutting plane lines. Practice on projection of solids and section of solids.

## SECTION C

**Intersection and Development of Surfaces:** Inter section of cylinders, cones, prisms, and pyramids, Axis of solids being vertical or horizontal. Development of surfaces of truncated cylinders, cones, pyramids and prisms. Exercises on intersection of solids– cylinder and cylinder, cylinder and cone, prism and prism, prism and cone, sphere with cylinder. Exercises involving development of surfaces (Y–Piece, Hopper, Tray and truncated pieces).

## SECTION D

**Isometric Projection:** Exercises on is ometric views.

**Orthographic Projections:** Orthographic views, Missing views. Exercises on identification of missing views. Practice on ortho graphic projections.

**Practice of free hand sketching of different types of objects.**

**Fasteners:** Introduction to temporary and permanent fasteners riveted and welded joints, types screw threads, conventional symbols for internal and external threads. Exercises involving drawing of bolts, nuts, studs and locking devices.

**Symbols and Conventions:** Symbol and conventions pertaining to relevant engineering disciplines.

**Books Recommended:**

1. Engineering Drawing by PS Gill, S K Kataria and Sons, Ludhiana.

2. Engineering Drawing by NK Bhatt.

3. Text Book of Engineering Drawing by R.K. Dhawan, S.Chand & Company Ltd.

4. Engineering and Teaching Drawing by Earl D.Black.

***B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester***

| | | |
|---|---|---|
| **Course Name** | **:** | **Mathematics-II** |
| **Course Code** | **:** | **MTL-102** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

The goal of the course is to introduce the theory of differential equations along with their applications in modeling the engineering system. The course also introduces complex analysis and its uses to study Fourier transform and series. The students will also be apprised with Laplace and Fourier transforms as a toll for analysis/ processing of signals and solution of differential and integral equations.

**Total No. of Lectures –**

| | **Lecture wise breakup** | **Number of Lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | Differential Equations: Exact differential Equation, Higher order linear Differential equations, ODE's with constant coefficients. | |
| | **SECTION - B** | |
| **2** | Laplace Transforms: Laplace transforms, Properties of Laplace transforms, Laplace transform of derivatives and differentiation theorem, Integration theorem, Laplace transform of Integrals, Inverse Laplace transform, Formulas for obtaining inverse Laplace transforms, Convolution theorem, The second shifting property. | |
| | **SECTION - C** | |
| **3** | Fourier Series and Fourier Transform: Fourier series expansion, Fourier series for even and odd functions, half range series, harmonic functions, Modulation theorem, Shifting properties, convolution theorems, sine and cosine transforms, Fourier transform of derivatives and integrals, inverse Fourier transform, applications to PDE's & ODE's . | |
| | **SECTION - D** | |
| **4** | Complex Analysis: De Moivre's theorem with applications, Analytic functions, Cauchy – Riemann equations, Laplace equation, Cauchy's integral theorem, Cauchy's integral formula (without proofs), Taylor series and Laurent series(without proofs), Residues and their application in evaluating real improper integrals | |

| Course Outcomes: | |
|---|---|
| **1** | It will help the students in the study of engineering system by modeling it with ordinary and partial differential equations. |
| **2** | With Laplace transform, mathematical models involving differential equations can be simplified and studied by solving algebraic equations. |
| **3** | In engineering, sound, signal, etc can be represented by mathematical functions, Fourier transforms/ series enable the engineers in simplications of the study of these functions. |

| Suggested / Reference Books: | |
|---|---|
| **1** | Louis A. Pipes: Applied Mathematics for Engineers and Physicists, McGraw Hill Book Company. |
| **2** | Kreyszig: Engineering Mathematics, Wiley Eastern Ltd. |
| **3** | B.S. Grewal: Higher Engineering Mathematics, Khanna Publisher, New Delhi. |

*B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Physics** |
| **Course Code** | **:** | **PHL-183** |
| **Credits (L-T-P)** | **:** | **5 (3-1-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

- To make the students aware about Electromagnetic wave fundamentals.
- To make students aware about quantum physics phenomena.

**Total No. of Lectures – 48**

| | **Lecture wise breakup** | **Number of Lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | Electric and magnetic fields in a medium, Susceptibility and Conductivity, Maxwell's equations, Boundary conditions; EM wave equation, Plane wave solutions. | 12 |
| | **SECTION – B** | |
| **2** | Polarization of the EM waves, Pointing vector and intensity of the EM wave; Wave packet, Phase and Group velocities; Reflection and refraction of EM waves at a dielectric interface; Brewster angle; Total internal reflection at a dielectric interface; EM waves in a conducting medium and plasma. | 12 |
| | **SECTION – C** | |
| **3** | Wave-particle duality, de-Broglie waves; Quantum mechanical operators; Schroedinger equation, Wave function, Statistical interpretation, Superposition Principle, Continuity equation for probability density; Stationary states, Bound states. | 12 |
| | **SECTION - D** | |
| **4** | Free-particle solution, 1-D infinite potential well, Expectation values and uncertainty relations; 1-D finite potential well, Quantum mechanical tunneling and alpha- decay, Kronig-Penny model and emergence of bands | 12 |

| **Course Outcomes:** | |
|---|---|
| **1** | This will enable the students to learn physical concepts associated with electromagnetic radiation and devices. |
| **2** | Student will understand quantum mechanical aspects of physics. |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Concepts of Modern Physics. Arthur Beiser, (Tata McGraw-Hill, Sixth Edition 2003). |
| **2** | Lasers & Nonlinear optics. B.B. Laud (New Delhi, India: Wiley Eastern 1991). |

*B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Introduction to Engineering Materials** |
| **Course Code** | **:** | **MEL-110** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

At the end of this course, the student should be able to understand the:

1. To review physics and chemistry in the context of materials science & engineering.
2. To describe the different types of bonding in solids, and the physical outcomes of these differences.
3. Give an introduction to metals, ceramics, polymers, and electronic materials in the context of a molecular level understanding of bonding.
4. Give an introduction to the relation between processing, structure, and physical properties.
5. Give the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class.
6. Give the beginning student practice in basic expository technical writing.

**Total No. of Lectures – 47**

| | **Lecture wise breakup** | **Number of Lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | Introduction**:** Historical perspective, scope of materials science and engineering. Atomic structure and inter atomic bonding. Lattices, basic idea of symmetry. | 11 |
| | **SECTION - B** | |
| **2** | Lattice structure: Bravais lattices, unit cells, crystal structures, crystal planes and directions,co-ordinationnumber.Singlecrystals,polycrystalline,non-crystalline,nano-crystallinematerials.Imperfections in solids: point defects, line defects, surface defects. | 12 |
| | **SECTION - C** | |
| **3** | Solid solutions: phases, phase diagrams. Diffusion phenomenon, phase transformations. Strengthening mechanisms. | 12 |
| | **SECTION - D** | |
| **4** | Classification of materials: properties of materials. Structure, properties and applications of different metals and alloys, ceramics, composites and polymers. | 12 |

| **Course Outcomes:** | |
|---|---|
| **1** | Given a type of material, be able to qualitatively describe the bonding scheme and its general physical properties, as well as possible applications. |
| **2** | Given a type of bond, be able to describe its physical origin, as well as strength. |
| **3** | Be able to qualitatively derive a material's Young's modulus from a potential energy curve. |
| **4** | Given the structure of a metal, be able to describe resultant elastic properties in terms of its 1D and 2D defects. |
| **5** | Be able to do simple diffusion problems. |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | MaterialsScienceandEngineeringbyW.D.CallisterJr.(JohnWiley&SonsInc.,EighthEdition). |
| **2** | MaterialsScienceandEngineering:AFirstCoursebyV.Raghvan(Prentice-HallofIndiaPvt.Ltd.). |

*B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester*

**PBL 131 : ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ–II**

ਸਮਾਂ : 3 ਘੰਟੇ ਕਰੈਡਿਟ : 2

ਕੁਲ ਅੰਕ : 50

**Mid Semester Examination: 20% weightage**
**End Semester Examination: 80% weightage**

## ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

### ਸੈਕਸ਼ਨ–ਏ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ) 1–4 ਨਿਬੰਧ
(ਨਿਬੰਧ ਦਾ ਸਾਰ, ਵਾਰਤਕ ਕਲਾ ਅਤੇ ਸ਼ੈਲੀ)

II. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਧਾਤੂ/ਮੂਲ, ਵਧੇਤਰ (ਅਗੇਤਰ, ਪਿਛੇਤਰ, ਵਿਉਂਤਪਤ ਅਤੇ ਰੁਪਾਂਤਰੀ), ਸਮਾਸ।

### ਸੈਕਸ਼ਨ–ਬੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ) 5–8 ਨਿਬੰਧ
(ਨਿਬੰਧ ਦਾ ਸਾਰ, ਵਾਰਤਕ ਕਲਾ ਅਤੇ ਸ਼ੈਲੀ)

II. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਕਲਾਸ ਵਿਚ 10 ਵਿਸ਼ਿਆਂ (ਸਭਿਆਚਾਰ, ਧਾਰਮਕ ਅਤੇ ਰਾਜਨੀਤਕ) 'ਤੇ ਪੈਰ੍ਹਾ ਰਚਨਾ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ।

### ਸੈਕਸ਼ਨ–ਸੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ) 1–4 ਰੇਖਾ ਚਿਤਰ
(ਨਾਇਕ ਬਿੰਬ, ਕਲਾਤਮਕ ਪੱਖ)

II. ਮੁਹਾਵਰੇ ਤੇ ਅਖਾਣ (ਅਖਾਣ ਤੇ ਮੁਹਾਵਰਾ ਕੋਸ਼ ਵਿਚ) 200 ਮੁਹਾਵਰਿਆਂ ਅਤੇ 100 ਅਖਾਣਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤਣ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ (ਕਲਾਸ ਵਿਚ ਤੇ ਘਰ ਲਈ)।

### ਸੈਕਸ਼ਨ–ਡੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
5–8 ਰੇਖਾ ਚਿਤਰ
(ਨਾਇਕ ਬਿੰਬ, ਕਲਾਤਮਕ ਪੱਖ)

II. ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸੰਬੰਧਕ

## ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਸਤਿੰਦਰ ਸਿੰਘ, **ਪੰਜਾਬੀ ਵਾਰਤਕ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
2. ਪ੍ਰੋ. ਪਿਆਰਾ ਸਿੰਘ, **ਪੰਜਾਬੀ ਵਾਰਤਕ : ਸਿਧਾਂਤ ਇਤਿਹਾਸ ਪ੍ਰਵਿਰਤੀਆਂ**, ਨਿਊ ਬੁੱਕ ਕੰਪਨੀ, ਜਲੰਧਰ।
3. ਇੰਦਰਪ੍ਰੀਤ ਸਿੰਘ ਧਾਮੀ, **ਪੰਜਾਬੀ ਰੇਖਾ ਚਿਤਰ : ਰੂਪ ਤੇ ਪ੍ਰਕਾਰਜ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
4. ਬਲਬੀਰ ਸਿੰਘ ਦਿਲ, **ਪੰਜਾਬੀ ਨਿਬੰਧ : ਸਰੂਪ, ਸਿੱਧਾਂਤ ਅਤੇ ਵਿਕਾਸ**, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
5. ਹਰਕੀਰਤ ਸਿੰਘ ਤੇ ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ, **ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ**, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।
6. ਡਾ. ਅਮਰ ਕੋਮਲ (ਸੰਪਾ.), **ਚੋਣਵੇਂ ਪੰਜਾਬੀ ਨਿਬੰਧ** (ਭੂਮਿਕਾ), ਨੈਸ਼ਨਲ ਬੁੱਕ ਟਰੱਸਟ, ਇੰਡੀਆ।
7. ਅਬਨਾਸ਼ ਕੌਰ, **ਪੰਜਾਬੀ ਰੇਖਾ ਚਿੱਤਰ**, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
8. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
9. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।

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## PBL-132 : ਮੁੱਢਲੀ ਪੰਜਾਬੀ
## (In lieu of Compulsory Punjabi)

ਸਮਾਂ : 3 ਘੰਟੇ ਕਰੈਡਿਟ : 2

ਕੁਲ ਅੰਕ : 50

**Mid Semester Examination: 20% weightage**
**End Semester Examination: 80% weightage**

### ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਸੈਕਸ਼ਨ-ਏ

ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ
(ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ)

ਸੈਕਸ਼ਨ-ਬੀ

ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ : ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇ-ਨਾਤੇ, ਖੇਤੀ ਅਤੇ ਹੋਰ ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਤ

ਸੈਕਸ਼ਨ-ਸੀ

ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ
ਸਾਧਾਰਨ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)
ਸੰਯੁਕਤ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)
ਮਿਸ਼ਰਤ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)

ਸੈਕਸ਼ਨ-ਡੀ

ਪੈਰ੍ਹਾ ਰਚਨਾ
ਸੰਖੇਪ ਰਚਨਾ

### ਸਹਾਇਕ ਪੁਸਤਕਾਂ


1. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਅਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।
2. **ਮੁੱਢਲੀ ਪੰਜਾਬੀ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
3. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।

*B.Tech. (Mechanical Engineering) (CBEGS) 2nd Semester*

## PUNJAB HISTORY & CULTURE
### HSL-102 : HISTORY AND CULTURE OF THE PUNJAB (1717-1947)
### (Special paper in lieu of Punjabi Compulsory)

**Credits: 2-0-0**
**Marks : 50**
**Mid Semester Examination: 20% Weightage**
**End Semester Examination: 80% Weightage**

**Instructions for the Paper Setters**
**Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.**

**SECTION-A**

1. Sikh Struggle for Sovereignty.
2. Ranjit Singh : Conquests, Administration and the Anglo-Sikh Relations.

**SECTION-B**

3. Anglo-Sikh Wars and the Annexation.
4. The Punjab under the British: New Administration, Education and social Change.

**SECTION-C**

5. Economic Changes: Agricultural
6. Socio-Religious Reform Movements.

**SECTION-D**

7. Role of Punjab in the Freedom Struggle.
8. Fairs and Festivals.

**Suggested Reading**

1. Kirpal Singh (ed.), *History and Culture of the Punjab,* Part-II, Punjabi University, Patiala, 1990.
2. Fauja Singh (ed.), *History of Punjab,* Vol, III, Punjabi University, Patiala, 1987.
3. J.S. Grewal, *The Sikhs of the Punjab, Cup, Cambridge, 1991.*
4. Khushwant Singh, *A History of the Sikhs,* Vol. I, OUP, New Delhi, 1990

*B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **MATHEMATICS–III** |
| **Course Code** | **:** | **MTL–201** |
| **Credits** | **:** | **4** |
| **L TP** | **:** | **3-1-0** |

**Total Marks: 100**

**Mid Semester Examination: 20% weightage**
**End Semester Examination: 80% weightage**

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

The objective of the course is to make the understanding of random phenomena and to introduce students to the theory of probability. The course will also apprise the students to the applications of theory of probability to study the reliability of the system, noise in signal, modeling the life length of the components. The emphasis of the course is to acquaint the students with Monte Carlo simulation for the study of the random experiment and computational methods.

