

**MGSC – B.Sc. – Physics Curriculum OBE Pattern**  
**SEMESTER 1 MAJOR: PHM111 (T)**  
**Major Course: 4-Credits**

<b>Semester: 1 NEP-2020</b>	<b>Course No.: 111</b>	<b>Course Category: Major paper</b> <b>Course Code: PHM 111(T)</b> <b>Credits: 4</b> <b>Course Title: Mechanics, Basic analog Electronics and Optics.</b>
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**Course Objective**

1. Gain proficiency in vector algebra and operations including scalar and vector products. Develop the ability to use vector differential operators: gradient, divergence, and curl, and understand their physical meanings. Apply vector integral calculus: compute line, surface, and volume integrals and utilize divergence, Green's, and Stokes' theorems in physical contexts.

2. Understand the concept of rectification and its significance in converting AC to DC. Learn the operation and characteristics of various rectifier circuits (half-wave, full-wave, and bridge rectifier). Measure and interpret parameters like output voltage, ripple factor, and voltage regulation in rectifier experiments.

**Transistor Course Objective:**

Gain a fundamental understanding of transistor types (such as BJT) their structure, and operational principles.

Study transistor characteristics in different configurations (such as CE, CB, and CC for BJT) Learn the importance of biasing and compensation techniques in amplifier circuits.

Develop the ability to design and analyse amplifier circuits using transistors.

3. To understand the propagation of light using the Fermat's principle and apply the principle to derive the laws of reflection and refraction. To grasp the knowledge of interference produced by thin film and different kind of fringe formation through it. To understand how matrices can be used for image formation

4. Develop a clear understanding of core terms like amplitude, frequency, wavelength, phase, and the distinction between oscillations and waves.

Use differential equations and analytical techniques to solve for the motion of oscillators and the propagation of waves in various media. Analyse Different Types of Oscillations and Waves. Distinguish between simple harmonic, damped, and forced oscillations, and their real-world applications including resonance.

**Course Outcomes:** On successful completion of the course, learners will be able to

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<b>CO1</b>	Understand scalars, vectors, product of vectors and their applications, Learning the concept of Gradient, the Divergence theorem. Gauss's law, The curl and Stoke's theorem.	<b>Remember</b> <b>Understand</b>
<b>CO2</b>	Remember basic concepts of semiconductor diode, design rectifier circuits, study important aspects of rectifier circuits, and know about the Characteristics of transistor, load line analysis, operating point, cut off and saturation points.	<b>Remember</b> <b>Understand</b>
<b>CO3</b>	Understand basic concepts of optics in the interference and its applications; Fermat's Principle and its	<b>Remember</b> <b>Understand</b>

	application; Use of matrix method to analyse complex optical systems	<b>Analyse</b>
<b>CO4</b>	Recall Waves and oscillations and describe basic concepts related to Composition of two S.H.M. , Lissajous figures, forced vibration, amplitude resonance, Understand the difference between velocity of longitudinal wave in a solid medium and velocity of transverse wave along a stretched string	<b>Remember Understand</b>

**Syllabus:**

<b>Unit Contents</b>	<b>Lectures (Hours)</b>
<p><b>Unit 1: Vector Algebra.</b> Introduction, Applications of Vector Multiplication, Triple Scalar Product, Triple Vector Product, Differentiation of Vectors, Fields, Directional Derivative, Gradient, Some other Expressions involving del , Green's Theorem in the plane, The Divergence and the Divergence theorem. Gauss's law, The curl and Stoke's theorem.</p>	15
<p><b>Unit 2: Electronics.</b> <b>1.Diode: load line analysis of diode circuit</b> Rectifier: Full wave rectifier circuits, Mathematical analysis of full wave rectifier circuit, Important aspects of rectifier circuits, comparison of half wave and full wave rectifier, Bridge rectifier. <b>2. Transistor.</b> Transistor, Naming the transistor terminals, some facts about the transistor, transistor action, Transistor symbols, transistor as an amplifier, Transistor connections, CB connection, Characteristics of CB connection, CE connection, Measurement of leakage current, characteristics of CE connection, CC connection, comparison of transistor connections, commonly used transistor connection, Transistor as an amplifier in CE arrangement, Transistor load line analysis, operating amplifier, cut off and saturation points. Practical way of drawing CE circuit, output from transistor amplifier, Performance of transistor.</p>	15
<p><b>Unit 3:Optics</b> <b>1. Farnat's principle and its applications:</b> Farnat's principle of least time, laws at reflection, laws of refraction. Interference in thin films: Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film. Newton's ring. Michelson interferometer (Only construction and working) <b>2. Matrix Method in Optics:</b> Introduction, The matrix method, Unit planes, Nodal point planes, A system of two thin lenses.</p>	15
<p><b>Unit 4: Waves and oscillations:</b> Composition of two S.H.M. , Lissajous figures , Lissajous figures by C.R.O. , motion due to constant force , a particle executing S.H.M. acted upon by a harmonic force, motion in a resisting medium, forced vibration, amplitude resonance , maximum energy of the system , phase of the forced vibration , power supply in forced vibration. Velocity of plane longitudinal waves in gas , velocity of sound through gases , velocity of longitudinal wave in a solid medium , velocity of transverse wave along a stretched string .</p>	15

**Text Books/Reference books:****For unit 1:**

1. Mathematical methods in Physical Sciences By M.L. Boas , chapter 6 , articles 1 to 7 and 9 to 11 , 3rd edition ,2006, John Willey & Sons.
2. Mathematical Methods for Physicist, Arfken, Weber and Harris 7th Edition, 2012, Elsevier.

**For unit 2:**

1. Fundamentals of Electronics by Anokh Singh Chapter-5, articles-5.1 to 5.9., 4 th Edition 1986, Khanna Publishers.
- 2, Principles of Electronics V. K. Mehta and Rohit Mehta, Chapter-8, 8.1 to 8.27. 34th edition, 2017, S. Chand publication.
3. Electronics devices and circuits – An introduction Allen Mottershead Ch-2, article 2.1 PHI learning privet Ltd. , 2011
4. Basic Electronics and Linear Circuits, N.N, Bhargava, D.C. Kulshrestha and S.C.Gupta, 2nd Edition, 2017, NITTR, Chandigarh.

**For unit 3:**

1. A text book of Optics by N. Subramanian, Brijlal and M. N. Avadhanulu, Chapter 2 articles: 2.2, 2.5, 2.6, chapter 15 articles 15.1 to 15.6 ,15.7.1, 15.7.2, 15.7.3, 23rd edition , 2006 , S. Chand and company Ltd.
2. Optics – Ajoy Ghatak,, chapter 4 , articles 4.1 to 4.5, 3rd Edition, 2005, TMH Publication.
3. Optics by Satya Prakash, 8th edition, 2021 Pragati Prakshan.

**For unit 4:**

1. A textbook on oscillations, waves & Acoustics by M. Ghosh, D. Bhattacharya. Chapter2, articles 2.10 to 2.12, chapter 3 , articles 3.2, 3.4 to 3.10 , Chapter 9, articles 9.1 to 9.5. , 3rd edition, 2006, S.Chand and Company limited
2. Physics-volume 1 –, 5th edition, 2002, Robert Resnick, David Halliday, Kenneth Krane John Willey & Sons