## SEMESTER – VI

## DYNAMICS OF MACHINES ME – 6001

| Course Code | **ME – 6001** | Credits : 4 | L-3, T-1, P-0 |
|---|---|---|---|
| Name of the Course | **DYNAMICS OF MACHINES** | | |
| Lectures to be delivered | **52 (1 Hr Each) (L = 39, T = 13 for each semester)** | | |
| Semester End Examination | **Max. Time: 3 hrs.** | **Max. Marks: 100** | **Min. Pass Marks: 40** |
| Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%) | | **Max. Marks: 50** | |

**Instructions:**

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

**Section – A**

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms, dynamic force analysis including inertia and frictional forces of planar mechanisms.

Balancing of Rotating Components: Static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing machines.

**Section – B**

Dynamics of Reciprocating Engines: Engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.

Balancing of Reciprocating Parts: Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines.

**Section – C**

Governors: Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors.

**Section – D**

Dynamometers: types of dynamometers, prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

Gyroscope: precession angular motion and gyroscopic couple and their effects on aeroplane, ship during steering, rolling and pitching.Stability of four wheel vehicles moving on curved paths.

**Text Books:**


1. Theory of Mechanisms and Machines : Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East West Press.
2. Theory of Machines and Mechanisms: Joseph Edward Sigley and john Joseph Uicker, Jr. Second Edition McGraw Hill, Inc.
3. Theory of Machines: S.S.Rattan, Tata McGraw Hill.


**Reference Books:**


1. Mechanism and Machine Theory: J.S.Rao and R.V.Dukkipati Second Edition New age International.
2. Theory of Machines: Thomas Beven.

## SEMESTER – VI

## MACHINE DESIGN – II ME – 6002

| Course Code | **ME – 6002** | Credits: 6 | L-4, T-1, P-0 |
|---|---|---|---|
| Name of the Course | **MACHINE DESIGN – II** | | |
| Lectures to be delivered | **52 (1 Hr Each) (L = 39, T = 13 for each semester)** | | |
| Semester End Examination | **Max. Time: 3 hrs.** | **Max. Marks: 100** | **Min. Pass Marks: 40** |
| Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%) | | **Max. Marks: 50** | |

**Instructions**

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

**Section – A**

Design for Production: Erogonomic considerations in design, Design considerations of casting, forging and machining. Variable Loading : Different types of fluctuating / variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc. Fatigue design for finite and infinite life against combined variable stress using Goodman and Soderberg's Criterion. Fatigue design using Miner's equation, Problems.

**Section – B**

Shafts: Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration. problems

Springs: Types of Springs, Design for helical springs against tension and their uses. Compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs. Design problem.

**Section – C**

Bearings: design of pivot and collar bearing, Selection of ball and roller bearing based on static and dynamic load carrying capacity using load life relationship, Selection of bearings from manufacturer's catalogue, types of lubrication – Boudary, mixed and hydradynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

**Section – D**

Gears: Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam and wear strength of gear tooth, form or Lewis factor for gear tooth, Dynamic load on gear and Buckingham equation and Design of spur, helical, bevel & worm gear including the consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

**Text Books:**


1. Mechanical Engg. Design – First Metric Editions : Joseph Edward Shigley – Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B.Bhandari – Tata McGraw Hill, New Delhi.


**Reference Books:**


1. Engineering Design – George Dieter, McGraw Hill Book Co.
2. Product Design and Manufacturing – Edition PHI –A.K.Chitale and R.C.Gupta.
3. Machine Design An Integrated Approach: Robert L.Norton, Second Edition – Addison Wesley Longman.
4. Machine Design : S.G.Kulkarini – Tata McGraw Hill.
5. Machine Design – Maleev &Hartman, $5^{th}$ Edition (edited by O.P.Grover) CB 1999 in SI units.


**Note**: The paper setter will be required to mention in the note in the question paper that the use of only PSG Design Data book is permitted.

**SEMESTER – VI**

**MACHINE TOOLS** **ME – 6003**

| Course Code | **ME – 6003** | Credits : 4 | L-3, T-0, P-0 |
|---|---|---|---|
| Name of the Course | **MACHINE TOOLS** | | |
| Lectures to be delivered | **39 (1 Hr Each) (L = 39, T = 0 for each semester)** | | |
| Semester End Examination | **Max. Time: 3 hrs.** | **Max. Marks: 100** | **Min. Pass Marks: 40** |
| Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%) | | **Max. Marks: 50** | |

**Instructions**

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

**Section – A**

Machine Tools: Classification of machine tools, generation and forming, methods of generating surfaces, accuracy and finish achievable. Basic elements of machine tools: Support structures, guideways, general work holding methods, fundamentals of machine tool drives (Ray Diagram).

