I B.TECH. DEGREE

(PHYSICS)

SYLLABUS
FOR
CREDIT BASED CURRICULUM

(2012 – 2013 onwards)

DEPARTMENT OF PHYSICS

NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI - 620015

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DEPARTMENT OF PHYSICS

SEMESTER I

		L (Periods)	T	P (Periods)	C
PH101	Physics-I	2	0	3	3

SEMESTER II

PH102	Physics-II	3	0	3	4

PH101 PHYSICS - I

I Lasers

Introduction to laser - characteristics of lasers - spontaneous and stimulated emissions – Einstein's coefficients – population inversion and lasing action – laser systems: Ruby laser, He-Ne Laser, semiconductor laser - applications: – holography- CD-drive – industrial and medical applications **6 hours**

II Fiber Optics

Fermat's principle and Snell's law-optical fiber – principle and construction – acceptance cone - numerical aperture ⁻ V-number - types of fibers, fabrication: double crucible technique, vapour phase oxidation process – fiber optic communication principle – fiber optic sensors-other applications of optical fibers. **6 hours**

III Acoustics

Characteristics of musical sound – loudness – Weber-Fechner law – decibel – absorption coefficient – reverberation – reverberation time – Sabine's formula – acoustics of buildings – ultrasonics – production of ultrasonics using piezoelectric method – magnetostriction method- applications. **6 hours**

IV Crystallography

Crystalline and amorphous solids – lattice and unit cell – seven crystal system and Bravais lattices – symmetry operation – Miller indices – atomic radius – coordination number – packing factor calculation for sc, bcc, fcc – Bragg's law of X-ray diffraction –Laue Method-powder crystal method. **6 hours**

V Magnetic materials, conductors and superconductors

Magnetic materials: definition of terms – classification of magnetic materials and properties – domain theory of ferromagnetism- hard and soft magnetic materials – applications.

Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity-Wiedemann- Franz law-band theory of solids-conductors-semiconductors-insulators.

Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory (qualitative) – high temperature superconductors ⁻ Josephson effect – quantum interference (qualitative) – SQUID – applications. **6 hours**

References

1. *Laser Fundamentals, William T. Silfvast, 2nd Edn., Cambridge University Press, New York (2004)*
2. *Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York (2001).*
3. *Introduction to Solid State Physics,7th Edn., Charles Kittel, Wiley, New Delhi (2007)*
4. *A Text Book of Engineering Physics, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi (2009).*

Lab Experiments

1. Torsional pendulum
2. Numerical aperture of an optical fiber
3. Temperature measurement - Thermocouple
4. Specific rotation of a liquid – Half shade polarimeter
5. Thickness of a thin wire – Air wedge
6. Conversion of galvanometer into ammeter and voltmeter
7. Dispersive power of a prism – Spectrometer

Reference

1. *Physics Laboratory Manual, Department of Physics, NITT.*

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PH102 PHYSICS – II

I Quantum Mechanics

Inadequacy of classical mechanics (black body radiation, photoelectric effect) – wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigenvalues and eigenfunctions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential. **8 hours**

II Nuclear and Particle Physics

Fundamental forces - nuclear properties and forces - nuclear models - Shell model- nuclear reaction - radioactivity - types and half lives - applications in determining the age of rocks and fossils- neutrons and its applications (neutron diffraction, nuclear reaction etc)- stellar nucleosynthesis. Particle physics - classification of matter - quark model- neutrino properties and their detection. **8 hours**

III Non-Destructive Testing

Principle of ultrasonic testing – inspection methods – different types of scans – liquid penetrant testing – magnetic particle inspection – principle and types of radiography – exposure factor – attenuation of radiation – real time radiography – principle of thermography – thermographic camera – advantages and limitations of all methods.

8 hours

IV Advanced Materials

Nanomaterials: introduction and properties – synthesis – chemical vapour deposition – ball milling – applications. Carbon nanotubes: structure and properties – synthesis– arc method – pulsed laser deposition- applications.

Liquid Crystals: types – nematic, cholesteric, smectic – modes: dynamic scattering, twisted nematic – display systems.

Shape memory alloys-one way and two way memory effect- pseudoelasticity-applications.

8 hours

V Electrodynamics

Coulomb's law - Gauss's law – dielectric polarization, polarizability and susceptibility- types of polarization – internal field and Claussius-Mosotti equation. Lorentz force -steady current and equation of continuity - Biot-Savart law – Ampere's law – Faraday's law of induction – generalization of Ampere's law – Maxwell's equation – propagation of EM waves in free space. **8 hours**

References

1. *Concepts of Modern Physics. Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).*
2. *Hand Book of Non-destructive Evaluation, C.J. Hellier, McGraw-Hill, New York (2001)*
3. *Introduction to Nanotechnology, C.P. Poole and F.J. Owens, Wiley, New Delhi (2007)*
4. *Introduction to Liquid Crystals Chemistry and Physics,* 2nd edn, *Peter J. Collings, Princeton University Press, New Jersey, (2002).*
5. *Shape Memory Alloys-Modeling and Engineering Applications, Ed. D. C. Lagoudas, Springer, New York (2008)*
6. *Engineering Physics, R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8th Edn., New Delhi (2001).*

Lab Experiments

1. Wavelength of sodium light – Newton's rings
2. Thermal conductivity –Lee's Disc
3. Wavelength of mercury spectrum – Spectrometer
4. Calibration of Voltmeter – Potentiometer
5. Wavelength of laser using diffraction grating
6. Field along the axis of a Circular coil
7. Non-destructive testing by ultrasonic flaw detector.

Reference

1. *Physics Laboratory Manual, Department of Physics, NITT.*

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