The National College

Autonomous
Jayanagar, Bangalore -560070

Department of Physics

For B.Sc III & IV Semester

For the Academic years 2022-23, 2023-24 & 2024-25

	CourseContent **Phy.DSCT3: WaveMotion andOptics**	
	Unit -1 Waves and Superposition of Harmonic waves **(11hoursof teachingplus 2hoursof activities)**	
	ChapterNo. 1 **Waves:PlaneandSphericalWaves.LongitudinalandTransverseWaves.Characteristicsofwavemotion,PlaneProgressive (Travelling) Wave and its equation (derivation),Wave Equation – Differential form (derivation). Particle andWave Velocities - Relation between them, Energy Transport – Expressionforintensityofprogressivewave,Newton'sFormulaforVelocityofSound.Laplace'sCorrection(Derivation).BriefaccountofRippleandGravity Waves.(TextBook:1-4)** **5hours** **ChapterNo. 2** **SuperpositionofHarmonicWaves:LinearityandsuperpositionPrinciple.Superpositionoftwocollinearoscillationshaving(1)equalfrequenciesand(2)differentfrequencies (Beats) – Analytical treatment. Superposition oftwoperpendicularharmonicoscillations:LissajousFigureswith equal and unequal frequency- Analytical treatment. UsesofLissajous'figures.** **(TextBook:1-4) 6hours**	
	Unit – 2 **- Standing Waves and Acoustics(11hoursof teachingplus2hoursof activities)** **ChapterNo.3** **StandingWaves:**Velocityoftransversewavesalongastretched string (derivation), Standing (Stationary) Waves in aString - Fixed and Free Ends (qualitative). Theory of Normalmodes of vibration in a stretched string, Energy density andenergy transport of a transverse wave along a stretched	

	string.Vibrationsinrods– longitudinalandtransversemodes(qualitative).VelocityofLongitudinalWavesingases(derivation). Normal Modes of vibrations in Open and ClosedPipes–Analyticaltreatment.ConceptofResonance,TheoryofHelmholtzresonator. **(Text Book:1-4)8hours** **ChapterNo. 4** **Acoustics**:Absorptioncoefficient,Reverberationtime-Sabine's Reverberation formula (derivation), Factors affectingacoustics in buildings, Requisites for good acoustics. Acousticmeasurements–intensityand pressurelevels. **(Text Book:1-4)3hours**	
	Unit – 3: Nature of light and Interference(11hoursofteachingplus2hoursofactivities) **ChapterNo. 5** **Nature of light**: Corpuscular theory, The Wave model, Huygens' wave theory, ,Maxwell's electromagnetic waves, Dual nature of light, concept of wave packet.Group velocityandwavevelocity-relationbetweenthem. **(TextBookNo 5)2hours** **ChapterNo. 6** **Interference of light by division of wave front**: Coherent source-Interference oflightwavesbydivisionofwave-front,Young'sdoubleslit interference-theoryandexperiment,FresnelBiprism-theoryandexperiment(determinationofwavelength) (**TextBookNo5)4hours** **ChapterNo. 7** **Interference of light by division of amplitude:**at thin films - reflected andtransmitted light, Colours of thin films; Theory of air wedge; Theory of Newton'srings(Reflection)-DeterminationofRefractiveindexofaliquid.Michelson Interferometer(qualitative)**(TextBookNo5)5hours** **Topics forSelf-study** Whycolour strips areseeninpaddlesonroadsinrainyseasons?Givereasons. Makeareport ofit**.**	
	Unit–4-DiffractionandPolarisation **(11hoursof teachingplus2hoursof activities)** **ChapterNo. 8** **Fraunhoferdiffraction**:Introduction-Fraunhoferdiffraction-Theoryofsingleslit diffraction, Two slit diffraction pattern (qualitative), Theory of	

	diffractionGrating-obliqueincidence– experimentaldeterminationofwavelength.Resolvingpower– Rayleighcriterion,Expressionforresolvingpowerofgrating and telescope. (TextBookNo5) **4hours** **ChapterNo. 9** **FresnelDiffraction**-ConceptofFresnelhalfperiodzones(mentionofequations), Qualitative discussion on diffraction by a circular apertureanddiffraction by an opaque disc, Zone plate (mention of equation for focal length)ComparisonofZoneplatewithlens, Theoryofdiffractionatastraightedge. (TextBookNo 5) **3hours** **ChapterNo. 10** **Polarisation:**Productionofpolarizedlight,Malus'law,Phenomenonofdoublerefractionincrystals,Huygen'stheoryofdoublerefraction(qualitative),Quarter **4hours** waveplateandhalfwaveplate,Opticalactivity**,**Laurent'shalfshadepolarimeter. (TextBookNo5**)**	

