SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)
Syllabus with effect from the Academic Year 2021-2022

Bachelor of Science
B.Sc. Physics Semester II

Course Code	US02CPHY51	Title of the Course	Mechanics-II, Basic Electronics and LASER
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. To apply geometric and algebraic properties of vectors to compute scalar and vector product, to find divergence and curl of vector function. 2. To study the fundamental concepts of special theory of relativity and the effect of relative motion on observations. 3. To understand the basics of semiconductor and components like diode and transistor. 4. To provide exposure to various properties of Laser, production techniques of Laser and its applications.

Course Content		
Unit	Description	Weightage* (%)
1.	**Vector algebra** Introduction to scalar and vector, Surface area as a vector, Scalar triple product, Reciprocal vectors, Vector triple product, Pseudo vectors and Pseudo scalars, Gradient of a scalar point function, Divergence of a vector, Equation of continuity, Curl of a vector point function, Irrotational and solenoidal vectors, Gauss' Theorem, Green's Theorem, Stokes' Theorem. [R.G.Takwale & P.S.Puranik: 1.8, 1.11, 1.12, 1.13, 1.16, 2.5, 2.6,2.7, 2.8, 2.12, 2.14, 2.15, 2.17] Related Numerical	25%
2.	**Special theory of relativity** Introduction, Frame of reference, Galilean transformation equation, Michelson Morley experiment, Einstein theory of relativity, Lorentz transformation of space and time, Length contraction, Explanation of negative results, Time dilation, Experimental verification of time dilation, Addition of velocities, Variation of mass with velocity, Equivalence of mass and energy. [R.K. Gaur and S.L. Gupta: 64.1,64.2, 64.3, 64.4, 64.5, 64.6, 64.7, 64.8, 64.9, 64.10, 64.11, 64.12, 64.13] Related Numerical	25%

3.	**Basic Electronics** DC power supply: Use of diodes in rectifiers, Half wave rectifier, PIV, Output DC Voltage, Full wave rectifier: Centre tap rectifier, PIV, Bridge Rectifier, PIV, Output DC Voltage, Definition of ripple factor and rectification efficiency, Filters: Definition of filter, How to get better DC, Shunt capacitor filter, Series inductor filter, choke input LC filter, π- filter, Diodes: Types of diodes, Signal diodes, Power diodes, Zener diode (Zener effect, Avalanche effect & Voltage regulation), Varactor diodes, Light emitting diodes Transistor: Introduction, Junction Transistor structure, Relations between different currents in a Transistor, DC Alpha, Three configurations, CE configuration(Input and output characteristics only). [N.N. Bhargava, D.C. Kulshreshtha and S.C. Gupta : 4.6, 4.6.1, 4.6.2, 4.7, 4.8, 4.8.1, 4.8.2,4.8.3,4.8.4, 4.9, 4.9.1, 4.9.3, 4.9.4, 4.9.5, 5.1, 5.2, 5.4.1, 5.4.2, 5.6, 5.7.2,] Related Numerical	25%
4.	**LASER** Introduction & Properties of LASER: Directionality, Intensity, Monochromaticity, Coherence, Stimulated absorption, Spontaneous emission and Stimulated emission, Relation between Einstein's A and B coefficients, Population Inversion, Pumping: Optical pumping, Electrical discharge, Inelastic atom-atom collision, Direct Conversion, Chemical Conversion, Main component of LASER, ND:YAG LASER, CO_2 LASER, Semiconductor LASER: Homo junction LASER, Hetero junction Semiconductor LASER, Application of LASER: in material processing: LASER Cutting, LASER Welding, Hole Drilling, Other Applications CD-ROM, Holography (Concept of recording , Reconstruction of the image and applications), Other applications of LASERS. [K. Rajagopal: 5.1, 5.2, 5.3, 5.3.1, 5.3.2, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.10.1, 5.10.2, 5.11, 5.11.1, 5.11.2, 5.11.3, 5.11.4, 5.11.5, 5.12, 5.12.1, 5.12.2, 5.13] Related Numerical	25%
Teaching-Learning Methodology	Direct Teaching through Chalk-Walk and Talk ICT enabled teaching Question-Answer Class discussion led by teacher/students Case Studies Literature review Problem solving activities Debate Collaborative and Co-operative Learning Think Pair Share Jigsaw Inquiry Based Learning Panel Discussion Project Based Learning Flipped Classroom Blended Learning designs Concept Mapping	

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: On the successful completion of the course, the students will be able to understand	
	dot product and cross product of vectors, gradient of a scalar function, divergence and curl of vector functions.
	the setup and significance of Michelson-Morley experiment, significance of the postulates of Special Theory of Relativity and relativistic motion.
	diode and transistor characteristics, various diode applications.
	the structure and properties of lasers , their performance and applications in engineering and medical fields

Suggested References:	
Sr. No.	References
1.	Introduction to Classical Mechanics R.G. Takwale & P.S. Puranik Tata McGraw-Hill Publishing Company Ltd., New Delhi (1994)
2.	Engineering Physics R.K. Gaur and S.L. Gupta Dhanpat Rai Publications Ltd., New Delhi (2014)
3.	Basic Electronics and Linear Circuits N.N. Bhargava, D.C. Kulshreshtha and S.C. Gupta Tata McGraw-Hill Ltd., New Delhi (2005)
4.	Engineering Physics K. Rajagopal, PHI Learning Private Ltd. New Delhi (2009)

On-line resources to be used if available as reference material
On-line Resources:
https://math.libretexts.org/ https://www.cse.iitb.ac.in/~cs749/spr2017/handouts/jem_graddivcurl.pdf
https://www.space.com/36273-theory-special-relativity.htmlhttps://nptel.ac.in/courses/115/101/115101011/ https://www.coursera.org/learn/einstein-relativity
https://www.electronics-tutorials.ws/ https://www.electronicshub.org/tutorials/ www.allaboutcircuits.com
https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser-fundamentals-i/ https://nptel.ac.in/courses/104/104/104104085/

*****