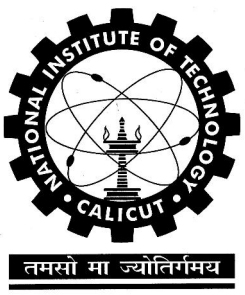

B.Tech. Engineering Physics

Curriculum & Brief Syllabi



DEPARTMENT OF PHYSICS

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

DEPARTMENT OF PHYSICS

Curriculum for Engineering Physics
B. Tech. Degree programme (2010 Admission)

Semester I

Sl. No	Code	Title	L	T	P	C	Category
01	MA1001	Mathematics I	3	1	0	3	BS
02	PH1001/CY1001	Physics / Chemistry	3	0	0	3	BS
03	MH1001/EE1001	Professional Communication / Basic Electrical Sciences	3	0	0	3	HL/ES
04	ZZ1001/ZZ1002	Engineering Mechanics / Engineering Graphics	3 1	0 0	0 3	3	ES/TA
05	PH1002/ZZ1004	Introduction to Engineering Physics Profession/Computer Programming	2	0	0	2	PT
06	ZZ1091/ZZ1092	Workshop I / Workshop II	0	0	3	2	TA
07	PH1091/CY1091	Physics Lab./ Chemistry Lab.	0	0	2	1	BS
08	ZZ1094/ZZ1093/ ZZ1095	OT(Value Education(1), Physical Education(1), NSS(1)	-	-	-	3*	OT
		Total	14/ 12	1	5/8	17+3*	

Semester II

Sl. No	Code	Title	L	T	P	C	Category
01	MA1002	Mathematics II	3	1	0	3	BS
02	CY1001/PH1001	Chemistry / Physics	3	0	0	3	BS
03	EE1001/MH1001	Electrical Sciences/ Professional Communication	3	0	0	3	ES/HL
04	ZZ1002/ZZ1001	Engineering Graphics/ Engineering Mechanics	1 3	0 0	3 0	3	TA/ES
05	ZZ1004 /PH1002	Computer Programming / Introduction to Engineering Physics Profession	2	0	0	2	PT
06	CY1094/PH1091	Chemistry Lab./ Physics Lab	0	0	2	1	BS
07	ZZ1092/ZZ1091	Workshop II / Workshop I	0	0	3	2	TA
		Total	12/ 14	1	8/5	17	

Semester III

Sl. No	Code	Title	L	T	P	C	Category
01	MA2001	Mathematics III	3	1	0	3	BS
02	PH2001	Classical Mechanics	4	0	0	4	PT
03	PH2002	Thermodynamics	3	0	0	3	PT
04	PH2003	Optics	3	0	0	3	PT
05	PH2004	Electromagnetics	4	0	0	4	PT
06	CY2001	Physical Chemistry	3	0	0	3	PT
07	PH2091	Physics Lab -II (general Physics)	0	0	3	2	PT
		Total	20	1	3	22	

Semester IV

Sl. No	Code	Title	L	T	P	C	Category
01	MA2002	Mathematics IV	3	1	0	3	BS
02	PH2005	Quantum Mechanics	4	0	0	4	PT
03	PH2006	Statistical Physics	4	0	0	4	PT
04	PH2007	Analog & Digital Electronics	3	0	0	3	PT
05	PH2008	Applied Electromagnetics	3	0	0	3	PT
06	CY2002	Organic Chemistry	3	0	0	3	PT
07	PH2092	Physics Lab –III (Electronics)	0	0	3	2	PT
		Total	20	1	3	22	

Semester V

Sl. No	Code	Title	L	T	P	C	Category
01	PH3001	Applied Quantum Mechanics	4	0	0	4	PT
02	PH3002	Condensed Matter Physics	4	0	0	4	PT
03	PH3003	Computational Physics	3	0	0	3	PT
04	BT 2001	Cell Biology	3	0	0	3	PT
05		Elective - I	3	0	0	3	PT
06	CY3093	Chemistry Lab	0	0	3	2	PT
07	PH3091	Physics Lab -IV (Solid State)	0	0	3	2	PT
		Total	17	0	6	21	

Semester VI

Sl. No	Code	Title	L	T	P	C	Category
01	PH3004	Semiconductor Physics and Technology	3	0	0	3	PT
02	PH3005	Lasers and Applications	3	0	0	3	PT
03		Elective - II	3	0	0	3	PT
04	PH3006	Experimental Techniques in Physics	3	0	0	3	PT
05		Elective - III/ Independent Study / Minor project	3	0	0	3	PT
06	PH3007	Environmental Studies	3	0	0	3*	OT
07	PH3092	Physics Lab -V (computational)	0	0	3	2	PT
08	PH3093	Mini Project / Industrial training	0	0	3	1	PT
		Total	18	0	6	18+3*	

Semester VII

Sl. No	Code	Title	L	T	P	C	Category
01	PH4001	Introduction to Photonics	3	0	0	3	PT
02	PH4002	Nuclear Science & Engineering	3	0	0	3	PT
03	ME4104	Principles of Management	3	0	0	3	HL
04		Elective - IV	3	0	0	3	PT
05		Elective - V	3	0	0	3	PT
06	PH4051	Seminar	0	0	2	1	PT
07	PH4052	Project	0	0	6	3	PT
		Total	15	0	8	19	