**Total No. of Lectures – 48**

| | Lecture wise breakup | Number of Lectures |
|---|---|---|
| | **SECTION - A** | |
| **1** | Probability: Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem. | 12 |
| | **SECTION - B** | |
| **2** | Random Variables: Random Variables, probability mass function, probability density function, cumulative distribution function, function of random variable. Two and higher dimensional random variables, joint distribution, marginal and conditional distributions, Stochastic independence. Expectation: Mathematical expectations and moments, moment generating function and its properties. | 12 |
| | **SECTION - C** | |
| **3** | Probability Distributions: Binomial, Poisson, Uniform, Exponential, Gamma, Normal distribution, t– distribution, chi–square distribution, F–distribution. | 12 |

| SECTION - D | | |
|---|---|---|
| **4** | Uniform Pseudo random number generation and random variable generation, Generating random variate from standard statistical distribution (discrete and continuous distribution), Monte– Carlo integration. | 12 |

| **Course Outcomes:** | |
|---|---|
| **1** | The students can apply the theory of probability in estimating the noise in the signal and reliability of the system. |
| **2** | It will give deep insight of the various courses of communication courses, like Information Theory and Coding Techniques, Advanced Digital Communication System, Theory of Estimation in communications etc. |
| **3** | It will help the students to study the engineering system with simulation. |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Hogg, RV, Mckean, JW and Craig, AT: Introduction to Mathematical Statistics. |
| **2** | Gupta, SC and Kapoor, K: Fundamentals of Mathematical Statistics, Sultan Chand & Co. |
| **3** | Rubinstein, R.Y.: Simulation and the Monte Carlo Method, John Wiley. |
| **4** | Probability and Statistics with Reliability by KS Trivedi, Prentice Hall. |

***B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester***

| | | |
|---|---|---|
| **Course Name** | **:** | **Solid Mechanics** |
| **Course Code** | **:** | **MEL- 211** |
| **Credits (L-T-P)** | **:** | **(3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To familiarize the students with the fundamentals of deformation, stresses, strains in structural elements. Know the concepts of stress and strain, Analyze the beam of different cross sections for shear force, bending moment, slope and deflection, Understand the concepts necessary to design the structural elements and pressure vessels, Understand the concept of torsion. |

**Total No. of Lectures-48**

| **Lecture wise breakup** | | **Number of lectures** |
|---|---|---|
| **SECTION – A** | | |
| **1** | **Simple Stresses and Strains-** Concept of stress and strain, St. Venant's principle, stress and strain diagram, Hooke's law, Young's modulus, Poisson's ratio, stress at a point, stresses and strains in bars subjected to axial loading, Modulus of elasticity, stress produced in compound bars subjected to axial loading. Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound walls. | 8 |
| **2** | **Compound Stresses and Strains-** Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants. | 8 |

| | | |
|---|---|---|
| | **SECTION – B** | |
| **3** | **Bending moment and Shear Force Diagrams**- Bending moment (BM) and shear force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformlyvarying loads, application of moments. | 6 |
| **4** | **Theory of bending stresses**-Assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel sections, Composite beams, bending and shear stresses in composite beams. | 6 |
| | **SECTION –C** | |
| **5** | **Slope and deflection**- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams. | 6 |
| **6** | **Torsion** - Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity., Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs. | 6 |
| | **SECTION - D** | |
| **7** | **Thin Cylinders and Spheres**- Derivation of formulae and calculations of hoopstress, longitudinal stress in a cylinder, and sphere subjected to internal pressures. | 4 |
| **8** | **Columns and Struts**- Columns under uni-axial load, Buckling of Columns, Slenderness ratio and conditions. Derivations of Euler's formula for elastic buckling load, equivalent length. Rankine Gordon's empirical formula. | 4 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Pytel A.H. and Singer F.L., "Strength of Materials", Harper Collins, New Delhi. |
| **2** | Beer P.F. and Johston (Jr) E.R., "Mechanics of Materials", SI Version, McGraw Hill, NY. |
| **3** | Popov E.P., "Engineering Mechanics of Solids", SI Version, Prentice Hall, New Delhi. |
| **4** | Timoshenko S.P. and Young D.H., "Elements of Strength of Materials", East West Press, New Delhi. |
| **5** | Shames, I.H., Pitarresi, J.M., "Introduction to Solid Mechanics," Prentice-Hall, NJ. |
| **6** | NPTEL courses, http://nptel.iitm.ac.in/courses.php, web and video courses on Strength of Materials by Sharma, S.C., and Harsha, S.P. |

*B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Thermodynamics -I** |
| **Course Code** | **:** | **MEL-213** |
| **Credits (L-T-P)** | **:** | **3 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components. The students will be able to identify, track and solve various combustion problems and evaluate theoretically the performance of various components involved in steam power plants and internal combustion engines.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Basic Concepts**- Basic concepts-concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi- static process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases. | 5 |
| **2** | **First Law of Thermodynamics**-Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow | 9 |

| | | |
|---|---|---|
| | **SECTION - B** | |
| **3** | **Second Law of Thermodynamics**-Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, theCarnot refrigeration and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids andsolids, the entropy change of ideal gases, reversible steady-flow work, minimizing the compressor work, isentropic efficiencies of steady-flow devices, and entropy balance. | 9 |
| **4** | **Energy** - a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, energy change of a system, energy transfer by heat, work, and mass, the decrease of energy principle and energy destruction, energy balance: closed systems and control volumes energy balance. | |
| | **SECTION - C** | |
| **5** | **Properties of Pure Substance**- Properties of pure substances. Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces. Thermodynamic properties of steam. Calculations of work done and heat transfer in non- flow and flow processes. | 5 |
| **6** | **Power Cycles**- Vapour and combined power cycles, including the Carnot vapor cycle, Rankine cycle: the ideal cycle for vapor power, the ideal reheat and regenerative and the second law analysis of vapour power cycles. Gas power cycles, including basic considerations in the analysis of power cycles, the Carnot cycle and its value in engineering, , an overview of reciprocating engines, air standard assumptions ,gasoline engine Otto cycle, diesel engine cycle, gas-turbine Brayton cycle, and the second-law analysis of gas power cycles. | 8 |
| | **SECTION - D** | |
| **7** | **Ideal and Real Gases and Thermodynamic Relations**- Gas mixtures – properties ideal and real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius Clapeyron equations, Joule – Thomson coefficient. | 3 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Nag. P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi. |
| **2** | Cengel, “Thermodynamics- An Engineering Approach”, Tata Mc Graw Hill, New Delhi. |
| **3** | Sonntag, R. E., Borgnakke, C., &Wylen, G. J. V., “Fundamentals of Thermo dynamics ”Wiley..materials: Pearson Education. |
| **4** | Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. “Fundamentals of Engineering Thermodynamics” John Wiley & Sons.. |
| **5** | Jones, J. B., & Dugan, R. E., “Engineering Thermodynamics” Prentice Hall. |
| **6** | Potter, M. C., & Somerton, C. W., “Schaum’s Outline of Thermodynamics forEngineers”, McGraw- Hill. |

*B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Engineering Materials** |
| **Course Code** | **:** | **MEL-214** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

This course is designed to develop fundamental concepts of crystallography, phase transformation and heat treatment processes. The students will learn the atomic structure of metals, imperfections, diffusion mechanisms and theories of plastic deformation. They will also understand equilibrium diagrams, time-temperature transformation curves and heat treatment processes. Upon completion of the course, the students will be able to understand the concepts of crystal structure, microstructure and deformation. They will also be able to understand the phase diagrams which are useful for design and control of heat treating processes.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Basic Crystallography**- Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices. Crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number. Frank Reed source of dislocation Elastic& plastic modes of deformation, slip & twinning, strain hardening, seasons cracking, Bauschinger's effect, yield point phenomenon, cold/hot working, recovery, re-crystallization, and grain growth, strengthening of metals. | 7 |
| **2** | **Constitution of Alloys and Phase Diagrams**- Constitution of alloys – Solid solutions - substitutional and interstitial. Phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions. Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application. | 7 |

| | | |
|---|---|---|
| | **SECTION - B** | |
| **3** | **Heat Treatment**-Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and tempering of steel. Isothermal transformation diagrams–cooling curves superimposed on I.T. diagram CCR Hardenability, Jominy end quench test Austempering, martempering. Case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening. | 7 |
| | **SECTION - C** | |
| **4** | **Ferrous and Non Ferrous Metals**- Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti& W) - stainless and tool steels – HSLA. Gray, White malleable, spheroidal –Graphite - alloy cast-iron. Copper and Copper alloys – Brass, Bronze and Cupronickel. Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys. | 5 |
| **5** | **Non-Metallic Materials**- Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers. Urea and Phenol formaldehydes. Engineering ceramics – Properties and applications of Al2O3, SiC, SiC, Si3, N4, PSZ etc. Fibre and particulate reinforced composites and resin plastics. Powder metallurgy, Manufacturing Process, Compacting, Sintering, Vacuum processing. Properties of Powder processed materials, high energy compaction. Metal matrix composites, preparation properties and uses. | 7 |
| | **SECTION - D** | |
| **6** | **Mechanical Properties and Testing**- Mechanism of plastic deformation, slip and twinning. Types of fracture – Testing of materials under tension, compression and shear loads, hardness tests (Brinell, Vickers and Rockwell) Impact test, Izod and charpy, fatigue and creep test. | 6 |
| **7** | **Introduction to Science and Technology of Nano materials**- Nano structured materials, Low- dimensional structures: Quantum wells, Quantum wires, and Quantum dots, Nano clusters & Nano crystals. Electronic and optical properties of nano crystallites,Metallic and semiconducting super lattices. Synthesis of nanostructured materials, Fabrication and characterization of nano-electronic devices and MEMS. Basics of synthesis and characterization of nano-multi-component systems for sensors (magnetic, electronic and optical) and electrodes. Synthesis and fabrication of carbon nano structures for fuel cell and energy storage applications. | 6 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Kenneth G. Budinski and Michael K.Budinski, "Engineering *Materials"* Prentice-Hall ofIndia |
| **2** | William D Callister, "Material Science and Engineering", John Wiley and Sons. |
| **3** | Raghavan.V., "Materials Science and Engineering", Prentice Hall of India. |
| **4** | Lakhtin, Y., &Weinstein, N., "Engineering Physical Metallurgy" University Press of thePacific. |
| **5** | Avner, S. H.,"Introduction to Physical Metallurgy" McGraw-Hill. |
| **6** | Jacobs, J. A., &Kilduff, T. F. "Engineering Materials Technology: Structures, Processing, Properties, and Selection" Pearson/Prentice Hall. |
| **7** | Bolton,W., "Engineering Materials Technology", Butterworth-Heinemann. |
| **8** | Flinn, R. A., & Trojan, P. K., "Engineering Materials and Their Applications", Wiley |
| **9** | Koch, C. C., "Nanostructured materials: processing, properties, and applications",WilliamAndrew Pub |
| **10** | NPTEL courses, http://www.nptel.iitm.ac.in/courses.php?disciplineId=112: related web and video resources under Mechanical Engineering & Metallurgy and Material Science |

*B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Machine Drawing** |
| **Course Code** | **:** | **MEL-215** |
| **Credits (L-T-P)** | **:** | **5 (3-1-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

The objective of this course is to make students understand the principles and requirements of production drawings and learning how to assemble and disassemble important parts use din major mechanical engineering applications. After going through this course, the student shall be able to under stand the drawings of mechanical components and their assemblies along with their utility for design of components.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction:** Principles of Drawing, Requirements of production drawing, Sectioning and conventional representation, Dimensioning, symbols of standard tolerances, Machining Symbols, introduction and Familiarization of Code IS: 296 | 4 |
| **2** | **Classification of Machine Drawings (with examples):** Assembly Drawing, Part Drawing, Detailed Drawing, Catalogues Drawing. | 2 |
| | **SECTION - B** | |
| **3** | **Conventional Representation of Machine Components:** screw threads, spring, gears, bearings, splined shaft | 4 |
| | **SECTION - C** | |
| **4** | **Assembly and Part Drawings:** couplings, clutches, bearings, gear assemblies, I.C. Engine components, valves, machine tools, etc. | 25 |
| | **SECTION - D** | |
| **5** | **Symbols:** Symbols for surface roughness, Weldments, process flow, electrical and instrumentation units. | 2 |
| **6** | **Solid Modeling:** Introduction to solid modelers, solid modeling of various machine parts. | 4 |
| **7** | **Project:** A **drawing** project. | 4 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Singh, Ajeet, “Machine drawing Includes AutoCAD”, Tata Mc GrawHill, 2008. |
| **2** | ND Junnarkar, “Machine Drawing”, Pearson Education, 2007. |
| **3** | N. D. Bhatt, “Machine Drawing”, Charotar Book Stall, Anand, 1996. |
| **4** | N. Sidheswar, P. Kanniah and V. V. S. Sastry, “Machine Drawing”, Tata McGraw Hill,1983. |
| **5** | National Drawing Code, http://bis.org.in/other/WC_SP_46_03122014.pdf |

*B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Solid Mechanics Lab** |
| **Course Code** | **:** | **MEP-211** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties. | 2 |
| **2** | To perform compression test on Cast Iron. | 2 |
| **3** | To perform any one hardness tests (Rockwell, Brinell &Vicker's test). | 2 |
| **4** | To perform impact test to determine impact strength. | 2 |
| **5** | To perform torsion test and to determine various mechanical properties. | 2 |
| **6** | To perform Fatigue test on circular test piece. | 2 |
| **7** | To perform bending test on beam and to determine the Young's modulus and modulus | 2 |
| **8** | Determination of Bucking loads of long columns with different end conditions. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Engineering Material Lab** |
| **Course Code** | **:** | **MEP-214** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Preparation of models/charts related to atomic/crystal structure of metals. | 2 |
| **2** | Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel. | 2 |
| **3** | Hardening the steel specimen and study the effect of quenching medium on hardness of steel. | 2 |
| **4** | Practice of specimen preparation (cutting, mounting, polishing, etching) of mild steel, aluminium and hardened steel specimens. | 2 |
| **5** | Study of the microstructure of prepared specimens of mild steel, Aluminium and hardened steel. | 2 |
| **6** | Identification of ferrite and pearlite constituents in given specimen of mild steel. | 2 |
| **7** | Determination of hardenability of steel by Jominy End Quench Test. | 2 |