**Section – B**

Centre Lathe: Introduction, constructional features of centre lathe, aids for support and location, cutting tools, operations performed on centre lathe, taper turning methods, thread cutting methods, special attachments, machining time and power estimation, typical set-ups.

Special Purpose Lathes: Limitations of a centre lathe, capstan and turret lathes, automatic lathes, tooling layout and CAM design for automatic lathes. Reciprocating machine tools: Shaper, planer, slotter.

**Section – C**

Milling Introduction, types of milingmachines, milling operations, dividing head, milling mechanics, maching time estimation, special set-ups.

Hole making operations: Introduction, drilling, reaming, boring, tapping and other hole making operations.

Abrasive Processes: Introduction, grinding wheel-designation and selection, types of grinding machines, grinding processes, grinding processes parameters, creep feed grinding, honing, lapping, other finishing processes. Other machine tools: Sawing, Broaching.

**Section – D**

Numerical Control of Machine Tools: Introduction, numerical control. NC machine tools, part programming fundamentals, manual part programming methods, computer aided part programming (CAP).

**Text Books:**


1. Manufacturing Technology – Metal cutting and Machine Tools: P.N.Rao, Tata McGraw Hill, New Delhi.
2. Text Book of Production Engineering: P.C.Sharma, S.Chand & Sons.


**Reference Books:**


1. Principles of Machine Tools: G.C.Sen & A.Bhattacharya, Tata McGraw hill, New Delhi.
2. Manufacturing Engineering & Technology – Kalpakjian, Scrope Addison – Wesley Publishing Co. New Delhi.
3. Modern Machining Processes – P.C.Pandey & H.S.Shan, Tata McGraw hill, New Delhi.

**SEMESTER – VI**

## MEASUREMENT AND CONTROL ME – 6004

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|---|---|---|---|
| Course Code | **ME – 6004** | Credits: 4 | L-3, T-1, P-0 |
| Name of the Course | **MEASUREMENT AND CONTROL** | | |
| Lectures to be delivered | **52 (1 Hr Each) (L = 39, T = 13 for each semester)** | | |
| Semester End Examination | **Max. Time: 3 hrs.** | **Max. Marks: 100** | **Min. Pass Marks: 40** |
| Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%) | | **Max. Marks: 50** | |

**Instructions**

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

**Section – A**

- **General Concept:**
  Need and classification of measurements and instruments, basic and auxiliary functional elements of a measurement system, Mechanical versus electrical/electronic instruments, primary, secondary and working standards.

- **Static and Dynamic characteristics of Instruments**
  Range and span, accuracy and precision, calibration, hysterecsis and dead zone, sensitivity and linearity, threshold and resolution : speed of response, lag, fidelity and dynamic error, dead time and dead zone.

  Zero, first and second order systems and their response to step, ramp and sinusoidal input signals.

- **Error in Measurement**
  Sources of errors, systematic and random errors: Statistical analysis of test data.

**Section – B**

- **Functional Elements:**
  Review of Electro-mechanical sensors and transducers – variable resistance, inductance and capacitive pick ups, photo cells and piezo-electric transducers, and application of these elements for measurement of position/displacement, speed/velocity/acceleration, force and liquid level etc.

  Resistances strain gauges, gauge factor, bonded and unbonded gauges, surface preparation and bonding technique, signal conditioning and bridge circuits, temperature compensation, Application of strain gauges for direct, bending and torsional loads.

**Section – C**

- **Pressure and Flow Measurement:**
  Bourdon tube, diaphragm and bellows, vacuum measurement – Mecleod gauge, thermal conductivity gauge and ionisation gauge, Dead weight gauge testor.

  Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: Flow visualisation technique.
- **Temperature Measurement:**
  Thermal expansion methods – bimetallic thermometers, liquid-in-glass thermometer and filled-in-system thermometers, thermo-electric sensors-common thermo couples, reference junction considerations, special materials and configurations: metal resistance thermometers and thermistors; optical and to radiation phyrometers, calibration standards.
- **Speed, Force, Torque and Shaft Lower Measurement**
  Mechanical techometers, vibration and techometer and strobscope; proving ring, hydraulic a pneumatic load cells, torque on rotating shafts, absorption, transmission and driving dynamometers.

**Section – D**

- **Controls:**
  Control system-open and closed loop system; elements of a control system; servo mechanism process control and regulators, transfer function; block diagram and overall transfer function of a multi loop control system, signal flow graph and Mason's Rule system stability – Routh and Harwitz criteria stability; Time and frequency domain Nyquist plot for stability study.

**Books Suggested:**


1. Measurement system: Application and Design by Doebelin E.O., McGraw Hill Publishing Company.
2. Experimental Method for Engineers by Holman J.P., McGraw Hill Publication Company.
3. Mechanical Measurement and Control by Kumar D.S., Metropolitan Book Co. Pvt. Ltd., New Delhi.
4. Automatic Control System by Kuo B.C., Prentice Hall.

