ST. ALOYSIUS COLLEGE(AUTONOMOUS), JABALPUR

Reaccredited 'A+ 'Grade by NAAC(CGPA:3.68/4.00)
College with Potential for Excellence by UGC
DST-FIST Supported & STAR College Scheme by DBT

Department of Physics

UG I Semester
MECHANICAL WORKSHOP SKILL

Course Outcomes

CO. No.	Course Outcomes	Cognitive Level
CO 1	Learner will Understand ancient Indian measuring systems and Kanad's laws of motion.	U
CO 2	Learn modern measurement techniques and unit conversions.	An, Ap
CO 3	Learner will Understand vector fields, and vector differentiation (gradient, divergence, curl).	U, C
CO 4	Learner will be able to Explore surface tension, viscosity, and fluid flow equations (Bernoulli's theorem).	E, AP
CO 5	Learner will be able to Develop practical skills in workshop practices and machine tool operations.	C

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Content of the Course
Theory (Credit: 3)

Total No. of Lectures: 45 Hrs.   **Maximum Marks:** 100

Unit	Topic	Lectures
I	**Historical background and Measuring system** 1. Historical background: Ancient Indian units of time as mentioned in the Shrimad Bhagavat Purana, Dongla observatory, Kanad's laws of motion. 2. Measuring system: Measuring units, Conversion to SI and CGS, Familiarization with meter scale, Vernier calipers, Screw gauge and their utility, Measure the dimension of a solid block, Volume of cylindrical beaker/glass, Diameter of a thin wire, Thickness of metal sheet, Use of Sextant to measure height. **Activities** 1. Measure the external diameter of a pen using a Screw gauge. 2. Measure the volume of a metal cylinder using Vernier callipers. **Keywords/Tags**: Ancient time units, Kanad's laws. Vernier callipers, screw gauge.	9
II	**Mathematical Tools and Vectors** 1. Plotting of functions, Approximations: Taylor and binomial series (statements only), Fundamental concepts of Limit, Continuity and Differentiability, Basic Integration Formulas, Integration by parts, Integration by partial fraction, Integration by trigonometric functions. 2. Vector Algebra: Properties of vectors, Scalar product and vector product, Scalar and Vector fields, Vector Differentiation, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Del and Laplacian operators. **Activities:** 1. Ask students to sketch graphs of some trigonometric functions. 2. To compute the limit of the given functions at specific points and determine their continuity using graphical method. **Keywords/Tags**: Plotting functions, Taylor series, gradient, divergence, curl, Laplacian operators.	9
III	**Rigid body mechanics and Deformable bodies**	9

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	1. Rigid body mechanics: Concept of Rigid body, Torque, center of mass, Conservation of linear & angular momentum, Rotatory motion and concept of moment of inertia, Theorems on moment of inertia: theorem of addition, theorem of perpendicular axis, theorem of parallel axis, application of moment of inertia in daily life. 2. Deformable bodies: Hook's law, Young's modulus. Bulk modulus, Modulus of rigidity and Poisson's ratio. Relationship between various elastic moduli. **Activities:** 1. Determination of Young's Modulus of a Metallic Bar using the Cantilever method. 2. To determine the Modulus of Rigidity of a metallic wire using a torsion pendulum. **Keywords/Tags**: Rigid body mechanics, torque, Center of mass, moment of inertia theorems, Hooke's law, elastic moduli.	
IV	**Surface Tension and Viscosity** 1.Surface Tension: Inter-molecular forces and potential energy curve, Force of cohesion and adhesion, Surface tension, Explanation of surface tension on the basis of intermolecular forces, Surface energy, Daily life application of surface tension, Angle of contact, Capillarity. 2. Viscosity: Ideal and viscous fluid, Streamline and turbulent flow, Equation of continuity, Bernoulli's theorem (without derivation) and its applications (Velocity of efflux, shapes of wings of airplane, Magnus effect). **Activities:** 1.Determination of surface tension of a liquid by Jaeger's method. 2.Study streamline and turbulent flow by visualizing Flow Using Ink. **Keywords/Tags:** Surface tension, cohesion, adhesion, viscosity. fluid flow, Bernoulli's theorem, Magnus effect.	9
V	**Mechanical Skil1:** 1. Concept of workshop practice, Overview of manufacturing methods: casting, foundry, machining, forming and welding, Types of welding joints and welding defects, Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. 2. Concept of machine processing, Introduction to common machine tools like lathe, shaper, drilling, milling and surface machines, cutting tools, lubricating oils, cutting of a metal sheet using blade, smoothening of cutting	9

| | edge of sheet using file, Drilling of holes of different diameter in metal sheet and wooden block, Use of bench vice and tools for fitting.
Activities:
1. Show Students various tools (hammer, wrench, saw, files, welding rods, etc.). Let them identify tools, materials (steel, copper, alloys), and their uses.
2. Arrange a visit to a workshop or show videos of milling and shaper machines in action.
Keywords/Tags: Workshop practice, welding, materials. machine tools, drilling, fitting. | |

References

Test/Reference Books:

1.Arfken G.B., Weber H.J., Harris F.E., "Mathematical Methods for Physicists", Elsevier, 2013, 7th Edition.

2. Spiegel M. R., "Vector Analysis: Schaum Outline Series", McGraw Hill Education, 2017.

3. Mathur D. S., "Mechanics", S. Chand, 2012.
4. Mathur D. S., "Elements of Properties of Matter", Shyamlal Charitable Trust, New Delhi 2008.
5. Sears and Zeemansky, "University Physics: with Modern Physics". 12th Edition. Hugh D. Young, Roger A. Freedman, Albert Lewis Ford, Pearson Education India.2008.
6. Say M.G., "Performance and design of AC machines", ELBS Edn.
7. John K.C., "Mechanical workshop practice", PHI Learning Pvt. Ltd, 2010.
8. Black B. J., "Workshop Processes, Practices and Materials", Editor Newnes. 2005.
9. Smyth Lawrence, Liam Hennessy "New Engineering Technology", The Educational Company of Ireland.
10. The Vaiśeṣika Sūtra by Rishi Kanada.
11. Subash Kak. Kaṇāda, Great Physicist and Sage of Antiquity
12. Śrīmad Bhāgavatam (Bhāgavata Purāṇa) - Canto 3, Chapter 11" Calculation of Time, from the Atom".
13. मध्य प्रदेश हिंदी ग्रंथ अकादमी, भोपाल द्वारा प्रकाशित पुस्तकें।

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Web Links:

1. https://www.eshiksha.mp.gov.in/mpdhe/ Learning Management System, Department of higher education, Government of Madhya Pradesh (M.P.)
.
2. https://nptel.ac.in/courses/115/106/115106090/ Mechanics, Heat, Oscillations and Waves by Prof. V. Balakrishnan, Department of Physics, Indian Institute of Technology, Madras

Evaluation Scheme

External (Theory)
(100 Marks)
Section(A) : Very Short Questions **Section (B) :** Short Questions **Section (C) :** Long Questions