***B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester***

| | | |
|---|---|---|
| **Course Name** | **:** | **Basic Simulation Laboratory Lab** |
| **Course Code** | **:** | **MEP-218** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Creating a One-Dimensional Array (Row / Column Vector)<br>Exercise – Creating a vector of even whole numbers between 31 and 75;<br>Creating a Two-Dimensional Array (Matrix of given size) and<br>(A). Performing Arithmetic Operations - Addition, Subtraction, Multiplication and Exponentiation.<br>(B). Obtaining Modified Matrix - Inverse, Transpose, with Appended and Deleted Elements. | 2 |
| **2** | Performing Matrix Manipulations - Concatenating, Indexing, Sorting, Shifting, Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis; Creating Arrays X & Y of given size (1 x N) and Performing (A). Relational Operations - >, <, ==, <=, >=, ~= (B). Logical Operations - ~, &, \|, XOR | 2 |
| **3** | Generating a set of Commands on a given Vector (Example: X = [1 8 3 9 0 1]) to<br>(A). Add up the values of the elements (Check with sum)<br>(B). Compute the Running Sum (Check with sum), where Running Sum for element j = the sum of the elements from 1 to j, inclusive.<br>(C). Compute the Sine of the given X-values (should be a vector).<br>Also, Generating a Random Sequence using rand()/randn() functions and plotting them. | 2 |
| **4** | Evaluating a given expression and rounding it to the nearest integer value using Round,Floor, Ceil and Fix functions; Also, generating and Plots of (A) Trigonometric Functions- *sin(t), cos(t), tan(t), sec(t), cosec(t) and cot(t)* for a given duration ' *t*'. (B). Logarithmic and other Functions – log(A), log10(A), Square root of A, Real nth root of A. | 2 |
| **5** | *Creating a vector X with elements, Xn = (-1)(n+1) (2n-1) and adding up 100 elements of the vector X; and plotting the function, x, x3, ex and exp(x.x), the interval 0<x<4* (by choosing appropriate mesh values for x to obtain smooth curves), on (A). A Rectangular Plot (B). A Semi log Plot (C). A log-log Plot. | 2 |

| | | |
|---|---|---|
| **6** | Generating a Sinusoidal Signal of a given frequency (say, 100Hz) and Plotting with Graphical Enhancements - Titling, Labelling, Adding Text, Adding Legends, Adding New Plots to Existing Plot, Printing Text in Greek Letters, Plotting as Multiple and Sub-Plots; *Also*, Making Non-Choppy and Smooth Plot of the functions, $f(x) = sin(1/x)$ for $0.01 < x < 0.1$ and $g(x) = ( sin x)/ x$. | 2 |
| **7** | Creating A Structure, An Array of Structures and Writing Commands to Access Elements of the created Structure and Array of Structures; *Also*, Solving First Order Ordinary Differential Equation using Built-in Functions; *And*, Creating an M x N Array of Random Numbers using **rand** and setting any value that is < 0.2 to „0' and any value that is ≥ 0.2 to „1' by moving through the Array, Element by Element; | 2 |
| **8** | Generating normal and integer random numbers (1-D & 2-D) and plotting them; *Also*,Writing a Script (which keeps running until no number is provided to convert) that asks for Temperature in degrees Fahrenheit and Computes the Equivalent Temperature in degrees Celsius. [Hint: Function **is empty** is useful] | 2 |
| **9** | Writing brief Scripts starting each Script with a request for input (using input)<br>to Evaluate the function h(T) using if-else statement, where h(T)=(T – 10) for 0 < T < 100<br>=(0.45T+900) for T>100<br>Exercise: Testing the Scripts written using<br>A). T = 5, h = -5 and<br>B). T = 110, h = 949.5 Also, Creating a Graphical User Interface<br>(GUI);<br>And, Curve Fitting using<br>(A) Straight line Fit<br>(B). Least Squares Fit | 2 |
| **10** | Interpolation based on following Schemes (A). Linear (B). Cubic (C). Spline Also, Generating the first Ten Fibonacci numbers according to the relation Fn = Fn-1 + Fn-2 with F0 = F1 = 1, and Computing the ratio Fn / Fn-1 for the first 50 Fibonacci numbers.<br>[Exercise: Verifying that the computed ratio approaches the value of the golden mean (1 + sqrt(5)) / 2 ]; Also Generating Equivalent Square Wave from a Sine Wave of given Amplitude and Frequency; And,. Obtaining the Covariance & Correlation Coefficient Matrices for a given Data Matrix. | 2 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Getting Started with MATLAB - A Quick introduction for Scientists & Engineers by Rudra Pratap, Oxford Univ. Press, 5th edition, 2010. |
| **2** | MATLAB An Introduction with Applications by Amos Gilat, Wiley Student Edition, 2009. |
| **3** | MATLAB Programming for Engineers by Stephen J. Chapman, Thomson Learning, 2008. |
| **4** | www.mathworks.com/nn8/moler, e-book, 2009. |
| **5** | Introduction to MATLAB 7 for Engineers by William Palm III, McGraw-Hill, 2nd Edition, 2004. |
| **6** | MATLAB and its Applications in Engineering by Raj Kumar Bansal Ashok Kumar |
| **7** | Goel, Manoj Sharma - Pearson Education, 1$^{st}$Edition, 2009. |

*B.Tech. (Mechanical Engineering) (CBEGS) 3rd Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Computer Graphics Lab** |
| **Course Code** | **:** | **MEP-219** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Introduction of the CAD software and its utilities in the engineering software. | 2 |
| **2** | Study of the various toolbar options and exercises to familiarize all the drawing tools. | 2 |
| **3** | Study the basic initial setting and viewing of the drafting software interfaces. | 2 |
| **4** | Use of basic entities in 2D. | 2 |
| **5** | Use of various modify commands of the drafting software. | 2 |
| **6** | Dimensioning in 2D and 3D entries. | 2 |
| **7** | Study and implementing of coordinate systems & UCS. | 2 |
| **8** | Draw the different type of 3D modelling entries using viewing commands to view them (Isometric projection). | 2 |
| **9** | Sectioning of solid primitives and rendering in 3D. | 2 |
| **10** | Intersection of solid primitives. | 2 |
| **11** | Draw different surface models with different editing commands. | 2 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Bethune, James D. Engineering Graphics with AutoCAD 2020. Macromedia Press, 2019. |
| **2** | Kulkarni, Dhananjay M., A. P. Rastogi, and Ashoke K. Sarkar. Engineering Graphics with AutoCAD. PHI Learning Pvt. Ltd., 2009. |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Mechanisms and Machines** |
| **Course Code** | **:** | **MEL-221** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

Planar kinematics of rigid bodies, systems of rigid bodies and particles, problem formulation and solution methods for the dynamic equations of motions for planar motion of rigid bodies, develop simplified, rigid body models for systems of mechanical components, introduce the concepts and uses of work and kinetic energy, understand fundamental concepts and solution strategies for cams, governors, belts, ropes, chains, gears and concepts of balancing. The students will understand the basic concepts of machines and able to understand constructional and working features of important machine elements. The students should be able to understand various parts involved in kinematics of machines for different applications. The students shall also be able to understand requirements of basic machine parts which would help them to understand the design aspects of the machine parts.

**Total No. of Lectures-46**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction**-General concepts, Introduction of Simple mechanism, Different types of Kinematics pair, Grublers rule for degree of freedom, Grashof's Criterion for mobility determination. Inversions of 3R-P, 2R-2P chains. | 5 |
| **2** | **Kinematic Analysis**–Concepts of vectorial analysis. Velocity and Acceleration, Analysis of planar mechanisms. | 5 |
| | **SECTION - B** | |
| **3** | **Cams**-Classification, Cams with uniform acceleration and retardation, SHM, Cylcloidal motion, oscillating followers. | 6 |
| **4** | **Governors:** Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson-Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power, controlling force curve, effect of sleeve friction. | 6 |

| | | |
|---|---|---|
| | **SECTION - C** | |
| **5** | **Gears**- Geometry of tooth profiles, Law of gearing, Involute profile, interference, helical, spiral and worm gears, simple, compound gear trains. Epicyclic gear trains – Analysis by tabular and relative velocity method, fixing torque. | 6 |
| **6** | **Dynamic Analysis**- Slider-crank mechanisms, turning moment computations.<br>Belts, Ropes and Chains: Material & Types of belt, Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, Velocity Ratio, Crowning of Pulley, Loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack side of belts, Length of belt, Power transmitted by belts including consideration of Creep and Slip, Centrifugal Tensions and its effect on power transmission. | 6 |
| | **SECTION - D** | |
| **7** | **Balancing**- Static and Dynamic balancing, Balancing of revolving & reciprocating massesin single and multi-cylinder engines. | 6 |
| **8** | **Gyroscopes**-Basic concepts Gyroscopic law, effect of gyroscopic couple on automobiles,ships, aircrafts. | 6 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Mallik, A. K., Ghosh, A., &Dittrich, G. Kinematic analysis and synthesis of mechanisms: CRC Press. |
| **2** | Uicker, J. J., Pennock, G. R., &Shigley, J. E. Theory of machines and mechanisms: OUP. |
| **3** | Norton, R.L. Design of machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, McGraw-Hill |
| **4** | Rattan.S.S. Theory of Machines: McGraw-Hill Education (India) Pvt Ltd. |
| **5** | Rao, J. S. The Theory of Machines Through Solved Problems: New Age International |
| **6** | Ballaney PL, Theory of Machines and Mechanisms, Khanna Publications. |
| **7** | Bevan, T. The theory of machines: A Text-Book for Engineering Students: Pearson Education |
| **8** | Vinogradov, O. G. Fundamentals of Kinematics and Dynamics of Machines and Mechanisms: CRC Press. |
| **9** | NPTEL courses: http://nptel.iitm.ac.in/courses.php, related web and video resources on Kinematics of Machines and Dynamics of Machines. |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Design of Machine Elements** |
| **Course Code** | **:** | **MEL-224** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

Basics of mechanical design: visual thinking, engineering drawing, and machine anatomy.

Basics of manufacturing: processes, and materials aspects.

Use of computers in various phases of design and manufacturing.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction to Mechanical Engineering Design**- Review of models of Solid mechanics, uncertainties in design equations and factor of safety. Role of off the shelf available machine elements and standards. Standard numbering system including BIS designations of materials. Application of theories of failure to design | 7 |
| | **SECTION - B** | |
| **2** | **Design procedure and applications of Statically Loaded Machine Elements**- Design of elements subjected to simple loading: Riveted joints, Screws including power screws, Bolted joints including eccentrically loaded joints, Axles, and coupling, Clutches and brakes. | 14 |
| | **SECTION - C** | |
| **3** | **Fatigue**-Introduction to design for fatigue strength. Endurance and modifying factors. Surface strength. Review of design procedure of fatigue failure with application to the design of bolts and springs subjected to fatigue loading. | 10 |
| | **SECTION - D** | |
| **4** | **Design procedure and applications of Dynamically Loaded Machine Elements**- Shafts, Spur, helical, bevel and worm gears, Journal and rolling contact bearings, Belts and chains. Design of a gear box. | 14 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Budynas, R. G., &Nisbett, J. K., Shigley's Mechanical Engineering Design: McGraw-Hill. |
| **2** | Norton, R. L. Machine Design: an Integrated Approach: Prentice Hall |
| **3** | Spotts, M. F., Shoup, T. E., &Hornberger, L. E. Design of Machine Elements: Pearson/Prentice Hall |
| **4** | Hamrock,B.J. et.al., Fundamentals of Machine Elements, McGraw Hill |
| **5** | Bhandari, V. B. Design of Machine Elements: McGraw-Hill Education (India) Pvt Ltd. |
| **6** | NPTEL courses: http://nptel.iitm.ac.in/courses.php - Web and Video Resources on Dynamics of Mechanical System/ Design of Machine Elements /Machine Design. |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

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|---|---|---|
| **Course Name** | **:** | **Fluid Mechanics** |
| **Course Code** | **:** | **MEL-225** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To provide the basic knowledge of fluid statics and dynamics. |

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Basic Concepts and Properties**- Fluid – definition, distinction between solid and fluids and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension. Fluid statics concept of fluid static pressure, absolute and gauge pressures–pressure measurements by manometers and pressure gauges. Hydrostatic forces on submerged surfaces, Stability of floating bodies. | 5 |
| | **SECTION - B** | |
| **2** | **Fluid Kinematics and Fluid Dynamics**- Fluid Kinematics - Flow visualization - lines of flow- types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function – velocity potential function - circulation - flow net. Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation, applications - Venturi meter, Orifice meter, Pitot tube. Dimensional analysis - Buckingham's Pei theorem- applications - similarity laws and models. | 12 |
| | **SECTION - C** | |
| **4** | **Incompressible Fluid Flow**- Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates – Laminar flow through circular tubes. (Hagen Poiseulle's equation). Hydraulic and energy gradient - flow through pipes - Darcy -Weisback's equation – pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel – power transmission. Boundary layer flows, boundary layer thickness and boundary layer separation. Drag and lift coefficients. | 16 |

| | | |
|---|---|---|
| **5** | **Dimensional Analysis and Similitude:** Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froude, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws. | |
| | **SECTION - D** | |
| **6** | **Internal Flows:** Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart.**Pressure and Flow Measurement:** Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters. | 12 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Som, S. K., & Biswas, G. Introduction to Fluid Mechanics and Fluid Machines: Tata McGraw-Hill. |
| **2** | Fox, R. W., McDonald, A. T., & Pritchard, P. J. Introduction to fluid Mechanics: Wiley. |
| **3** | Munson, B. R., Young, D. F., &Okiishi, T. H. Fundamentals of Fluid Mechanics: Student Solutions Manual: Wiley. |
| **4** | Bansal, R. K. A Textbook of Fluid Mechanics and Hydraulic Machines: (in S.I. Units): Laxmi Publications. |
| **5** | Massey, B. S., &Ward-Smith, J. Mechanics of Fluids: Stanley Thornes. |
| **6** | NPTEL Courses: http://nptel.iitm.ac.in/courses.php - Web and Video Resources on Fluid Mechanics. |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Mechanical Measurement and Metrology** |
| **Course Code** | **:** | **MEL-226** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To impart basic knowledge about the measurement systems and their components and various methods of engineering metrology. |

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Mechanical Measurement:** Need of mechanical measurement, Basic definitions: Hysteresis, Linearity, Resolution of measuring instruments, Threshold, Drift, Zero stability, loading effect and system response. Measurement methods, Generalized Measurement system, Static performance characteristics, Errors and their classification. | 3 |
| **2** | **Linear and angular measurements:** Linear Measurement Instruments, Vernier calliper, Micrometer, Interval measurements: Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges, Problems on measurements with gauge. | 4 |
| **3** | **Measurement of Force, Torque and Strain:** Force measurement: load cells, cantilever beams, proving rings, differential transformers. Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements. Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, temperature compensation. | 4 |

| | | |
|---|---|---|
| **SECTION - B** | | |
| **4** | **Displacement, Velocity/Speed, and Acceleration, Measurement:**<br>Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer | 5 |
| **5** | **Temperature measurement:**<br>Temperature Measuring Devices: Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring devices, Numerical Examples on Flow Measurement. | 5 |
| **SECTION - C** | | |
| **6** | **Metrology:**<br>Basics of Metrology, Need for Inspection, Accuracy and Precision, Objectives, Standards of measurements.<br>**Metrology of Gears and screw threads:**<br>Gear tooth terminology, Sources of errors in manufacturing of gears, Measurement of tooth thickness: Gear tooth vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope or projector, Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking. Measurement of concentricity, Alignment of gears. Screw Thread Measurement: Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread calliper gauges. | 5 |
| **SECTION - D** | | |
| **7** | **Metrology of Surface finish:**<br>Surface Metrology Concepts and terminology, Analysis of surface traces, Specification of surface Texture characteristics, and Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments, Wave length, frequency and cut off, other methods for measuring surface roughness: Pneumatic method, Light Interference microscopes, Mecrin Instruments. | 9 |
| **8** | **Comparators:**<br>Functional Requirements, Classification, Mechanical Comparators, Mechanical Optical Comparators, Electrical Comparators, Pneumatic Comparators.<br>**Miscellaneous Metrology:**<br>Precision Instrumentation based on Laser Principals, Coordinate measuring machines: Structure, Modes of Operation, Probe, Operation and applications. Optical Measuring Techniques: Tool Maker's Microscope, Profile Projector, Optical Square. Basics of Optical Interference and Interferometry, Optoelectronic measurements, | 9 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Rajput, R.K. Engineering Metrology, S.K. Kataria and Sons |
| **2** | Jain, R.K., Engineering Metrology, Khanna Publishers |
| **3** | Raghavendra, N. V., and L. Krishnamurthy. Engineering metrology and measurements. Oxford: Oxford University Press, 2013. |
| **4** | Figliola, Richard S., and Donald E. Beasley. "Theory and design for mechanical measurements." (2001): 1743. |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Primary Manufacturing** |
| **Course Code** | **:** | **MEL-227** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