## SEMESTER – VI

## INDUSTRIAL ENGINEERING ME – 6005

| Course Code | **ME – 6005** | Credits : 4 | L-3, T-1, P-0 |
|---|---|---|---|
| Name of the Course | **INDUSTRIAL ENGINEERING** | | |
| Lectures to be delivered | **52 (1 Hr Each) (L = 39, T = 13 for each semester)** | | |
| Semester End Examination | **Max. Time: 3 hrs.** | **Max. Marks: 100** | **Min. Pass Marks: 40** |
| Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%) | | **Max. Marks: 50** | |

**Instructions**

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

**Section – A**

- **Importance of Industrial Management:**
  Principles of scientific management. Definition of a manager, Relationship between management, organisation an administration. Authority and responsibility. Types of organization: Military (Departmental functional and line and staff type, Management charts.
- **Labour Compensation:**
  Time rates, piece rates and their combination. What are incentives, premium bonus systems? British and American systems. Is profit sharing an effective incentive? Financial incentives.

**Section – B**

- **Research and Development:**
  Considerations while developing a new product for manufacture, sources of new ideas, Simplification and diversification of products as related to the volume of sale. Research basic and applied. Their respective field. Agencies for research, council of Scientific and Industrial Research (India). Consideration in the selection of research personnel. Standards, their usefulness, right line fro introduction of standard. Different types of fits tolerance, standard sizes of drawing. Importance of Indian Standard Institutions.

**Section – C**

- **Planning Production and Production Control:**
  Functions of planning routing, scheduling, despatchng and follow up. Types of manufacture, jobbing batch and mass production. Production control charts. Route and process charts. Operation charts, machine load charts, Gantt charts, Progress charts; Mechanical and Bar Type.

- **Quality Control and Inspection:**
  Economics of Quality Control. Organisation of quality control, Inspection, inspection standards and methods; introduction to statistical methods of quality control.

**Section – D**

- **Time and Motion Study:**
  Their importance in scientific management. Classification of motion, Therbligs Process charts, principles of motion, economy, layout of work place, time study technique. Merit rating, setting time standards, standard time.

- **Materials and store control:**
  Ordering of new material, when to order, material purchase requisition, inventory control types of store room and store main record. Qualities of a good purchase officer.

**Text Books:**


1. Industrial Management: Spregiel. John Wiley & Sons. N.York, 1961.
2. Industrial Organisation: Kimball and Kimball. Vakils Feffer & Simsons Pvt. Ltd. Bombay, 1971.
3. Industrial Engg. & Management: Dhanpat Rai & Sons, N.Delhi, 1992.

## SEMESTER – VI

## HEAT TRANSFER ME – 6006

| | | | |
|---|---|---|---|
| Course Code | **ME – 6006** | Credits: 4 | L-3, T-1, P-0 |
| Name of the Course | **HEAT TRANSFER** | | |
| Lectures to be delivered | **52 (1 Hr Each) (L = 39, T = 13 for each semester)** | | |
| Semester End Examination | **Max. Time: 3 hrs.** | **Max. Marks: 100** | **Min. Pass Marks: 40** |
| Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%) | | **Max. Marks: 50** | |

**Instructions**

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

**Section – A**

Steady State Heat Conduction: Introduction, I-D heat conduction thorugh a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical co-ordiante systems.

Steady State Conduction with Heat Generation: Introduction, 1 – D heat conduction with heat sources, Extended surfaces (fins), Fin effectiveness 2-D heat conduction.

**Section – B**

Transient Heat Conduction: Systems with negligible internal resistance, Transient heat conduction in plane wall, cylinders, spheres with convective boundry conditions, Chart solution, Relaxation Method, Numericals.
Convection: Forced convection – Thermal and hydro-dynamic boundry layers, Equation of continuity, Momentum and energy equations, some results for flow over a flat plate and flow through tube, Fluid friction and heat transfer (Colburn analogy), Free convection from a vertical flat plate, Empirical relations for free convection from vertical and horizontal of planes and cylinders.

**Section – C**

Thermal Radiation: The Stephen – Boltzmann law, The black body radiation, Shape factors and their relationships, Heat exchange between non black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields.

**Section – D**

Heat Exchangers: Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness.
Heat Transfer with change of Phase: Laminar film condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective, Nucleate and film boiling.

**Text Books:**


1. Heat Transfer – J.P.Holman, John Wiley & Sons, New York.
2. Fundamentals of Heat and Mass Transfer – Incropera, F.P. & Dewill, D.P.-John Willey & Sons, New York.
3. Heat Transfer – D.S.Kumar, Kataria & Sons, Delhi.


