Course structure and syllabi for MINOR programme in Engineering Physics:
(to be applicable from Jan-May 2026 semester onwards)

Semester	Course No	Course Title	Credit Structure
II	PH1092M	Computational Physics	2- 0- 2- 6
III	PH2091M	Engineering Optics	3- 0- 0- 6
IV	PH2092M	Quantum Physics	2- 1- 0- 6
V	PH3091M	Laser Physics and Technology	3- 0- 0- 6
VI	PH3092M	Materials Science & Engineering	3- 0- 0- 6

PH 1092M Computational Physics (2-0-2-6)

Review of error analysis and roots finding method; Solution of linear algebraic equations: LU decomposition, Jacobi method, and Gauss–Seidel method, eigen value problems; ; Interpolation: linear interpolation, cubic spline interpolation, least square method; Numerical integration: equidistant example points, Newton–Cotes formulae, Gaussian integration. Numerical differentiation: simple forward difference, extrapolation Methods; Ordinary differential equations: Euler Method, Runge-Kutta Method; Partial differential equations: finite difference method.

Texts:

1. P. O. J. Scherer, *Computational Physics: Simulation of Classical and Quantum Systems*, 1st Ed., Springer; 2010.
2. R. H. Landau, M. J. Paez and C. C. Bordeianu, *Computational Physics: Problem Solving with Computer*, Wiley VchVerlagGmbh& Co. KGaA, 2007.

References:

1. W. H. Press, S. A. Teukolsky, W. T. Verlling and B. P. Flannery, *Numerical Recipes in C*, Cambridge, 1998.
2. Tao Pang, *An Introduction to Computational Physics*, Cambridge University Press, 2006.

PH 2091M Engineering Optics (3-0-0-6)

Fermat's principle, laws of reflection and refraction; Reflection and refraction by a single spherical surface, thin lens equation; basic idea of monochromatic and chromatic aberrations; mutual coherence, Interference: division of wave front and amplitude, interference in dielectric films, Multiple beam interferometry; Huygen's principle; Fraunhofer diffraction: rectangular and circular aperture, diffraction grating; Polarization and birefringence; Nonlinear Optics: Nonlinear optical susceptibilities, second harmonic generation; Fibre Optics: basic characteristics of a step index optical fibre, attenuation and dispersion in optical fibres, principles of a fibre optic communication system; Basic principle of holography, optical microscope, telescope, spectrometer; Cameras.

Texts:

1. Pedrotti, Pedrotti and Pedrotti, Introduction to *Optics*, 2nd Ed., Pearson, 2012.
2. E. Hecht, *Optics*, 4th Ed., Pearson Education, 2002.

References:

3. A. Ghatak, *Optics*, 4$_{th}$Ed., Tata McGraw Hill, 2009.
4. R. D. Guenther, *Modern Optics*, Wiley&Sons, 1990.
5. M. Born and E. Wolf, *Principles of Optics*, 7th Ed., Cambridge University Press, 2005.

PH 2092M Quantum Physics (2-1-0-6)

Overview of basics: Basic postulates, Schrödinger equation; eigenvalues and eigenfunctions; Simple applications: particle in a box; potential well; quantum dots; potential barrier, linear harmonic oscillator; Angular momentum: spherical harmonics, commutation relations, Stern-Gerlach experiment and concept of spin; Three dimensional problems: harmonic oscillator, Central Potential, Hydrogen atom; Approximate methods: non-degenerate .

Texts:

1. D.J. Griffiths, *Introduction to Quantum Mechanics*, 2ndEd., Pearson Education, 2000.
2. P. M. Mathews and K. Venkatesan, *A Textbook of Quantum Mechanics,* Tata McGraw Hill, 1995.

References:

1. S. Gasierowicz, *Quantum Physics*, John Wiley, 2000.
2. E. Merzbacher, *Quantum Mechanics*, 3rdEd., John Wiley and Sons, 1998.

3. W. Greiner, *Quantum Mechanics: an Introduction*, Springer, 2004.
4. B.H. Bransden and C.J. Joachain, *Quantum Mechanics*,2nd Ed., Pearson Education, 2007.
5. J. J. Sakurai, *Modern Quantum Mechanics*, Pearson Education, 2002.

PH 3091M Laser Physics and Technology (3-0-0-6)

Laser basics: Spontaneous and stimulated emission, Einstein A and B coefficients, line broadening mechanism, properties of laser, laser rate equations, population inversion, pumping mechanism, optical resonators, laser cavity modes, Gaussian beam, Q-switching, mode-locking and pulse compression; Laser systems: gas, solid state, semiconductor and dye lasers; Laser technology: ultrafast lasers, pulse width measurement, frequency up and down conversion; Working principle of: holography, laser interferometry, laser spectroscopy

Texts:

1. W. T. Silfvast, *Laser and Fundamentals,* Cambridge University Press, 2004.
2. J Wilson and JFB Hawkes, *Optoelectronics: An Introduction*, Prentice Hall, 1996.

Reference:

1. B. E. Saleh and M.C. Teich, *Photonics*, John Wiley & Sons, 2007.

PH 3092M Materials Science and Engineering (3-0-0-6)

Classification of engineering materials; structure of solids: unit cells and crystal systems, crystallographic directions and planes, Miller indices; X-ray diffraction: the crystalline and the non-crystalline states, structure determination; covalent solids, metals and alloys, ionic solids, polymers; Imperfections in solids: point defects, line defects; diffusion in solids: diffusion process and mechanisms; Phase Diagrams; solubility limits, phases, phase equilibria, binary isomorphic systems, binary eutectic systems, non-equilibrium cooling; phase transformation process, nucleation and growth, precipitation, solidification and crystallization, re-crystallization and grain growth; Mechanical properties of metals and alloys; visco-elastic behaviour; structure-property correlations; Optical, electronic, dielectric, thermoelectric and magnetic properties of different materials.

Texts/References:

1. W. D. Callister Jr., *Materials Science and Engineering: An introduction*, 6th Ed., John Wiley India, 2006.

2. V. Raghavan, *Materials science and engineering: a first course*, Prentice Hall of India, 200