This course is designed to provide students with an overview of a wide variety of manufacturing processes for processing of engineering materials. The students will learn principles, operations and capabilities of various metal casting and metal joining processes. They will also learn about the defects, their causes and remedies in these processes. Upon completion of the course, the students should have the ability to understand the importance of the manufacturing processes and to select a suitable metal casting and metal joining processes to fabricate an engineering product.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **General** Introduction-Manufacturing; definition and broad classification with typical examples of applications | 2 |
| **2** | **Casting**-Introduction; History of the technology; Definition and major classification; Casting materials, Sand mould casting: Basic principles with simple examples of a solid casting and a hollow casting.<br>Patterns; types, material and design including pattern allowances; Moulding sands; composition, preparation, properties and testing;<br>Core; Purpose, definition, materials, preparation and applications;<br>Design of gating system; pouring basin, sprue, runner and risers; Advantages, limitations and applications of top gate, bottom gate, parting gate and step gate; Estimation of pouring time for top gate and bottom gate type moulds.<br>Foundry equipment and furnaces. Melting, pouring and solidification. Principles, method, relative advantages and applications of floor mould casting, shell mould casting, pit mould and loam mould casting CO2 mould casting; centrifugal casting (pure, semi and centrifuging types) investment casting including mercasting; Permanent mould casting.<br>Die casting; types, methods, relative advantages and applications Slush casting; principle and use, Casting defects; types, causes and remedy | 16 |

| | | |
|---|---|---|
| | **SECTION – B** | |
| **3** | **Forming Processes** - Introduction; General principles; major classification with typical examples; Hot working and cold working; principle, purpose, relative advantages and applications. Forging:-Definition and classification giving few example of application; work materials different forging operations, tools and equipment; Smithy, drop forging and press forging (pressing) methods and use; Forging dies ;types, materials and design.<br>Rolling: Introduction; basic principles and general applications; Characteristics and applications of hot rolling and cold rolling; various rolling processes and applications and rolled products; Roll pass design for different products Wire drawing and Extrusion: Basic principles and requirements; Classification, methods and applications; work materials and products; Press tool works; Basic principles, system, operations and applications. | 12 |
| | **SECTION - C** | |
| **4** | **Shearing** - Parting, notching, blanking and piercing. Cupping (drawing) and deep drawing. Design of blanks for any shearing and cupping operation. Estimation of forces and power required for shearing and cupping operations. Coining and embossing; basic principle and methods. Other forming processes: Principles, methods, essential requirements and applications of Spinning and flow turning; Bulging; Hydro forming; Magneto forming;Explosive forming. | 5 |
| | **SECTION - D** | |
| **5** | **Welding**- Introduction: Major classes of joining; Mechanical joining; temporary, semi- permanent and permanent Giving examples; Welding; Brazing and soldering; Adhesive bonding; Welding in Liquid state. Fusion welding: - Introduction; basic principle, definition and major classification; characteristics and applications of different fusion welding processes using different heat-sources. Heat source:- chemical; gas welding; thermit welding; Heat source:- electrical; Arc welding; Manual arc welding; Submerged arc welding; TIG and MIG; Induction welding; Plasma arc welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Laser beam welding and electron beam welding. Solid state welding: - Principles. Methods, requirements and application of the different types; Solid state welding in hot condition; Forge welding; Friction welding; Diffusion welding; Solid state welding in cold condition; Ultrasonic welding. Pressure welding. Explosive welding. Welding defects; Types, causes, effects and remedy. | 10 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Rao.P.N. 2001. Manufacturing technology: foundry, forming and welding: McGraw-Hill. |
| **2** | Ghosh, A., &Mallik, A. K. 1986. Manufacturing science: Ellis Horwood. |
| **3** | Kalpakjian, S., &Schmid, S. R. 2008. Manufacturing processes for engineering. |
| **4** | Campbell, J. S. Principles of manufacturing materials and processes: Tata McGraw-Hill. |
| **5** | Date. P.P. Introduction to manufacturing processes; Jaico Publishing House. |
| **6** | NPTEL courses, http://www.nptel.iitm.ac.in/courses.php?disciplineId=112 web and video resources on Manufacturing Processes - I. |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Mechanisms and Machines Lab** |
| **Course Code** | **:** | **MEP-221** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism. | 2 |
| **2** | To study the various inversions of kinematic chains. | 2 |
| **3** | Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor. | 2 |
| **4** | Determination of gyroscopic couple (graphical method). | 2 |
| **5** | Balancing of rotating masses (graphical method). | 2 |
| **6** | Cam profile analysis (graphical method) | 2 |
| **7** | Determination of gear- train value of compound gear trains and epicyclic gear trains. | 2 |
| **8** | To draw circumferential and axial pressure profile in a full journal bearing. | 2 |
| **9** | To determine coefficient of friction for a belt-pulley material combination. | 2 |
| **10** | Determination of moment of inertia of flywheel. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Design of Machine Element Lab** |
| **Course Code** | **:** | **MEP-224** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Design of circumferential/longitudinal riveted joint of boiler. | 4 |
| **2** | Design of rigid flange coupling. | 4 |
| **3** | Design of flexible coupling (Bush pin type) | 4 |
| **4** | Design of eccentrically loaded bracket. | 4 |
| **5** | Design of pipe and pipe joints subjected to internal pressure. | 4 |
| **6** | Design of shaft carrying one pulley and supported in two bearing. | 4 |

***B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester***

| | | |
|---|---|---|
| **Course Name** | **:** | **Fluid Mechanics Lab** |
| **Course Code** | **:** | **MEP-225** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | To determine the metacentric height of a floating vessel under loaded and unloaded conditions. | 2 |
| **2** | To study the flow through a variable area duct and verify Bernoulli's energy equation. | 2 |
| **3** | To determine the coefficient of discharge for an obstruction flow meter (venturi meter/orifice meter) | 2 |
| **4** | To determine the discharge coefficient for a V- notch or rectangular notch. | 2 |
| **5** | To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number. | 2 |
| **6** | To determine the hydraulic coefficients for flow through an orifice. | 2 |
| **7** | To determine the friction coefficients for pipes of different diameters. | 2 |
| **8** | To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend. | 2 |
| **9** | To determine the velocity distribution for pipeline flow with a pitot static probe. | 2 |
| **10** | Experimental evaluation of free and forced vortex flow. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Mechanical Measurement and Metrology Lab** |
| **Course Code** | **:** | **MEP-226** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **20% weightage** |
| **External Marks** | **:** | **20% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Measurement of an angle with the help of sine bar | 2 |
| **2** | Measurement of surface roughness of a machined Plate, Rod and Pipe | 2 |
| **3** | Measurement of gear elements using profile projector | 2 |
| **4** | Measurement of effective diameter of external threads using Three wire method | 2 |
| **5** | Measurement of thread element by Tool maker's microscope | 2 |
| **6** | Calibration of a pressure gauge with the help of a dead weight gauge tester | 2 |
| **7** | Use of stroboscope for measurement of speed of shaft | 2 |
| **8** | Use of pitot tube to plot velocity profile of a fluid through a circular duct | 2 |
| **9** | Preparation of a thermocouple, its calibration and application for temperature measurement | 2 |

*B.Tech. (Mechanical Engineering 4th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Primary Manufacturing Lab** |
| **Course Code** | **:** | **MEP-227** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-12**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| | **Casting** | 8 |
| **1** | To determine clay content, moisture content, hardness of a moulding sand sample. | 2 |
| **2** | To determine shatter index of a moulding sand sample. | 2 |
| **3** | To test tensile, compressive, transverse strength of moulding sand in green condition. | 2 |
| **4** | To determine permeability and grain fineness number of a moulding sand sample. | 2 |
| | **Welding** | 4 |
| **1** | To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes | 2 |
| **2** | To study MIG, TIG and Spot welding equipment and make weld joints by these processes. | 2 |
| | **Machining and Forming** | 12 |
| **1** | To study constructional features of following machines through drawings/ sketches:<br>a. Grinding machines (Surface, Cylindrical)<br>b. Hydraulic Press<br>c. Draw Bench<br>d. Drawing and Extrusion Dies<br>e. Rolling Mills | 2 |
| **2** | To grind single point and multipoint cutting tools | 2 |
| **3** | To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads. | 2 |
| **4** | To prepare job on shaper involving plane surface, | 2 |
| **5** | Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters. | 2 |
| **6** | To determine cutting forces with dynamometer for turning, drilling and milling operations. | 2 |

*B.Tech. (Mechanical Engineering 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Computer Aided Design** |
| **Course Code** | **:** | **MEL-310** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

Overview of CAD, CAD Applications, Solid Modeling: Wireframe, B-Rep, CSG approaches, Transformations and Projections, Mathematical representation of curves and surfaces, Ferguson, Bezier and B-spline curves and properties, Ferguson, Bezier and B-spline surfaces and properties, Computations for Geometric Design, Introduction to Finite Element Analysis and Optimization.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction**-Need and Scope of Computer Aided Design, Fundamental of CAD and computer graphics-Application areas, Hardware and software-overview of graphics systems, video-display devices, and raster-scan systems, random scan systems, graphics monitors and workstations and input devices. Interactive hardware/software techniques, Drawing standards, dimensioning and text writing, concept of layers, advanced concepts of CAD software- blocks, UCS, 3D-line, 3D object, DXF & DXB file formats. Output primitives-Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives Scan line polygon fill algorithm, boundary fill and flood-fill algorithms. | 8 |
| | **SECTION - B** | |
| **2** | **2-D geometrical transforms**-Translation, scaling, rotation, reflection and shear transformations. Matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 2-D viewing-The viewing pipeline, viewing coordinate reference frame. Window to view port coordinate transformation, viewing functions. Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland–Hodgeman polygon clipping algorithm. | 7 |
| **3** | **3-D Object Representation**-Polygon surfaces, quadric surfaces, spline representation. Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon-rendering methods. 3-D viewing-Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping. | 7 |
| | **SECTION - C** | |

| | | |
|---|---|---|
| **4** | **3-D Geometric transformations**-Translation, rotation, scaling, reflection and shear transformations, composite transformations. Visible surface detection methods- Classification, back-face detection, depth buffer, scan-line, depth sorting, BSP-tree methods, area sub- division and octree methods. | 7 |
| | **SECTION - D** | |
| **5** | **Introduction to CAD CAM**- Overview, orientation and application commands of CAD and CAE modeling software platforms for feature based Parametric and Variation modelling and analysis. Boolean, and sweep operations on primitives with applications to CAD of machine elements. | 6 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | McConnell, J. J. Computer Graphics Theory into Practice Jones and Bartlett Publishers. |
| **2** | Davis, M. J. Computer Graphics Nova Science Pub Inc. |
| **3** | Rogers, D.F., Earnshaw, R.A., Graphics, B.C.S.C., Group, D., & Society, C. G. Computer Graphics Techniques Theory and Practice Springer-Verlag. |
| **4** | Salomon, D. Transformations and Projections in Computer Graphics Springer. |
| **5** | Bethune, J. D. Engineering Design and Graphics with Solid Works Prentice Hall. |
| **6** | Zeid, I. Mastering CAD/CAM (Engineering Series) McGraw-Hill Higher Education. |
| **7** | NPTEL courses http//nptel.iitm.ac.in/courses. php- web and video resources on Computer Aided Design and Manufacturing. |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Vibration and Noise Control** |
| **Course Code** | **:** | **MEL-312** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To introduce the fundamentals of vibration and noise control and application of these principles to real life problems. |

**Total No. of Lectures – 45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction-** - Types of vibration-Equations of motion for undamped free vibration - Translational and Torsional vibration- Free damped vibration- Forced vibration problems- Harmonic excitation- Rotating unbalance- critical speed, vibration isolation. | 6 |
| **2** | **Two degree of freedom systems-** Formulation of solution - undamped free vibration- Lagrangian energy method- coordinate Coupling Undamped vibration absorber- Rotor systems- Geared systems | 8 |
| | **SECTION - B** | |
| **3** | **Multi degree of freedom systems:** Eigen value and vector-Linear system-Matrix method- Influence coefficients- Numerical methods - Holzer's method, - Rayleigh's Approach - Dunkerley's method, Rayleigh Ritz method. | 10 |
| | **SECTION - C** | |
| **4** | **Vibration Measuring Instruments and Field Measurement** Vibration instruments - Transducer - Vibrometer - Velometer - Accelerometer - Seismometer - Frequency measuring instruments-Single reed-Multi reed - Stroboscope-Vibration Exciters- Experimental modal analysisCondition monitoring techniques- Diagnostic tools -Signal Analysis-Time and Frequency Domain analysis- Balancing of rotors. | 8 |

| SECTION - D | | |
|---|---|---|
| **5** | **Noise - Concept and Control**<br>Basics of noise - Introduction, amplitude, frequency, wavelength - Pressure level, noise dose level - Measurement and analysis of noise. Methods for control of noise - Mechanical noise - Sound enclosures - Acoustic barriers. | 8 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Meirovitch Leonard; Element of Vibration Analysis; TMH |
| **2** | Singiresu Rao, Mechanical Vibrations, Pearson Education |
| **3** | Dukikipati RV, Srinivas J, Textbook of Mechanical Vibrations; PHI |
| **4** | Thomson,W.T., Theory of Vibration with Applications, C.B.S Pub & Distributors |
| **5** | G.K.Grover, Mechanical Vibration, Nemchand and Bross, Roorkee. |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Heat Transfer** |
| **Course Code** | **:** | **MEL-313** |
| **Credits (L-T-P)** | **:** | **5 (4-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To impart basic knowledge of heat and mass transfer mechanisms. |