**Reference Books:**


1. Conduction of Heat in Solids – Carslow, H.S. and J.C.Jaeger – oxford Univ. Press.
2. Conduction Heat Transfer – Arpasi, V.S. – Addison – Wesley.
3. Engg. Heat Transfer – C.P.Gupa Nem Chand & Brothers, Roorkee.
4. Compact Heat Exchangers – W.M.Keys & A.L.Landon,Mc. Graw hill.
5. Thermal Radiation Heat Transfer – Siegel, R. and J.R.Howell, Mc.Gaw Hill.
6. Heat Transmission – W.M., Mc. Adams, Mc Graw Hill.
   Heat Mass Transfer – Domkundwar.


**Note**: The paper setter will be required to mention in the note in the question paper that the Use of steam table charts, graphical plots is permitted.

**SEMESTER – VI**

**DYNAMICS OF MACHINE LAB** **ME – 6007**

| | | | |
|---|---|---|---|
| Course Code | **ME – 6007** | Credits: 2 | **L-0, T-0, P-2** |
| Name of the Course | **DYNAMICS OF MACHINE LAB** | | |
| Lectures to be delivered | **26 hours of Lab sessions** | | |
| Semester End Examination | **Maximum Time: 3 hrs.** | **Max. Marks: 50** | **Min. Pass Marks : 20** |
| Laboratory | **Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)** | **Max. Marks: 50** | **Min. Pass Marks: 25** |

**Instructions for paper setter/Candidates**

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

**List of Experiments:**

1. To perform experiment on Watt and Porter Governors to prepare performance characteristic curves and to find stability and sensitivity.
2. To perform experiment on Proell Governor to prepare performance characteristic curves and to find stability and sensitivity.
3. To perform experiment on Hartnell Governor to prepare performance characteristic curves and to find stability and sensitivity.
4. To study gyroscopic effects through models.
5. To determine gyroscopic couple on motorized gryoscope.
6. To perform the experiment for static balancing on static balancing machine.
7. To perform the experiment for dynamic balancing on dynamic balancing machine.
8. Determine the moment of inertial of connecting rod by compound pendulum method and triflair suspension pendulum.

**SEMESTER – VI**

**HEAT TRANSFER LAB** **ME – 6008**

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|---|---|---|---|
| Course Code | **ME – 6008** | Credits: 2 | **L-0, T-0, P-2** |
| Name of the Course | **HEAT TRANSFER LAB** | | |
| Lectures to be delivered | **26 hours of Lab sessions** | | |
| Semester End Examination | **Maximum Time: 3 hrs.** | **Max. Marks: 50** | **Min. Pass Marks : 20** |
| Laboratory | **Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)** | **Max. Marks: 50** | **Min. Pass Marks: 25** |

**Instructions for paper setter/Candidates**

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

**List of Experiments:-**

1. To determine the thermal conductivity of a metallic rod.

2. To determine the thermal conductivity of an insulating powder.

3. To determine the thermal conductivity of a solid by the guarded hot plate method.

4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.

5. To find the effectiveness of a pin fin in a rectangular duct under forced convective conditions and plot temperature distribution along its length.

6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlations.

7. To determine the average heat transfer coefficient for a externally heated horizontal pipe under forced convection and plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.

8. To measure the emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity with surface temperature.

9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.

10. To verify the Stefen Boltzman constant for thermal radiation.

**SEMESTER – VI**

## MEASUREMENT AND CONTROL LAB ME – 6009

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|---|---|---|---|
| Course Code | **ME – 6009** | Credits: 2 | **L-0, T-0, P-2** |
| Name of the Course | **MEASUREMENT AND CONTROL LAB** | | |
| Lectures to be delivered | **26 hours of Lab sessions** | | |
| Semester End Examination | **Maximum Time: 3 hrs.** | **Max. Marks: 50** | **Min. Pass Marks : 20** |
| Laboratory | **Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)** | **Max. Marks: 50** | **Min. Pass Marks: 25** |

**Instructions for paper setter/Candidates**

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

**List of Experiments:-**

1. Study of the use of a planimeter for area measurement.
2. Calibration of pressure-gauge with the help of a dead weight gauge tester.
3. Use of the engine indicator for recording the cylinder pressure against cylinder volume.
4. Preparation of a thermocouple for measurement of temperature and a study of the use of potentiometer in temperature measurement with the help of a thermocouple.
5. Use of a tachometer and stroboscope for measurement of speed of a shaft.
6. Measurement of torque with the help of an absorption dynamometer.
7. Study of the use of a strain gauge for displacement measurement.
8. Measurement of flow with the help of obstruction meters.
9. Use of Pitot tube to plot the velocity profile of a fluid flow through a circular duct.
10. Case study of analysis of experimental data from fluid mechanics/thermodynamics course.