



# बिरसा मुंडा ट्रायबल युनिवर्सिटी Birsa Munda Tribal University

राजपिपला, जि. नर्मदा Rajpipla, Dist. Narmada

Established by Tribal Development Department, Govt. of Gujarat

## School of Science B.Sc. (Chemistry) Programme

**Subject Code & Name:** - BS02MICHE2 Fundamentals of Mechanics & Optics

### Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				CCE		SEE	
L	T	P	Total	TH	PWE	TH	PWE
3	0	1	4	37.5 %	12.5 %	37.5 %	12.5 %

Programme Name	B.Sc. (Chemistry)
Semester	II
Course Code	BS02MICHE2
Course Title	Fundamentals of Mechanics & Optics
Course Content Type(Th./Pr.)	Theory & Practical
Course Credit	3+1
Sessions+ Lab. Per Week	3+2
Total Teaching/Lab. Hours	45 Theory Hours + 30 Practical Hours
* 2 Laboratory = 1 Session	

### Learning Objectives

Students will be able to study

1. To understand the basic concepts of types of waves with special reference to Ultrasonic waves and its applications. The unit also introduces understanding of oscillations with special emphasis on properties of simple harmonic motion observed in case studies of different types of pendulums.
2. To understand the theoretical concepts of material behaviour with particular emphasis on their elastic property.
3. To provide exposure to various properties of Laser, production techniques of Laser and its applications.

### Prerequisites (if any)

12<sup>th</sup> Science passed with Physics subject.







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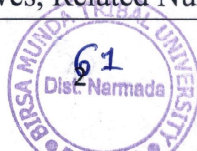
### Learning Outcomes

On the Completion of this course, students will able to:

1. The Student will get the overview of core concepts in the field of mechanics and basic optics.
2. Able to understand elastic nature of material, types of elastic modulus and different methods to determine elastic modulus.
3. Learn the structure and properties of lasers, their performance and applications in engineering and medical fields.
4. Learn the basic necessary mathematics tools to solve mechanics problems.

### Detailed Contents

UNIT	TOPIC/SUB-TOPIC	TEACHING HOURS
I	<b>Elasticity</b> Introduction, Definitions of Load, Stress and Strain, Hooke's Law & Stress-strain diagram, Three types of elasticity: (i) Young's modulus (ii) Bulk Modulus and (iii) Modulus of Rigidity, Work done per unit volume in elongation strain, Deformation of a cube- (Bulk modulus, Modulus of rigidity, Young modulus), Relation connecting the elastic constants, Poisson's ratio, Relation for $K$ and $\eta$ in terms of Poisson's ratio, Limiting values of $\sigma$ , Determination of Poisson's ratio for rubber, Twisting couple on a cylinder (or wire), Torsional pendulum, Determination of $\eta$ -Static method (Horizontal twisting apparatus for a rod), Bending of beams, Bending moment, The cantilever-when the weight of beam is ineffective, Depression of a beam supported at the ends when the beam is loaded at the centre, Related Numerical	15
II	<b>Fiber optics and Ultrasonic waves</b> Introduction, Fiber- Optic System, The Primary advantages of Fiber-Optic Communication compared to metallic cable (Electrical) communication, Fiber cable construction, Basic Principle- Total internal reflection, Acceptance angle and Numerical Aperture, Propagation of light through optical fiber, index Profile, Fiber configurations, Difference between various configurations, Related Numerical	15
II	Introduction to Ultrasonic waves, Production of ultrasonic waves (1) Magnetostriction method (2) Piezo-electric method, Detection of Ultrasonic, Properties of Ultrasonic, Wavelength of Ultrasonic waves, Applications of ultrasonic waves, Related Numerical	15 .







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III	<b>LASER</b> Introduction, Properties of LASER, Stimulated absorption, Spontaneous emission and Stimulated emission, Relation between Einstein's A and B coefficients, Population Inversion, Pumping, Main component of LASER, ND: YAG LASER, CO <sub>2</sub> LASER, Application of LASER in material processing, Holography and Other application of Laser, Related Numerical	15
<b>Unit-IV-Practical(s)</b>		<b>(30)</b>
<ol style="list-style-type: none"><li>1. Wattage of the bulb.</li><li>2. Y by Cantilever</li><li>3. <math>\eta</math> by static method</li><li>4. Depression of a beam when loaded at middle.</li><li>5. Determine the Moment of Inertia of different bodies using bifiller suspension method.</li><li>6. To measure the angle of prism and calibration of spectrometer.</li><li>7. Determine resolving power of prism.</li><li>8. Measure elastic constants using Searl's method.</li></ol>		
<b>Text Book(s)</b>		
<ol style="list-style-type: none"><li>1. Unit 1: Mechanics by D. S. Mathur, S. Chand Publication</li><li>2. Unit 2: (i) Engineering Physics by R K Gaur and S L Gupta, Dhanpatrai Publication (ii) Engineering Physics by G. Vijayakumari, Vikas Publishing house,</li><li>3. Unit 3: LASER by K. Rajgopal, PHI Learning, New Delhi</li></ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"><li>1. Mechanics by Prof. D.S.Mathur, Revised by Dr. P.S. Hemne, Revised Edition, S.Chand Publication.</li><li>2. Basics of LASER Physics by Karl. F.Rank, 2<sup>nd</sup> Edition, Springer Publication.</li><li>3. A Textbook of Optics, D. N. Vasudeva, Atma Ram &amp; Sons, Delhi (20<sup>th</sup> Edition).</li><li>4. Practical Physics by Gupta, Kumar Pragati Prakashan</li><li>5. B.Sc. Practical Physics by C.L. Arora, S.Chand Publication</li></ol>		
<b>Web Resources</b>		
<ol style="list-style-type: none"><li>1. <a href="https://phys.libretexts.org">https://phys.libretexts.org</a></li><li>2. <a href="https://www.youtube.com/watch?v=ssv9vDWKQDk">https://www.youtube.com/watch?v=ssv9vDWKQDk</a></li><li>3. <a href="https://archive.nptel.ac.in/courses/115/102/115102124/">https://archive.nptel.ac.in/courses/115/102/115102124/</a></li><li>4. <a href="https://youtu.be/i1Ei503LhFQ?si=wpJLHKrjVFT-GQDN">https://youtu.be/i1Ei503LhFQ?si=wpJLHKrjVFT-GQDN</a></li><li>5. <a href="https://archive.nptel.ac.in/courses/104/104/104104085/">https://archive.nptel.ac.in/courses/104/104/104104085/</a></li><li>6. <a href="https://nptel.ac.in/courses/115106119">https://nptel.ac.in/courses/115106119</a></li></ol>		







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## School of Science

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**L:** Lecture, **T:** Tutorial , **P:** Practical

**CCE:** Continuous and Comprehensive Evaluation

(CCE Theory includes Mid Semester Examination, Assignment, MCQ quizzes, Seminar, Reflective notes, class participation, case analysis and presentation, slip tests (announced/ surprised), attendance etc. or any combination of these)

**PWE:** Practical Work Examination

(PWE includes Laboratory practical work, project work, viva simulation exercise work etc.)

**SEE:** Semester End Evaluation