**Total No. of Lectures – 48**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction-**Modes and mechanisms of heat transfer: Basic laws of heat transfer, General discussion about applications of heat transfer. Conduction heat transfer: Fourier rate equation, General heat conduction equation in Cartesian, cylindrical and spherical coordinates. Simplification and forms of the field equation: steady, unsteady and periodic heat transfer, Initial and boundary conditions. | 8 |
| | **SECTION - B** | |
| **2** | **One Dimensional Steady State Conduction-** Heat transfer in homogeneous slabs, hollow cylinders and spheres overall heat transfer coefficient electrical analogy critical radius of insulation. Variable thermal conductivity systems with heat sources of heat generation. Extended surface (fins) heat transfer along a fin, fin with insulated tip and short fin. Application to error measurement of temperature. | 10 |
| **3** | **One Dimensional Transient Conduction Heat Transfer-** Systems with negligible internal resistance; Significance of Biot and Fourier numbers. Chart solutions of transient conduction systems- concept of functional body. | 6 |

| | | |
|---|---|---|
| | **SECTION - C** | |
| **4** | **Convective Heat Transfer-** Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow. Dimensional analysis as a tool for experimental investigation. Buckingham Pi-Theorem and method. Application for developing semi-empirical non- dimensional correlation for convection heat transfer, significance of non- dimensional numbers. Concepts of continuity. Momentum and energy equations. Forced convection: External flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer. Flat plates and cylinders. Internal Flows: Concepts about hydrodynamic and thermal entry lengths division of internal flow based on this use of empirical relations for horizontal pipe flow and annulus flow. | 8 |
| **5** | **Free Convection-** Development of hydrodynamic and thermal boundary layer along a vertical plate. Use of empirical relations for vertical plates and pipes. | 4 |
| | **SECTION - D** | |
| **6** | **Heat Transfer with Phase Change-** Boiling: Pool boiling regimes calculations on nucleate boiling, critical heat flux and film boiling. Condensation: Film wise and drop wise condensation, Nusselt Theory of condensation on a vertical plate-Film condensation on vertical and horizontal cylinders using empirical correlations. Heat Exchangers- Classification of heat exchangers overall heat transfer-Coefficient and fouling factor. Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods. | 6 |
| **7** | **Radiation Heat Transfer-** Emission characteristics and laws of black-body radiation, Irradiation total and monochromatic quantities, laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann, heat exchange between two black bodies, concepts of shape factor. Emissivity heat exchange between grey bodies radiation shields electrical analogy for radiation networks. | 6 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Som, S. K Introduction To Heat Transfer. Prentice-Hall of India Pvt. Ltd. |
| **2** | Incropera, F. P., DeWitt, D. P., Bergman, T. L., &Lavine, A. S. Fundamentals of Heat and Mass Transfer: John Wiley & Sons. |
| **3** | Özısık, M. N. Heat transfer: a Basic Approach: McGraw-Hill. |
| **4** | Holman, J. P. Heat Transfer: McGraw Hill Higher Education. |
| **5** | Çengel, Y. A. Heat transfer: a Practical Approach: McGraw-Hill. |
| **6** | Lienhard, J. H., &Lienhard, J.H. A Heat Transfer Textbook: Fourth Edition: Dover Publications. |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Advanced Mechanics of Solids** |
| **Course Code** | **:** | **MEL-351** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| |

**Total No. of Lectures – 36**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Strain Energy & Impact Loading:** Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's& Maxwell's theorems, Numericals. | 5 |
| **2** | **Theories of Elastic Failure:** Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals. | 7 |
| | **SECTION - B** | |
| **3** | **Unsymmetrical Bending**: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numericals. | 7 |
| **4** | **Thick Cylinders & Spheres:** Derivation of Lame's equations, radial & hoop stresses and strains in thick and compound cylinders and spherical shells subjected to internal fluid pressure only, wire wound cylinders, hub shrunk on solid shaft, Numericals. | 7 |
| | **SECTION - C** | |
| **5** | **Rotating Rims & Discs:** Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (i) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders. Numericals. | 7 |

| | | |
|---|---|---|
| **6** | **Bending of Curved Bars** : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem stresses in simple chain link, deflection of simple chain links, Problems. | 5 |
| **SECTION - D** | | |
| **7** | **Springs:** Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals. | 7 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Strength of Materials – G.H.Ryder, Third Edition in SI Units 1969 Macmillan, India. |
| **2** | Strength of Materials – Sadhu Singh, Khanna Publishers |
| **3** | Book of Solid Mechanics – Kazmi, Tata Mc Graw Hill |
| **4** | Strength of Materials – D.S. Bedi - S. Chand & Co. Ltd |
| **5** | Strength of Materials – U.C Jindal - Pearson India Ltd. |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Sensors and Actuators** |
| **Course Code** | **:** | **MEL-355** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

- To get familiarize with sensors used in engineering
- To understand the signal conditioning circuits

**Total No. of Lectures – 36**

| | Lecture wise breakup | Number of lectures |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction to Instrumentation systems -** Basic elements of instrumentation systems, Input-Output configuration, Error sources – Calibration – standards, static and dynamic characteristics of instruments.<br>**General Transduction Principles for measurement applications:** Transduction principle – Resistive, Capacitive, Inductive, Piezo resistive, Piezoelectric, optical,Photo voltaic, Thermoelectric, Acoustic and Hall effect. | 9 |
| | **SECTION - B** | |
| **2** | **Construction and operation of typical instruments -** General measurement applications - temperature, pressure, vibration, force, acceleration, torque, position, velocity, angular velocity, humidity, tactile, flow and level measurement.<br>**Advanced sensors technologies and applications –**Opto-electronic sensors, Fiber optic sensor, Magnetic sensors, Digital transducers, LASER based instruments, Ultrasonic sensors, Micro sensors, Bio sensors. | 9 |
| | **SECTION - C** | |
| **3** | **Smart sensor systems and applications –** General architecture of a smart sensor – Self calibration – Wireless sensors- energy harvesting techniques – Web based instrumentation-Applications.<br>**Signal conditioning and Data Acquisition –** Operational Amplifiers, Amplifiers, bridges, filters, analog-to digital and digital-to-analog conversion, Elements of data acquisition system, basics of Virtual instrumentation systems, Data logging. | 9 |

| SECTION - D | | |
|---|---|---|
| **4** | **Industrial Applications of sensors and instrumentation systems –** Vibration measurement in machine tools, Position measurement of end effectors in robots – Speed measurement of road wheels in Automotive system, Environmental monitoring and biomedical applications- case studies | 9 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Bentley JP, Principles of measurement systems, Pearson Publishers., 2012. |
| **2** | Ernest. O. Doebelin, “Measurement System Application & Design”, (2008), McGraw Hill Book co 5th edition, 2008. |
| **3** | John G. Webster, HalitEren, “Measurement, Instrumentation, and Sensors Handbook”,(2014), Second Edition, CRC Press. |
| **4** | D. V. S. Murty, “Transducers and Instrumentation”, (2010), PHI Learning Pvt. Ltd. |
| **5** | H.R. Taylor, “Data Acquisition for Sensor Systems”, (2013), Springer Science & Business Media. |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Welding Technology** |
| **Course Code** | **:** | **MEL-353** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| |

**Total No. of Lectures – 42**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction-** Welding as a production process – its advantages and limitations. Gas welding process, Types of fuels, acetylene, Indene, Butane etc. Gas welding equipment, gas welding technique. Electric arc welding – manual metal arc welding – power supplies, cables and other accessories for arc welding, welding technique - atomic, hydrogen welding, thermit welding, soldering, brazing and braze welding. | 8 |
| **2** | **Special Welding Processes-** Power sources, equipments and accessories, application, limitation and other characteristics of: (a) Gas tungsten arc (TIG) welding (b) Gas metal arc (MIG) welding (c) Submerged arc welding (d) Electro slag welding processes. Resistance welding processes- principle- Types (spot, seam, projection and percussion flash), equipment required for each application. | 8 |
| | **SECTION - B** | |
| **3** | **Modern Welding Processes-**Electron beam welding, Laser beam welding, Plasma arc welding, Friction welding, Explosive welding, Ultrasonic welding, Stud welding, Under water welding, Diffusion bonding, Cold welding, Welding of dissimilar metals. | 8 |
| | **SECTION - C** | |
| **3** | **Weldment Testing-** Defects in welding in various processes-Causes and remedies; Destructive testing of weldments - Strength, hardness, ductility, fatigue, creep properties etc. Non- destructive testing of weldments; Ultrasonic dye penetrant, magnetic particle inspection. X ray testing procedures and identification of defects – case studies. Weld thermal cycle – Residual stressed distortion in welding stress relieving techniques. | 9 |
| | **SECTION - D** | |

| | | |
|---|---|---|
| **5** | **Weldability, Automation and Design in Welding**- Weldability –definition. Temperature distribution in welding –heat affected zone weldability of steel, cast iron. Aluminum, pre heating and post heating of weldments. Estimation of transition temperature. Automation in welding – Seam tracking vision and arc sensing welding robots. Design of weldments-welding symbols positions of welding joint and groove design. Weld stress –calculations – design of weld size. | 9 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Abbott, J., & Smith, K. M., Welding Technology: Texas State Technical College Publishing. |
| **2** | Radha krishnan.V.M. Welding Technology and Design, New Age International Pub. Ltd., |
| **3** | Little R.L.,Welding Technology Tata McGraw-Hill |
| **4** | Partner R.S.Welding Process and Technology, Khanna Publishers |
| **5** | Lancaster J.F.,Metallurgy of Welding,George Allen and Unwin. |
| **6** | “AWS Welding Hand Book”, Volume 1 to 4, AWS. |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Automobile Engineering** |
| **Course Code** | **:** | **MEL-354** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Total No. of Lectures – 45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Vehicle Structure and Engines-**Types of automobiles, vehicle construction – chassis, frame and body, aerodynamics, components of engine – their forms, functions and materials, review of cooling and lubrication systems in engine, turbo chargers, engine emission control by– way catalytic controller, electronic engine management system. | 9 |
| | **SECTION - B** | |
| **3** | **Engine Auxiliary Systems-**Carburetor– working principle, electronic fuel injection system – mono-point and multi - point injection systems, electrical systems – battery generator - starting motor and drives – lighting and ignition (battery, magneto coil and electronic type)- regulators-cut outs. | 9 |
| | **SECTION - C** | |
| **3** | **Transmission Systems-**Clutch – types and construction, gear boxes- manual and automatic, simple floor mounted shift mechanism, over drives, transfer box fluid flywheel- torque convertors, propeller shaft – slip Joint – universal joints, differential and rear axle, hotch kiss drive and torque tube drive. | 9 |
| | **SECTION - D** | |
| **4** | **Steering, Brakes and Suspension-** Wheels and tires – wheel alignment parameters steering geometry and types of steering gear box, power steering, types of front axle – suspension systems. Braking systems – types and construction – mechanical/ hydraulic/ pneumatic braking system – antilock braking system. | 9 |
| **5** | **Alternative Energy Sources-**Use of natural gas, LPG, biodiesel, gasohol and hydrogen in automobiles, electric and hybrid vehicles, fuel cells. | 9 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Crolla, D. Automotive Engineering: Powertrain, Chassis System and Vehicle Body: Butterworth-Heinemann. |
| **2** | Heisler, H. Advanced Vehicle Technology: Butterworth-Heinemann. |
| **3** | Happian-Smith, J. An Introduction to Modern Vehicle Design: Butterworth-Heinemann. |
| **4** | Newton, Steeds and Garet, Motor Vehicles, Butterworth Publishers. |
| **5** | Crouse, W. H., &Anglin, D. L. Automotive Mechanics, Study Guide: McGraw-Hill. |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Computer Aided Design Lab** |
| **Course Code** | **:** | **MEP-310** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Lab Syllabus** | | |
|---|---|---|
| **1** | **COMPUTER AIDED DRAFTING OF MACHINE ELEMENTS:** Orthographic views - Isometric views - Sectional views. Dimensioning - Annotations – Symbols – Welding - Surface finish - Threads. Text - Bill of Materials- Title block. Exercise: Knuckle, Gib and Cotter Joint - Screw Jack - Foot step bearing. | |
| **2** | **GEOMETRIC MODELING OF MACHINE COMPONENTS:** Protrusion - cut - Sweep - Revolve - Draft and loft - Modify/edit - Pattern - Transformation - Boolean operation. Exercise: Individual parts of Universal Joint - Flange Coupling – Piston and Connecting rod. | |
| **3** | **CONVERSION OF 3D TO 2D:** Conversion of 3D to 2D and Mass property calculations for parts created in Units I and II. | |
| **4** | **ASSEMBLY OF MACHINE PARTS:** Exercise: Assemble from parts created in Unit II. | |

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Orthographic projections – I (from part model) | 2 |
| **2** | Orthographic projections – II (from assembly model) | 2 |
| **3** | 3D part modeling with basic features. | 2 |
| **4** | 3D part modelling with advanced features. | 2 |
| **5** | 3D assembly modelling. | 2 |
| **6** | Data exchange standards. | 2 |
| **7** | 3D to 2D conversion. | 2 |
| **8** | Structural analysis | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Vibration & Noise Control Lab** |
| **Course Code** | **:** | **MEP-312** |
| **Credits (L-T-P)** | **:** | **1(0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **-** |
| **End Semester Examination** | **:** | **100% weightage** |

**Total No. of Practicals –**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Free vibration of cantilever beam | 2 |
| **2** | Free vibration of simply supported beam | 2 |
| **3** | Free vibration of fixed beam | 2 |
| **4** | Forced vibration of SDOF system | 2 |
| **5** | Base Excitation | 2 |
| **6** | Rotating Unbalance | 2 |
| **7** | 2DOF Forced vibration | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Heat Transfer Lab** |
| **Course Code** | **:** | **MEP-313** |
| **Credits (L-T-P)** | **:** | **1(0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **-** |
| **End Semester Examination** | **:** | **100% weightage** |

**Total No. of Practicals –**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Determination of thermal conductivity of:<br>-a solid insulating material by slab method<br>-powder materials by concentric spheres method / or by some transient heat transfer technique<br>-a metal by comparison with another metal by employing two bars when kept in seriesand / or in parallel under different boundary conditions<br>-Liquids by employing thin layer | 2 |
| **2** | Determination of coefficient of heat transfer for free/forced convection from the surface of a cylinder / plate when kept:<br>-along the direction of flow<br>-perpendicular to the direction of flow<br>-inclined at an angle to the direction of flow | 2 |
| **3** | To plot the pool boiling curves for water and to determine its critical point | 2 |
| **4** | Determination of heat transfer coefficient for<br>-film condensation<br>-drop-wise condensation | 2 |
| **5** | Determination heat transfer coefficient by radiation and hence find the Stefan Boltzman's constant using two plates/two cylinders of same size by making one of the plates/cylinders as a black body. | 2 |
| **6** | Determination of shape factor of a complex body by an analog technique. | 2 |
| **7** | To plot the temperature profile and to determine fin effectiveness and fin efficiency for<br>-A rod fin when its tip surface is superimposed by different boundary condition like: Insulated tip, Cooled tip, Temperature controlled tip<br>-Straight triangular fins of various sizes and optimization of fin proportions<br>-Circumferential fins of rectangular/triangular section. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Welding Technology Lab** |
| **Course Code** | **:** | **MEP-353** |
| **Credits (L-T-P)** | **:** | **1(0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **-** |
| **End Semester Examination** | **:** | **100% weightage** |

**Total No. of Practicals –**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Welding- Introduction. | 2 |
| **2** | Edge/joint preparation in welding and joining using arc welding and gas welding. | 2 |
| **3** | Hands-on practice on shielded metal arc welding. | 2 |
| **4** | Hands-on practice on metal inert gas welding (MIG) or gas metal arc welding. | 2 |
| **5** | Hands-on practice on tungsten inert gas welding (TIG) or gas tungsten arc welding. | 2 |
| **6** | Hands-on practice on spot welding. | 2 |
| **7** | Hands-on practice on submerged arc welding. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 5th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Automobile Engineering Lab** |
| **Course Code** | **:** | **MEP-354** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **-** |
| **End Semester Examination** | **:** | **100% weightage** |