Employability

Wave motion and optics:

A B.Sc. program with a specialization in "Wave Motion and Optics" offers a range of specific program outcomes. Graduates from this program will first and foremost demonstrate a comprehensive understanding of wave motion principles, encompassing the fundamental behavior of waves, wave equations, and the intriguing phenomenon of wave interference. In the realm of optics, they will acquire expertise in the behavior of light, geometric optics, wave optics, and the practical application of optical principles to a variety of systems.

Moreover, this program equips students with strong problem-solving skills. Graduates will be able to apply their knowledge of wave motion and optics to solve complex problems, both analytically and numerically. This includes, for instance, designing lenses, understanding diffraction, and working with polarization, all of which are essential aspects of the field.

In terms of practical experience, graduates will have extensive exposure to

laboratory work, where they will gain proficiency in conducting experiments related to wave motion and optics. They will be adept at using advanced optical equipment, collecting precise data, and drawing meaningful insights from their experimental results. Their critical thinking abilities will be honed as they evaluate and interpret both experimental data and theoretical models within the context of wave motion and optics.

The practicality of this specialization extends to various industries heavily reliant on optics and wave-based systems, such as telecommunications, photonics, and optical instrument development. Graduates will be well-prepared for roles in these technology-driven fields, where their understanding of optics is highly sought after.

Furthermore, this program instills research and development capabilities in its students. Graduates will possess the skills necessary to contribute to advancements in optical technologies and wave-based systems. Their strong quantitative and analytical skills will make them competitive candidates for positions that require data analysis, mathematical modeling, and problem-solving within the domain of wave motion and optics.

Finally, the B.Sc. program prepares students for advanced studies in optics, photonics, or related fields, offering a solid foundation for those who aspire to pursue master's or doctoral degrees in these areas. In summary, the program outcomes for "Wave Motion and Optics" provide students with a deep understanding of the subject matter, a diverse skill set, and numerous career opportunities in technology-driven industries.

1. Mastery of Electromagnetic Principles : Graduates will demonstrate a thorough understanding of the fundamental principles of electricity and magnetism, including Maxwell's equations, electromagnetic waves, and the behavior of charges and currents.

2. Problem-Solving Skills : Graduates will be proficient in applying electromagnetic theory to solve complex problems, both analytically and numerically, demonstrating competence in areas such as electrical circuits, magnetic fields, and electromagnetic radiation.

3. Laboratory Proficiency : Graduates will have hands-on experience in conducting experiments related to electricity and magnetism, with the ability to use advanced laboratory equipment, collect data, and analyze results.

4. Critical Thinking and Data Analysis : Graduates will exhibit critical

thinking skills when evaluating and interpreting experimental data and theoretical models in the context of electricity and magnetism.

5. Applications in Engineering : Graduates will be able to assess, design, and optimize electrical systems, making them well-suited for roles in electrical engineering, power generation, and the development of electronic devices.

6. Versatility in Technology : Graduates will be adaptable to various technology-driven industries, such as telecommunications, electronics, and energy, where their understanding of electromagnetism is highly relevant.

7. Research and Development Abilities : Graduates will possess the skills necessary for research, development, and design roles, with the capability to contribute to advancements in electromagnetism-related fields.

8. Quantitative and Analytical Skills : Graduates will have strong quantitative and analytical abilities, making them competitive candidates for jobs that require data analysis, mathematical modeling, and problem-solving.

9. Continued Education : The program will prepare students for advanced studies in physics or related fields, providing a solid foundation for those who wish to pursue master's or doctoral degrees.