Elements of Mechanical Engineering Lab		Semester	I / II
Course Code	1BEMEL107/207	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	24 Hours (12-week session)	Total Marks	100
Credits	1	Exam Hours	3
Examination type (SEE)	**Practical**		

Course Outcomes

At the end of the course, the student will be able to:

1. Perform various operations using lathe and welding machine.
2. Calibrate various measuring devices to achieve accuracy of measurement.
3. Demonstrate angular measurement of a given specimen using appropriate device.
4. Determine the properties and characteristics of fuels and oils.
5. Determine the hardness of materials using hardness testing machine.

Note:

1. The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum marks for the laboratory course are 100.
2. Both PART-A and PART-B are considered for CIE and SEE.
3. Students have answer 1(one) question from PART-A and 1(one) question from PART-B.
   a. The questions set for SEE shall be from among the experiments under PART-A. It is evaluated for 70 marks out of the maximum 100 marks.
   b. The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for 30 marks.
4. For continuous internal evaluation, during the semester, classwork, the typical open-ended questions shall be from PART-B, and any other similar questions to enhance the skill of the students.

PART – A

CONVENTIONAL EXPERIMENTS

1. Performing facing, plain turning and step turning operations by using a lathe.
2. Performing facing, plain turning and knurling operations by using a lathe.
3. Preparation of welded joints using the arc welding process.
4. Calibration of vernier caliper and micrometer using slip gauges.
5. Determination of the angle of a specimen using a sine bar.
6. Determination of the hardness of materials using hardness testing machine.

PART – B

TYPICAL OPEN-ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

1. Comparative study of flash point and fire point of various fuels / oils using the open cup method
2. Comparative study of flash point and fire point of various fuels / oils using the closed cup method
3. Comparative study on viscosity of different base fuels.
4. Investigation of the effect of additives on the viscosity of base fuels.
5. Selection and justification of appropriate joining techniques for given applications
6. Fabrication of a sheet metal part with simple geometry and soldering.

Suggested Learning Resources: (Textbook / Reference Book/ Manuals):

Textbooks:

1. Amitabh Ghosh and Amit Kumar Mallik, Manufacturing Science, Affiliated East West Press (p) Ltd, New Delhi, 2002
2. Hajara and Choudhary, Workshop Technology Vol. I (2008) & II (2010), Median Promoters & publishers, Bombay.
3. Khanna O. P, Workshop Practice, Vol. I, Dhanpat Rai & Co., 2000.
4. Engineering Metrology, R.K. Jain, Khanna Publishers, Delhi, 2009.

Reference books / Manuals:

1. Serope Kalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, Fourth Edition, Pearson Education, Asia, 2000.
2. P.N. Rao, Manufacturing technology--Foundry, Forming and Welding, Tata McGraw Hill Education, 2001.
3. I.C. Gupta, Engineering Metrology, Dhanpat Rai Publications, New Delhi, 2018.
4. Ganeshan. V, Internal Combustion Engines, Tata McGraw Hill, 4th Edition, 2012.

Web links and Video Lectures (e-Resources):

- https://openoregon.pressbooks.pub/manufacturingprocesses45/chapter/chapter-unit-1-the-engine-lathe/
- https://www.millerwelds.com/resources/article-library/the-fundamentals-of-welding-process-equipment-and-applications
- https://www.youtube.com/watch?v=sbbwJ5p6irc
- https://www.youtube.com/watch?v=TlhGTSDfQxc

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

- Flipped Classroom
- Simulation and Virtual Labs
- Video demonstration

Assessment Structure:

The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying **50% weightage** (i.e., 50 marks each).

The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks. The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 20 marks. For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for CIE – Continuous Assessment: 30 marks					
Performance Indicators	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**	**Poor**
Technical Skills & Procedure (PO1 & PO5) (10)	Performs operations flawlessly, correct sequence, excellent tool use. (9-10)	Minor errors, generally correct sequence and tool use. (7-8)	Performs task with some errors; needs occasional help. (5-6)	Many errors, requires frequent guidance. (3-4)	Cannot perform task without continuous supervision. (0-2)
Safety Compliance (PO6) (5)	Strictly follows all safety protocols, proper PPE usage at all times. **(5)**	Follows safety rules, occasional minor lapses. **(4)**	Mostly safe, some reminders needed. **(3)**	Frequent safety violations. **(2)**	Unsafe behavior, ignores safety rules. **(0-1)**
Interaction with the Group (PO8) (5)	Naturally leads, encourages, and includes all group members. Facilitates communication and ensures tasks are distributed fairly. Respects all opinions. **(5)**	Cooperates well with group members. Communicates clearly, shares the workload, and is a reliable and positive team member. **(4)**	Works alongside others but with limited communication or collaboration. Tends to work in isolation or contributes unevenly to the group effort. **(3)**	Fails to cooperate with the group. Is dismissive of others' ideas or causes friction and disagreement within the team. **(2)**	Refuses to work with the group or actively disrupts the group's ability to complete the experiment. **(1)**
Lab Report (PO9) (10)	Report is exceptionally well-organized, detailed, and insightful. All data and analysis are accurate. Submitted on time. **(9-10)**	Report is complete, well-organized, and accurate. All required sections are present and data is correctly reported. Submitted on time. **(7-8)**	Report has minor errors in data or analysis, or is missing some minor components. Organization could be clearer. **(5-6)**	Report is incomplete, contains significant errors, is poorly organized, or is submitted late without a valid reason. **(3-4)**	Fails to submit a report, or the submitted work is of completely unacceptable quality and lacks critical information. **(0-2)**

Rubrics for SEE / CIE Test:
(CIE test -To be conducted for 100 marks and the marks obtained shall be reduced to 20)
(SEE-To be conducted for 100 marks)

Performance Indicators	Excellent	Good	Satisfactory	Needs Improvement	Poor
Execution (PO3 & PO5) (8)/ (40)	Executes operations accurately with correct parameters; smooth, safe handling of equipment. **(7-8) / (33-40)**	Minor execution errors; mostly correct handling of tools/ machines. **(5-6) / (25-32)**	Acceptable performanc e with some parameter or handling errors. **(3-4) / (17-24)**	Multiple execution errors; needs frequent correction. **(2) / (9-16)**	Unable to perform operation independently. **(0-1)/ (0-8)**
Result and Discussion (PO4) (7)/ (40)	Presents accurate results; clearly compares with standards; insightful discussion of deviations and causes. **(7-8) / (33-40)**	Accurate results; some useful discussion. **5-6) / (25-32)**	Results mostly correct; discussion basic. **(3-4) / (17-24)**	Results incomplete or partially wrong; weak discussion. **(2) / (9-16)**	Presents accurate results; clearly compares with standards; insightful discussion of deviations and causes. **(0-1)/ (0-8)**
Viva Voce (PO9) (5)/ (20)	Answers all questions confidently, showing deep conceptual and practical understanding. **(5) / (17-20)**	Answers most correctly; minor conceptual gaps. **(4) / (13-16)**	Answers some but lacks depth. **(3) / (9-12)**	Gives vague or incomplete answers. **(2) / (5-8)**	Unable to answer. **(1) / (0-4)**

- To qualify and become eligible to appear for SEE, in the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE component**, a student must secure **a minimum of 35% of 50 marks**, i.e., **18 marks**.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.