**Total No. of Practicals –**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Study and demonstration of layout of an automobile. | 2 |
| **2** | Study and demonstration of differential. | 2 |
| **3** | Study and demonstration of clutches. | 2 |
| **4** | Study and demonstration of brakes. | 2 |
| **5** | Study and demonstration of gear box. | 2 |
| **6** | Study and demonstration of steering mechanism. | 2 |
| **7** | Study and demonstration of suspension system. | 2 |
| **8** | Study and demonstration of internal combustion engine. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Thermodynamics -II** |
| **Course Code** | **:** | **MEL-320** |
| **Credits (L-T-P)** | **:** | **5 (4-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| The course objective is to introduce students to the IC engine and various components of thermal power plants and the related thermal and economical tools for effective engineering analysis of such plants. |

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Fuels and their properties-** Stoichiometric and actual air requirements, flue gas analysis. Conversion of volumetric analysis into gravimetric analysis and vice-versa, Actual weight of air supplied, Use of mole, for solution of combustion problems, Heat of formation, Enthalpy of formation, Enthalpy of reaction, Adiabatic flame temperature. | 5 |
| **2** | **Boilers** - Different types of boilers, boiler mountings, feed water treatment, boiler loading and manner of operation. Boiler energy balance, draft system. Different types of furnaces for burning coal, fuel oil and gas. Circulation theory, down-comers and risers, economizers and super-heaters, air pre-heater, drum and its internals. | 8 |
| | **SECTION – B** | |
| **3** | **Plant Components -** Theory and design of condensers, air ejector and cooling towers. Types and applications | 8 |
| **4** | **Steam Nozzles -** Definition, types and utility of nozzles; Flow of steam through nozzles; Condition for maximum discharge through nozzle; Critical pressure ratio, its significance and its effect on discharge; Area of throat and at exit for maximum discharge; Effect of friction; Nozzle efficiency; Convergent and convergent-divergent nozzles; Calculation of Nozzle dimensions (length and diameters of throat and exit); Supersaturated (or metastable) flow through nozzle. | 8 |

| | | |
|---|---|---|
| | **SECTION – C** | |
| **5** | **Steam Turbines -** Theory and design. Impulse and reaction turbines, compounding of turbines, optimum velocity ratio, reheat factor and condition line, parallel exhaust, losses in steam turbines, steam turbine governing. | 8 |
| | **SECTION - D** | |
| **6** | **Internal Combustion Engines:** Actual Engine Indicator diagrams and valve-timing diagrams for two stroke and four stroke S.I. and C.I. Engines; Construction and Working Principle of Wankel rotary engine; Principle of simple carburator, Injection systems in Diesel and Petrol Engines( Direct Injection, MPFI in SI and CI Engines, respectively). Essential requirements for Petrol and Diesel Fuels. Theory of combustion in SI and CI Engines; Various stages of combustion; Pressuretime/crank - Angle diagrams; Various phenomenon such as turbulence, squish and swirl, dissociation, pre-ignition/auto- ignition, and after burning etc.; Theory of knocking (ie,. detonation) in SI and CI Engines; Effect of engine variables on the Delay Period in SI and CI engines; Effect of various parameters on knock in SI and CI Engines; Methods employed to reduce knock in SI and CI Engines; Octane and Cetane rating of fuels; Knockmeter; Dopes and inhibitors; Performance curves/maps of SI and CI Engines; Effect of knocking on engine performance; Effect of compression ratio and air-fuel ratio on power and efficiency of engine; Variation of engine power with altitude; Supercharging and turbo charging of SI and CI Engines; Advantages and applications of supercharging; Emissions from SI and CI Engines and methods to reduce/control them. Logarithmic plotting of PV-diagrams. High speed Engine Indicators. | 8 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Ganesan.V. Internal Combustion Engines: Tata Mcgraw-Hill Publishing Company Limited. |
| **2** | Heywood, J. B. Internal Combustion Engine Fundamentals: McGraw-Hill. |
| **3** | Lumley, J. L;Engines: An Introduction: Cambridge University Press. |
| **4** | Ferguson, C.R., & Kirkpatrick, A.T. Internal Combustion Engines: Applied Thermo sciences: John Wiley. |
| **5** | Stone, R. Introduction to Internal Combustion Engines: |
| **6** | Nag.P.K. Power plant engineering: Tata McGraw-Hill. |
| **7** | Arora, S. C., &Domkundwar, S. A course in power plant engineering: Dhanpat Rai. |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Refrigeration and Air Conditioning** |
| **Course Code** | **:** | **MEL-323** |
| **Credits (L-T-P)** | **:** | **5 (4-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

Analytical approach to the engineering problem and performance analysis of refrigeration and air conditioning system. Study of thermodynamics behind it. Design and operating characteristics of different types of refrigeration system. Refrigeration and air conditioning concepts.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Introduction-**Necessity and applications; of refrigeration and C.O.P. Mechanical refrigeration; Types of ideal cycles of refrigeration. Air refrigeration: Bell Coleman cycle and Brayton cycle, open and dense air systems; Actual air refrigeration system problems; Refrigeration needs of aircrafts. | 4 |
| | **SECTION – B** | |
| **2** | **Vapour Compression Refrigeration-** Working principle and essential components of the plant; Simple vapour compression refrigeration cycle; COP; Representation of cycle on T-S and p-h charts; effect of sub cooling and super heating; cycle analysis; Actual cycle Influence of various parameters on system performance; Use of p-h charts; numerical problems. | 6 |
| **3** | **Refrigeration System Components-**Compressors; General classification; comparison; Advantages and disadvantages. Condensers: classification; Working principles. Evaporators: classification; Working principles. Expansion devices: Types; Working principles. Refrigerants: Desirable properties; classification refrigerants used; Nomenclature; Ozone depletion; Global warming. | 7 |
| | **SECTION – C** | |
| **4** | **Vapor Absorption Refrigeration-** Calculation of max COP; description and working of NH3; water system and Li Br; water ( Two shell & four shell) system. Principle of operation Three fluid absorption system, salient features. | 7 |

| | | |
|---|---|---|
| **5** | **Other Refrigeration Systems-** Steam Jet refrigeration system; Working principle and basic components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube tube. | 7 |
| | **SECTION - D** | |
| **6** | **Introduction- :** Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling. Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables.<br>**Load Estimation**: Need for ventilation, consideration of infiltration; Load concepts of RSHF, GSHF- problems, concept of ESHF and ADP. Requirements of human comfort and concept of effective temperature; Comfort chart; Comfort Air conditioning; Requirements of industrial air conditioning | 7 |
| **7** | **Air Conditioning System Components-**Equipment for cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat pump; Heat sources, different heat pump circuits. | 7 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Arora, C. P. Refrigeration and Air Conditioning: McGraw-Hill. |
| **2** | Stoecker, W. F., & Jones, J. W. Refrigeration and Air Conditioning: McGraw-Hill. |
| **3** | Whitman, W. C., Johnson, W. M., &Tomczyk, J. Refrigeration & Air Conditioning Technology: Delmar |
| **4** | Dossat. Principles of Refrigeration: Pearson Education. |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Mechatronics** |
| **Course Code** | **:** | **MEL-324** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| Gain a complete understanding of basic electrical circuits and electronic devices. Learn how to understand and apply semiconductor devices. Learn the basics of digital electronics. Learn how to program and interface microcontrollers. Learn the theoretical and practical aspects of measurement system design. Learn the basics of sensor and actuator theory, design, and application. Become proficient with using laboratory instrumentation and with building basic circuits. |

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Introduction-** Mechatronics: What and why? | 2 |
| **2** | **Essential Electronics and Boolean Algebra-** Digital representation: binary, decimal, hexadecimal, conversion from binary to decimal and vice-versa. Binary arithmetic: addition, subtraction: 2's complement, multiplication and division, boolean algebra: AND, OR, NOT, NAND, NOR, XOR logic, Truth table, realization of logic in physical systems: switches-LEDs, cylinders. Fundamental identities, De Morgan's theorems and relationship with sets, simplification, electronics fundamentals: Review of some semiconductor devices, Concepts of digital and analog systems, digital output (DO) and input (DI), using switches, transistors, pneumatic devices, etc. to realize DI & DO. Operational Amplifier: principles, configurations: inverting; summing; integrating and differentiating configurations, digital to analog conversion (DAC), the R-2R and summing op-amp circuit, analog to digital conversion (ADC), successive approximation method, flash method, etc. Programs for DI, DO, DA and AD for PC based plug in cards. | 16 |

| | | |
|---|---|---|
| **SECTION – B** | | |
| **3** | **Microprocessor, Computers and Embedded Systems-** Introduction to the 8085 (8-bit microprocessor) and microcontroller: Architecture, programming, I/O, Computer interfacing, Programmable logic controller basics. | 6 |
| **SECTION – C** | | |
| **4** | **Sensors and Actuators-** Strain gauge, resistive potentiometers, tactile and force sensors, tachometers, LVDT, piezoelectric accelerometer, hall effect sensor, optical encoder, resolver, inductosyn, pneumatic and hydraulic actuators, stepper motor, DC motor, AC motor. | 8 |
| **SECTION - D** | | |
| **5** | **Control Systems-**Mathematical modeling of physical systems, system equations, controllability and observability, Pole placement, PID controller, control of hydraulic, pneumatic, mechanical and electrical systems. | 8 |
| **6** | **Integration and Case Studies-** Integration of mechatronics component subsystems into a complete mechatronics system, applications to CNC machines and robotics. | 5 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | David G. Alciatore, and Michael B. Histand, "Introduction to Mechatronics and Measurement Systems", Tata |
| **2** | McGraw Hill, New Delhi. |
| **3** | W. Bolton, "Mechatronics", Pearson Education Asia, New Delhi. |
| **4** | Dan Necsulescu, "Mechatronics", Pearson Education Asia, New Delhi. |
| **5** | N. P. Mahalik, "Mechatronics", Tata McGraw Hill, New Delhi. |
| **6** | Wolfram Stadler, "Analytical Robotics and Mechatronics", McGraw-Hill Book Co. |
| **7** | EroniniUmez-Eronini, "System Dynamics & Control", Thomson Asia. |
| **8** | ShettyDevdas and Richard A Kolk, "Mechatronics System Design", Thomson Learning, Vikas Publishing House, New Delhi. |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Fluid Machinery** |
| **Course Code** | **:** | **MEL-325** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To provide the basic knowledge of Fluid machinery and boundary layer |

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | Impulse momentum principle; jet impingement on stationary and moving flat plates, and on stationary or moving vanes with jet striking at the centre and tangentially at one end of the vane; calculations for force exerted, work done and efficiency of jet. | 2 |
| | **SECTION – B** | |
| **2** | Incompressible Fluid Flow- Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes. (Hagen Poiseulle's equation). Hydraulic and energy gradient - flow through pipes - Darcy -Weisback's equation – pipe roughness - friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission.<br>Boundary Layer Concept-Introduction to boundary layer formation, Navier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation – Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, flow with very small Reynolds number, Hagen Poisseuille flow, Plane Couette flow, Hydrodynamic theory of lubrication. | 6 |
| | **SECTION – C** | |
| **3** | Hydraulic Turbines- Fluid machines definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - components of energy transfer - degree of reaction. Hydro turbines definition and classifications - Pelton turbine - Francis turbine - propeller turbine Kaplan turbine .Working principles - velocity triangles - work done - specific speed – efficiencies - performance curve for turbines. | 8 |

| SECTION - D | | |
|---|---|---|
| **4** | Hydraulic Pumps-Pumps definition and classifications. Centrifugal pump classifications, working principles, velocity triangles, specific speed, efficiency and performance curves. Reciprocating pump classification, working principles, indicator diagram, work saved by air vessels and performance curves, cavitation in pumps Rotary pumps working principles of gear and vane pumps. | 8 |
| **5** | Hydraulic Devices and Systems: Const., operation and utility of simple and differential accumulator, intensifier, fluid coupling and torque converter, Air lift and jet pumps; gear, vane and piston pumps, Hydraulic Rams | 5 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | David G. Alciatore, and Michael B. Histand, "Introduction to Mechatronics and Measurement Systems", TataMcGraw Hill, New Delhi. |
| **2** | W. Bolton, "Mechatronics", Pearson Education Asia, New Delhi. |
| **3** | Dan Necsulescu, "Mechatronics", Pearson Education Asia, New Delhi. |
| **4** | N. P. Mahalik, "Mechatronics", Tata McGraw Hill, New Delhi. |
| **5** | Wolfram Stadler, "Analytical Robotics and Mechatronics", McGraw-Hill Book Co. |
| **6** | Eronini Umez-Eronini, "System Dynamics & Control", Thomson Asia. |
| **7** | ShettyDevdas and Richard A Kolk, "Mechatronics System Design", Thomson Learning, Vikas Publishing House, New Delhi. |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Finite Element Methods In Engineering** |
| **Course Code** | **:** | **MEL-361** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

1. To learn basic principles of finite element analysis procedure.
2. To learn the theory and characteristics of finite elements that represent engineering structures.
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others.
4. Learn to model complex geometry problems and solution techniques.

**Total No. of Lectures-45**

| | Lecture wise breakup | Number of lectures |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Basic Concepts-** The standard discrete system, finite elements of an elastic continuum- displacement approach, generalization of the finite element concepts- weighted residual and variational approaches. | 11 |
| | **SECTION – B** | |
| **2** | **Element Types-** Triangular, rectangular, quadrilateral, sector, curved, iso-parametric elements and numerical integration. Automatic mesh generation schemes. | 10 |
| | **SECTION – C** | |
| **3** | **Application to Structural Mechanics Problems-** Plane stress and plane strains, axi-symmetric stress analysis, three dimensional stress analyses, bending of plates. | 12 |
| | **SECTION - D** | |
| **4** | **FEM in Steady State Field Problems-** Introduction, heat conduction, fluid flow and non- linear material problems, plasticity, creep etc. Computer procedures for Finite element analysis. | 12 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Chandrupatla T.R., and Belegundu A.D., Introduction to Finite Elements in Engineering, Pearson Education |
| **2** | David V Hutton, Fundamentals of Finite Element Analysis McGraw-Hill Int. Ed. |
| **3** | Rao S.S. The Finite Element Method in Engineering, Pergammon Press. |
| **4** | Logan D.L., A First course in the Finite Element Method, Third Edition, Thomson Learning |
| **5** | Robert D.Cook., David.S, Malkucs Michael E Plesha , Concepts and Applications of Finite Element Analysis. |
| **6** | Reddy J.N, An Introduction to Finite Element Method, McGraw-Hill International Student Edition |
| **7** | O.C.Zienkiewicz and R.L.Taylor, The Finite Element Methods, Vol.1. The basic formulation and linear problems, Vol.1, Butterworth Heineman |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Robotics: Mechanics and Control** |
| **Course Code** | **:** | **MEL-364** |
| **Credits (L-T-P)** | **:** | **3 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To impart knowledge about the engineering aspects of Robots and their applications. |

**Total No. of Lectures-40**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Introduction to Robotics-** Robot, robotics, types of robot, robot classification, types of robot, degrees of freedom. | 8 |
| **2** | **Kinematics and Dynamics of Robotic Linkages (Open Ended Type Manipulators) -** Frames, transformations: Translation and rotation, Denavit-Hartenberg parameters, forward and inverse kinematics, Jacobian, dynamics: Equations of motion, Newton-Euler formulation. | 8 |
| | **SECTION – B** | |
| **3** | **Sensors and Actuators-** Strain gauge, resistive potentiometers, tactile and force sensors, tachometers, LVDT, piezoelectric accelerometer, Hall effect sensors, optical encoders, pneumatic and hydraulic actuators, servo valves, DC motor, stepper motor, drives. | 8 |
| | **SECTION – C** | |
| **4** | **Control of Manipulators-** Feedback control of II order linear systems, Joint control, trajectory control, controllers, PID control | 8 |
| | **SECTION - D** | |
| **5** | **Robot Programming-**Language-overview, commands for elementary operations. | 8 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | John J. Craig, Introduction to Robotics: Mechanics and Control, Addison-Wesley. |
| **2** | Tsuneo Yoshikawa, Foundations of Robotics, MIT Press. |
| **3** | Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications, Pearson Education Inc. |
| **4** | Spong M. W., and Vidyasagar M., Robot Dynamics and Control, John Wiley & Sons. |
| **5** | Murray R. M., et al, A Mathematical Introduction to Robotic Manipulation, CRC Press, |
| **6** | Waldron K. J., and Kinzel G. L., Kinematics, Dynamics and Design of Machinery, John Wiley |
| **7** | Eronini Umez-Eronini, System Dynamics & Control, Brooks/ Cole Publishing Company, |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Machinery Fault Diagnostics** |
| **Course Code** | **:** | **MEL-326** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| The objective is to provide tools to prepare students an expert in analyzing machinery faults by giving an introduction of various condition monitoring techniques, signal processing principles like FFT methods, Hilbert methods via FFT and related amplitude, phase and frequency demodulation, cepstrum, order tracking and time synchronous averaging. |

**Total No. of Lectures-48**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Condition monitoring techniques:** Condition Monitoring in manufacturing industries; Noise monitoring, Wear and debris Analysis, Thermography, Cracks monitoring, Ultrasonic techniques - Case studies. | 12 |
| **2** | **Sensors for condition monitoring:** Accelerometers, strain gauges, eddy current probes, LVDT for measurement of displacement, velocity and acceleration; Temperature transducers, radiation pyrometers and thermal imaging | |
| | **SECTION – B** | |
| **3** | **Signal processing:** Study of periodic and random signals, probability distribution, statistical properties, auto and cross-correlation and power spectral density functions. **Signal Analysis:** Time domain and Frequency domain and Time-frequency domain analysis. | 12 |
| | **SECTION – C** | |
| **4** | **Failure Analysis and Maintenance:** Maintenance Principles, Failure mode analysis - Equipment down time analysis – Breakdown analysis - condition based maintenance. | 12 |

| SECTION - D | | |
|---|---|---|
| **5** | **Machine Condition monitoring:** Vibration, Acoustic emission and vibro-acoustics signal analysis; Case studies. **Machine Learning:** Intelligent fault detection system, Use of signal processing and machine learning techniques for the detection of various faults, Case studies. | 12 |
| **Suggested / Reference Books:** | | |
| **1** | E. S. Tehrani and K. Khorasani, Fault Diagnostics of a Nonlinear System Using a Hybrid Approach , Springer. | |
| **2** | PareshGirdhar, Cornelius Scheffer, Practical Machinery Vibration Analysis and Predictive Maintenance, Elsevier | |
| **3** | Rolf Isermann, B. Freyermuth, Fault Detection, Supervision and Safety for Technical Processes, Pergamon | |

***B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester***

| | | |
|---|---|---|
| **Course Name** | **:** | **Thermodynamics-II Lab** |
| **Course Code** | **:** | **MEP-320** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | To study four strokes spark ignition (S.I) engine and differences between S.I. and C.I engines. | 2 |
| **2** | To study two strokes S.I. engine and differences between two strokes and four strokes engines. | 2 |
| **3** | To study battery ignition system for four cylinders S.I. engines and requirements of ignition system. | 2 |
| **4** | To study magneto ignition system for SI engine having four cylinders and differences between magneto and battery Ignition system | 2 |
| **5** | Study of carburetor with compensating and starting Jet devices | 2 |
| **6** | Determination of brake power (BP), friction power (FP) and indicated power (IP) of four stroke four cylinder diesel engine with rope break dynamometer. | 2 |
| **7** | To determine mechanical efficiency, brake thermal efficiency and indicated thermal efficiency of four strokes, four cylinder diesel engine. | 2 |
| **8** | To draw heat balance sheet for four stroke, four cylinder diesel engines. | 2 |
| **9** | To study open cycle constant pressure combustion gas turbine with inter cooler, regenerator and reheat. | 2 |
| **10** | To study centrifugal compressor and differences between centrifugal and axial compressors. | 2 |

***B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester***

| | | |
|---|---|---|
| **Course Name** | **:** | **Refrigeration and Air Conditioning Lab** |
| **Course Code** | **:** | **MEP-323** |
| **Credits (L-T-P)** | **:** | **1(0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Numberof Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | To study refrigeration cycle, determine of coefficient of performance of cycle & determine of tonnage capacity of refrigeration unit. | 2 |
| **2** | To determine the COP and tonnage capacity of the chilling plant. | 2 |
| **3** | To determine COP and tonnage capacity of an air conditioning system. | 2 |
| **4** | To determine the COP and tonnage capacity of a mechanical heat pump. | 2 |
| **5** | To determine the COP and tonnage capacity of an Ice plant. | 2 |
| **6** | To study the cut sectional model of reciprocating, rotary and centrifugal compressor. | 2 |
| **7** | To study various controls used in refrigeration and air-conditioning system. | 2 |
| **8** | To study different psychometric process & chart. | 2 |
| **9** | To study works principle of steam jet refrigeration system. | 2 |
| **10** | To study the analysis of simple vapour compression cycle and explain the types of vapour compression cycle with T-S and P-H diagram. | 2 |
| **11** | To study the chilling plant and its working cycle. | 2 |
| **12** | To determine sensible heat factor of Air on re-circulated air conditioning set up. | 2 |
| **13** | To Study the Mechanical heat pump and find it's C.O.P. | 2 |
| **14** | To study the Air and Water heat pump and find it's C.O.P. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Fluid Machinery Lab** |
| **Course Code** | **:** | **MEP-325** |
| **Credits (L-T-P)** | **:** | **1(0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Determination of various efficiencies of Hydraulic Ram | 2 |
| **2** | To draw characteristics of Francis turbine/Kaplan Turbine | 2 |
| **3** | To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance | 2 |
| **4** | To draw the characteristics of Pelton Turbine | 2 |
| **5** | To draw the various characteristics of Centrifugal pump | 2 |
| **6** | Determine the effect of vane shape and vane angle on the performance of centrifugal fan/Blower. | 2 |
| **7** | A visit to any Hydroelectric Power Station. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Machinery Fault Diagnostics Lab** |
| **Course Code** | **:** | **MEP-326** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | To find out the actual soft foot of rotating machinery by experimental method. | 2 |
| **2** | How to diagnosis of shaft misalignment and its effects based on vibration. | 2 |
| **3** | To study the static balancing of rotary systems. | 2 |
| **4** | To understand the effect of oil whirl on machinery vibration. | 2 |
| **5** | To understand the effect of looseness in rotating systems. | 2 |
| **6** | To study the vibration response of bearing defects of various types. | 2 |
| **7** | To study the effects of bent shafts on rotor performance. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Finite Element Methods in Engineering Lab** |
| **Course Code** | **:** | **MEP-361** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **-** |
| **End Semester Examination** | **:** | **100% weightage** |

**Total No. of Practicals –18**

| **Practical wise breakup** | | **Numberof Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Force and stress analysis using link elements in Trusses, cables etc. | 2 |
| **2** | Stress and deflection analysis in beams with different support conditions. | 2 |
| **3** | Stress analysis of flat plates and simple shells. | 2 |
| **4** | Stress analysis of axi-symmetric components. | 2 |
| **5** | Thermal stress and heat transfer analysis of plate. | 2 |
| **6** | Thermal stress analysis of cylindrical shells. | 2 |
| **7** | Vibration analysis of spring-mass systems | 2 |
| **8** | Model analysis of beams. | 2 |
| **9** | Harmonic, transient and spectrum analysis of simple systems. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 6th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Robotics: Mechanics and Control Lab** |
| **Course Code** | **:** | **MEP-364** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **-** |
| **End Semester Examination** | **:** | **100% weightage** |

**Total No. of Practicals –**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Using MATLAB for control systems. | 2 |
| **2** | Mathematical modeling of physical systems. | 2 |
| **3** | Modeling of physical systems using SIMULINK. | 2 |
| **4** | Linear time-invariant systems and representation. | 2 |
| **5** | Block diagram reduction. | 2 |
| **6** | Performance of first order and second order systems. | 2 |
| **7** | DC motor characteristics. | 2 |
| **8** | Validation of DC motor characteristics. | 2 |
| **9** | Effect of feedback on disturbance & control system design. | 2 |
| **10** | Effect of feedback on disturbance & control system design of tank level system. | 2 |
| **11** | Introduction to PID controller. | 2 |
| **12** | Open loop and closed loop position control of DC motor | 2 |
| **13** | Simple speed control of DC motor. | 2 |
| **14** | PID controller design for two tank system | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Non-Traditional And Computer Aided Manufacturing** |
| **Course Code** | **:** | **MEL-411** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| To provide the students with a proper understanding of nontraditional machining processes. |

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| **Non-Traditional Manufacturing** | | |
| | **SECTION – A** | |
| **1** | **Introduction-**Classifications of material removal processes. Characteristics of conventional material removal (machining) processes. Need for non-conventional or non- traditional processes | 5 |
| **2** | **Process Description, Modelling, Application and Product Quality Related Issues-** Abrasive Jet Machining. Ultrasonic Machining. Water Jet Machining. Abrasive Water Jet Machining. Electro-Discharge Machining. Chemical & Photo Chemical Machining. Electro- Chemical Machining. Electron Beam Machining. Laser Beam Machining. | 11 |
| | **SECTION – B** | |
| **3** | **Advanced Topics-** Basic introduction to chemical, physical vapour deposition processes. Thermal spraying processes. Hybrid processes like electro-jet drilling, electro chemical grinding, electro-chemical discharge machining. Rapid prototyping. | 8 |
| **Computer Aided Manufacturing** | | |
| | **SECTION – C** | |
| **1** | **Introduction-** Relation between production volume and flexibility. Various manufacturing systems – batch, mass, group, cellular and flexible manufacturing systems; Type of automation and benefits of soft or flexible automation. Automation in material handling and assembly. | 6 |

| SECTION - D | | |
|---|---|---|
| **2** | **CNC Machines-** Introduction, classification, design and control features including interpolations. | 4 |
| **3** | NC Part-Programming. | 4 |
| **4** | **Introduction to Robotics-**Definitions, motivation, historical development. Basic structure, classification, workspace, drives, controls, sensors, grippers, specifications. | 8 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Mishra, P. K., Non-Conventional Machining, Narosa Publishing House |
| **2** | Pandey and Shan, Modern Machining Processes, McGraw Hill |
| **3** | Bhattacharya, A., New Technology, Institution of Engineers (I) |
| **4** | Jain, S. K. and Schmid, S. R., Manufacturing Engg. & Technology, Addison Wesley Ltd. |
| **5** | NPTEL courses, http://www.nptel.iitm.ac.in/courses.php?disciplineId=112 web and video resources on Manufacturing Processes & Advanced manufacturing processes. |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Optimization Techniques** |
| **Course Code** | **:** | **MEL-412** |
| **Credits (L-T-P)** | **:** | **4 (3-1-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

The course objective is to make students understand the concept of optimum design, approach towards optimization approach, its techniques etc.

**Total No. of Lectures-45**

| | Lecture wise breakup | Number of lectures |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Introduction** - Origin of OR and its role in solving industrial problems, General approach for solving OR problems. Classification of mathematical models: various decision-making environments. | 4 |
| **2** | **Linear Programming** - Formulation of linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two-phase method, Introduction to duality theory and sensitivity analysis. | 9 |
| **3** | **Transportation and Assignment Models** - Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function. | 6 |
| | **SECTION – B** | |
| **4** | **Dynamic Programming** - Introduction to deterministic and probabilistic dynamic programming. | 4 |
| **5** | **Queuing Theory** -Types of queuing situation, Queuing models with Poisson's input and exponential service, their application to simple situations. | 5 |
| **6** | **Replacement Models** - Replacement of items that deteriorate, Replacement of items whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with time and value of money also changes, individual replacement policy, group replacement policy. | 7 |

| | | |
|---|---|---|
| **SECTION – C** | | |
| **7** | **Network models** - Shortest route and travelling sales - man problems, PERT & CPM- introduction, analysis of time bound project situations, construction of net works, identification of critical path, slack and float, crashing of network for cost reduction. | 7 |
| **SECTION - D** | | |
| **8** | **Non-linear Programming Models** - Introduction to non-linear programming models. Problems related to the topic. | 3 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | M Wagner, Principles of Operations Research, Prentice Hall. |
| **2** | P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co. |
| **3** | F.S. Hiller and G.I. Libermann, Introduction to Operation Research, Holden Ray. |
| **4** | A Management Guide to PERT/CPM Wiest & Levy Prentice Hall |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Surface Engineering** |
| **Course Code** | **:** | **MEL-413** |
| **Credits (L-T-P)** | **:** | **4 (4-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| The course objective is to introduce students the various types of surface coatings, their types and applications in engineering. |

**Total No. of Lectures-48**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction -** Influence of different manufacturing processes on various surface and subsurface properties; need of augmentation of surface properties; need from the view point of friction, wear, thermal barrier, erosion, corrosion etc. | 8 |
| **2** | **Techniques of different surface engineering-** Heat treatments, dip-coatings, galvanizing, painting electro-depositions, physical vapour deposition processes, chemical vapour deposition processes, thick coating processes (like plasma spraying, high velocity oxy fuel spray, detonation gun spray, cold spray gun etc.) | 12 |
| | **SECTION - B** | |
| **3** | **Corrosion-** Fundamentals of corrosion, types or corrosions and electrochemical protection, protective coating, corrosion measurement. | 6 |
| | **SECTION - C** | |
| **4** | **Experimental and Approach-** Evaluation of engineered properties – control properties, response properties; surface geometry – characterization techniques (conventional and recent trends); coating thickness measurements – laboratory techniques and special techniques for accurate routine thickness measurements; adhesion measurement – conventional methods and | 121 |
| | **SECTION - D** | |
| **5** | **Tribology and Nano technology-** Measurement of mechanical properties of engineered surface in nano scale; Evaluation of tribological characteristics of engineered surface in macro, micro and nano scale, simulation of actual application environment in tribometer | 10 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Brian N. Chapman, Science and technology of surface coating, Academic Press. |
| **2** | Niir Board, Modern technology of surface coating with formulae & their applications, Asian Pacific Business Press. |
| **3** | Swaraj Paul, Surface coatings: science & technology, Edition 2, J. Wiley, ISBN 0471958182. |
| **4** | P. Ghosh, Adhesive and Coating Technology, Tata McGraw Hill. |
| **5** | DonatasSatas, Arthur A. Tracton, Coatings technology handbook, Marcel Dekker. |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Non-Destructive Evaluation and Testing** |
| **Course Code** | **:** | **MEL-451** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| The course objective is to introduce students to the classification of NDT methods, defects of cast materials, Defects of welded materials, Visual testing methods. |

**Total No. of Lectures-41**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction and Visual Methods -** Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection; Penetrant Flaw Detection- Principles: Process: Penetrant systems: Liquid penetrant materials: Emulsifiers: cleaners, developers: sensitivity: Advantages: Limitations: Applications | 8 |
| | **SECTION - B** | |
| **2** | **Radiographic Methods-** Limitations: Principles of radiography: sources of radiation, Ionising radiation - X-rays sources, gama-rays sources Recording of radiation: Radiographic sensitivity: Fluoroscopic methods: special techniques: Radiation safety; Ultrasonic Testing of Materials- Advantages, disadvantages, Applications, Generation of. Ultrasonic waves, general characteristics of ultrasonic waves: methods and instruments for ultrasonic materials testing: special techniques. | 8 |
| | **SECTION - C** | |
| **3** | **Magnetic Methods-** Advantages, Limitations, Methods of generating fields: magnetic particles and suspending liquids Magnetography, field sensitive probes: applications. Measurement of metal properties; Electrical Methods- Eddy current methods: potential-drop methods, applications. | 8 |

| | | |
|---|---|---|
| **SECTION - D** | | |
| **4** | **Electromagnetic Testing-** Magnetism: Magnetic domains: Magnetization curves: Magnetic Hysteresis: Hysteresis loop tests: comparator - bridge tests Absolute single-coil system: applications. | 9 |
| **5** | **Other Methods-** Acoustic Emission methods, Acoustic methods: Leak detection: Thermal inspection. | 8 |
| **Suggested / Reference Books:** | | |
| **1** | P. Halmshaw, Non-Destructive Testing | |
| **2** | Metals Handbook Vol. II, Non-destructive inspection and quality control | |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Machine Tools and Machining** |
| **Course Code** | **:** | **MEL-455** |
| **Credits (L-T-P)** | **:** | **3 (3-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

| **Course Objectives:** |
|---|
| The course objective is to make students understand the various manufacturing processes, machine parts, chip formation, mechanisms of machining, tool wear, tool life, screw thread measurement and gear measurements. |

**Total No. of Lectures-47**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION - A** | |
| **1** | **Introduction-** Classifications of manufacturing processes, characteristics of material removal processes, need and purpose of conventional material removal processes. Basic description of conventional machining processes, identification of process parameters, concept of machinability. General Constructional Configuration of Basic Machine Tools- Constructional configuration and specifications of basic machine tools like lathe, drilling machine, shaping machine, milling machine, grinding machine. Concept of generatrix and directrix. | 5 |
| **2** | **Basic Kinematic Structure of Centre Lathe-** Kinematic analysis of: Speed Gear Box, Feed Gear Box, Apron Mechanism, Thread Cutting. Tool Geometry- Detailed discussions restricted to ASA, ORS and MRS and for single point cutting tool as well as WRS, Introduction to NRS. Introduction to tool geometry of milling cutters and drills. | 6 |
| **3** | **Mechanism of Chip Formation-** Detailing on chip formation mechanism of brittle and ductile work material. Chip reduction coefficient, shear angle. Kronenberg's relation. Build-up edge (BUE). Cutting strain, cutting strain rate, orthogonal machining, causes and modelling of chip deviation concept of effective rake, concept of oblique machining. Effect of process parameters and tool geometry on mechanism of chip formation. Introduction to characteristics of chip formation in milling. | 6 |

| | | |
|---|---|---|
| | **SECTION - B** | |
| **4** | **Mechanics of machining-** Identification of cutting forces on orthogonal plane. Merchant's circle diagram, interrelations between cutting forces, angle relationships. Merchant's 1st solution, 2nd solution and Lee and Shaffer's solution. Cutting forces in turning, milling, shaping and drilling. Effect of process parameters and tool geometry on mechanics of chip formation,Measurement of cutting forces, effect of tool geometry. Mechanism of chip formation of surface roughness. Effect of cutting forces on product quality. Cutting temperature - Identification of heat sources in machining. Effect of cutting temperature on product quality and cutting tool. Estimation, measurement and control of cutting temperature. Effect of process parameters and tool geometry on cutting temperature. | 5 |
| **5** | **Tool Wear, Tool Life and Tool Material-** Different mechanism of tool wear. Types of tool wear (crater, flank etc), Measurement and control of tool wear, Concept of tool life, Taylor's tool life equation (including modified version). Different tool materials and applications including effect of tool coating. Machining Time- Estimation of machining time in different machining operations, Introduction to economics of machining, Revisit to the concept of machinability. | 6 |
| **6** | **Introduction to Grinding -** Need and different methods of grinding, Wheel specifications, Mechanics of grinding, Similarities and differences between grinding and machining. Basic Kinematic systems and operations of Other Machine Tools- Kinematic system and operations of drilling machines. Kinematic system and operations of milling machines. Construction, working principle and applications of shaping, planing and slotting. | 6 |
| | **SECTION - C** | |
| **7** | **Precision and Accuracy-** Methods of estimating accuracy and precision; Needs for accuracy and precision; Standards and their evolution; Types of errors in measurements. Limits, Fits and Tolerances, & Gauge Design- Basic concepts in limits, fits and tolerances Tolerance grades; ISO system of tolerance, Principles gauge design. Work Shop and Inspection gauges. | 5 |
| | **SECTION - D** | |
| **8** | **Screw Thread Measurement-** Standard thread profiles, Different Thread Elements, Effective diameter, 2 wire and 3 wire methods as applied to standard and non-standard thread profiles, Best wire size, Virtual Effective Diameter. Surface Roughness- Sources of surface irregularities in manufacturing, Different elements of surface roughness, Definition of center line and related roughness parameters, Measurement Instruments, Profilometers, Analysis of roughness signal in frequency domain | 4 |

| | | |
|---|---|---|
| **9** | **Gear Metrology-** Different types of gears, Basic elements of a gear, Involute function, Relations between different gear elements of spur and helical gears, Virtual number of teeth, Use of gear tooth Vernier for chordal and constant chordal measurements, Span measurement using Base Tangent Micrometers. Coordinate Measuring Machines-Introduction to Coordinate Measuring Machines. | 4 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Sen, G. C., & Bhattacharyya, A. Principles of Machine Tools: New Central Book Agency |
| **2** | Bhattacharyya A, Theory & Practice Of Metal Cutting, New Central Book Agency |
| **3** | Boothroyd, G., & Knight, W. A., Fundamentals of machining and machine tools: Taylor and Francis. |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Mechanical Handling Systems and Equipment** |
| **Course Code** | **:** | **MEL-457** |
| **Credits (L-T-P)** | **:** | **4 (4-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

The course objective is to make students understand the basics of material handling system, selection of equipment, design of handling equipment.

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Elements of Material Handling System-** Importance, Terminology, Objectives and benefits of better Material Handling; Principles and features of Material Handling System; Interrelationships between material handling and plant layout, physical facilities and other organizational functions; Classification of Material Handling Equipment. | 6 |
| **2** | **Selection of Material Handling Equipment-**Factors affecting for selection;Material Handling\ Equation; Choices of Material Handling Equipment; General analysis Procedures; Basic Analytical techniques; The unit load concept; Selection of suitable types of systems for applications ; Activity cost data and economic analysis for design of components of MaterialHandling Systems; functions and parameters affecting service; packing and storage ofmaterials. | 7 |
| | **SECTION – B** | |
| **3** | **Design of Mechanical Handling Equipment-** Design of Hoists, Drives for hoisting, components, and hoisting mechanisms; rail travelling components and mechanisms; hoisting gear operation during transient motion; selecting the motor rating and determining breaking torque for hoisting mechanisms. Design of Cranes, Hand-propelled and electrically driven E.O.T. overheat Travelling cranes; Traveling mechanisms of cantilever and monorail cranes; design considerations for structures of rotary cranes with fixed radius ; fixed post and overhead travelling cranes; Stability of stationary rotary and travelling rotary cranes. | 10 |

| | | |
|---|---|---|
| **4** | **Design of load lifting attachments-** Load chains and types of ropes used in Material Handling System; Forged, Standard and Ramshorn Hooks; Crane Grabs and Clamps; Grab Buckets; Electromagnet; Design consideration for conveyor belts; Application of attachments. | 8 |
| | **SECTION – C** | |
| **5** | **Study of systems and Equipment used for Material Storage-** Objectives of storage; Bulk material handling; Gravity flow of solids through slides and chutes; Storage in bins and hoppers; Belt conveyors; Bucket-elevators; Screw conveyors; Vibratory Conveyors; Cabin conveyors; Mobile racks etc. | 6 |
| | **SECTION - D** | |
| **6** | **Material Handling / Warehouse Automation and Safety considerations-**Storage and warehouse planning and design; computerized warehouse planning; Need, Factors and Indicators for consideration in warehouse automation; which function, when and How to automate; Levels and Means of Mechanizations. Safety and design; Safety regulations and discipline. | 8 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | N. Rudenko, Material Handling Equipments, Peace Publishers, Moscow. |
| **2** | James M. Apple, Material Handling System Design, John-Wiley and Sons Publication, New York. |
| **3** | John R. Immer, Material Handling, McGraw Hill Co. Ltd., New York. |
| **4** | Colin Hardi, Material Handling in Machine Shops, Machinery Publication Co. Ltd., London. |
| **5** | P. Nexandrn, Material Handling Equipment, MIR Publication, Moscow. |
| **6** | C. R. Cock and J. Mason, Bulk Solid Handling, Leonard Hill Publication Co. Ltd., U.S.A. |
| **7** | Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers. |
| **8** | Kulwiac R.A., Material Handling Hand Book, John Willy Publication, New York. |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Simulation of Mechanical Systems** |
| **Course Code** | **:** | **MEL-458** |
| **Credits (L-T-P)** | **:** | **4 (4-0-0)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **20% weightage** |
| **End Semester Examination** | **:** | **80% weightage** |

**Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Objectives:**

The course objective is to make students understand the importance of use of probability and statistics in engineering along with systematic simulation and approach.

**Total No. of Lectures-43**

| | Lecture wise breakup | Number of lectures |
|---|---|---|
| | **SECTION – A** | |
| **1** | **Introduction** - A review of basic probability and statistics, random variables and their properties, Estimation of means variances and correlation. | 7 |
| | **SECTION – B** | |
| **2** | **Physical Modeling -** Concept of System and environment, Continuous and discrete systems, Linear and nonlinear systems, Stochastic activities, Static and Dynamic models, Principles of modeling, Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation | 12 |
| | **SECTION – C** | |
| **3** | **System Simulation and Approach -** Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages. System Dynamics: Growth and Decay models, Logistic curves, System dynamics diagrams. Probability Concepts in Simulation: Stochastic variables, discrete and continuous probability functions, Random numbers, Generation of Random numbers, Variance reduction techniques, Determination of length of simulation runs. | 12 |

| SECTION - D | | |
|---|---|---|
| **4** | **Simulation of Mechanical Systems -** Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems. Simulation of Manufacturing Systems: Simulation of waiting line systems, Job shop with material handling and Flexible manufacturing systems, Simulation software for manufacturing, Case studies. | 12 |

| **Suggested / Reference Books:** | |
|---|---|
| **1** | Geoffrey Gordon, System Simulation, Prentice Hall. |
| **2** | Robert E. Shannon ; System Simulation, The Art and Science ;Prentice Hall |
| **3** | J. Schwarzenbach and K.F. Gill Edward Arnold, System Modelling and Control. |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Non-Traditional &Computer Aided Manufacturing Lab** |
| **Course Code** | **:** | **MEP-411** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **Non-Traditional Manufacturing lab** | | |
| **1** | To perform an experiment on EDM. | 2 |
| **2** | To perform an experiment on ECM. | 2 |
| **3** | To perform an experiment on WJM. | 2 |
| **4** | To perform an experiment on AJM. | 2 |
| **5** | To perform an experiment on laser beam machining. | 2 |
| **6** | To perform an experiment on plasma arc machining | 2 |
| **CAM Lab** | | |
| **1** | **Manual part programming (using G and M codes) in CNC lathe.** | |
| **a** | Part programming for linear and circular interpolation, chamfering and grooving. | 2 |
| **b** | Part programming is using standard canned cycles for turning, facing, taper turning and thread cutting | 2 |
| **2** | **Manual part programming (using G and M codes) in CNC milling.** | |
| **a** | Part programming for linear and circular interpolation and contour motions. | 2 |
| **b** | Part programming involving canned cycle for drilling, peck drilling and boring | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Surface Engineering Lab** |
| **Course Code** | **:** | **MEP-413** |
| **Credits (L-T-P)** | **:** | **1 (0-0-1)** |
| **Total Marks** | **:** | **100** |
| **Internal Marks** | **:** | **-** |
| **External Marks** | **:** | **100% weightage** |

**Total No. of Practicals-**

| **Practical wise breakup** | | **Number of Practicals** |
|---|---|---|
| **List of Practicals** | | |
| **1** | Multipurpose Friction and Wear Test. | 2 |
| **2** | Lubricity Test. | 2 |
| **3** | Rolling Fatigue Testing. | 2 |
| **4** | Air Bearing Rig Test. | 2 |
| **5** | Friction and wear performance Test. | 2 |
| **6** | Bearing Friction Measurement. | 2 |

*B.Tech. (Mechanical Engineering) (CBEGS) 7th Semester*

| | | |
|---|---|---|
| **Course Name** | **:** | **Major Project** |
| **Course Code** | **:** | **MEP 416** |
| **Credits (L-T-P)** | **:** | **3 (0-0-3)** |
| **Total Marks** | **:** | **100** |
| **Mid Semester Examination** | **:** | **-** |
| **End Semester Examination** | **:** | **100% weightage** |

| **Course Objectives:** |
|---|
| The object of Project Work I is to enable the student to take up investigative study in the broad field of *Mechanical Engineering*, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. |

**Total No. of Lectures-45**

| | **Lecture wise breakup** | **Number of lectures** |
|---|---|---|
| | **SECTION** | |
| **1** | The assignment to normally include:<br>• Survey and study of published literature on the assigned topic;<br>• Working out a preliminary Approach to the Problem relating to the assigned topic;<br>• Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility<br>• Preparing a Written Report on the Study conducted for presentation to the Department;<br>• Final Seminar, as oral Presentation before a Departmental Committee. | |

***B.Tech. (Mechanical Engineering) (CBEGS) 8th Semester***

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| **1.** | MEP- 421 | Industrial Training / In-Campus Training | 0 | 0 | 20 | 20 |
| | | **Total Credits:** | **0** | **0** | **20** | **20** |

**Students are required to undergo an industrial training/ In-Campus Training of minimum 20 weeks duration and at the end he/ she should give a presentation along withreport.**