Semester VIII

Sl. No	Code	Title	L	T	P	C	Category
01	MS4003	Economics	3	0	0	3	HL
02	PH4004	Physics of Nanostructures and Nanoscale Devices	3	0	0	3	PT
03		Elective - VI	3	0	0	3	PT
04		Elective - VII	3	0	0	3	PT
05	PH4053	Project	0	0	12	6	PT
		Total	12	0	12	18	

Total Credit for the Course = 154+6OT = 160

LIST OF ELECTIVES

Sl. No	Code	Title	Credits
01	PH3021	Fiber Optics	3
02	PH3022	Atmospheric and Environmental Physics	3
03	PH3023	Optical Engineering	3
04	PH3024	Thin film technology	3
05	PH4021	Unconventional Electronics	3
06	PH4022	Introduction to Optoelectronics	3
07	PH4023	Relativity and Gravitation	3
08	PH4024	Nano Photonics	3
09	PH4025	Light-Matter interaction in Resonators	3
10	PH4026	Introduction to Critical phenomena	3

Brief Syllabi for Engineering Physics
B. Tech. Degree programme (2010 Admission)

PH2001 Classical Mechanics

L	T	P	C
4	0	0	4

Pre-requisites: Nil
Brief Syllabus:
Equations of motion and integration, calculus of variations, Lagrange's equations, Kepler's problem, system of oscillators, rigid body motion, motion in non-inertial reference frames, scattering, Hamilton's equations, canonical transformations, Poisson bracket formulation, Hamilton-Jacobi equation, action-angle variables

Total Hours: 56

PH2002 Thermodynamics

L	T	P	C
3	0	0	3

Pre-requisites: Nil
Brief Syllabus:
Macroscopic models, thermal equilibrium, zeroth law, temperature, work, heat, internal energy, first law, adiabatic processes, heat capacities, enthalpy, second law, reversible processes, Carnot cycle, entropy, free energy, Legendre transformations, Maxwell's relations, Clausius-Clayperon equation, Joule-Thomson process, chemical reactions, IC engines, third law, Nernst theorem, kinetic theory, ideal gas, Van der Waals equation, heat transfer processes

Total Hours: 42

PH2003 Optics

L	T	P	C
3	0	0	3

Pre-requisites: Nil
Brief Syllabus:
Geometrical optics - laws of reflection and refraction, matrix methods in paraxial optics and aberrations, physical optics - coherence, spectral bandwidth and coherence time, interference, diffraction, polarization, dichroism, birefringence, light sources and optical instruments

Total Hours: 42

PH2004 Electromagnetics

L	T	P	C
4	0	0	4

Pre-requisites: Nil
Brief Syllabus:
Different coordinate systems, Coulomb's law, divergence theorem, electric potentials, Poisson's and Laplace's equations, magneto statics, amperes circuital theorem, Stokes theorem, force on current elements, time varying fields, Maxwell's equations, wave propagation in different medium, Poynting vector, rectangular waveguide, dispersion, reflection and refraction of plane wave

Total Hours: 56

PH2091 Physics Lab II (General Physics Lab)

L	T	P	C
0	0	3	2

Pre-requisites: Nil
Brief Syllabus:
Basic and advanced level experiments in mechanics, electromagnetics, optics, heat and thermodynamics.

Total Hours: 42

PH2005 Quantum Mechanics

L	T	P	C
4	0	0	4

Pre-requisites: Nil
Brief Syllabus: Dirac formalism, Born interpretation, measurement theory, time evolution, Schrödinger equation, applications of quantum mechanics to simple systems, semi-classical approaches – WKB method, rotations, angular momentum, central field, hydrogen atom, symmetry, conservation laws, density matrix, partition function, path-integral formalism.

Total Hours: 56

PH2006 Statistical Physics

L	T	P	C
4	0	0	4

Pre-requisites: Nil
Brief Syllabus:
Models of macroscopic systems, macro states and micro states, phase space, Liouville's theorem, postulate of equilibrium statistical mechanics, Maxwell-Boltzmann distribution, applications of classical statistical mechanics, quantum statistics, systems of identical, indistinguishable particles, Bose-Einstein and Fermi-Dirac distributions, applications and examples of quantum statistics, phase transitions, Ising and Heisenberg models, microscopic simulations.

Total Hours: 56

PH2007 Analog and Digital Electronics

L	T	P	C
3	0	0	3

Pre-requisites: Nil
Brief Syllabus:
Circuit theorems, special diodes, operational amplifier theory, frequency effects, negative feedback, linear and non-linear amplifier circuits, regulated power supplies, thyristors, oscillators and timers, phase locked loop (PLL) - operating principles and applications, A/D and D/A converters, sample-and hold-circuit, review of digital principles - algebra for logic circuits, logic gates, TTL and CMOS inverters, sequential logic circuits- design and analysis of synchronous and asynchronous sequential circuits, introduction of microprocessor and microcontroller, memory- Read Only Memory (ROM), EPROM, Flash, static and dynamic random access memories

Total Hours: 42

PH2008 Applied Electromagnetics

L	T	P	C
3	0	0	3

Pre-requisites: PH2004 Electromagnetics
Brief Syllabus:
Transmission lines, Smith chart, the lossy line, parallel wave guides, modes in waveguides, rectangular wave guides and cavity resonator, dispersion and group velocity, reflection and refraction of plane waves, radiating systems and antennas, numerical methods in electromagnetics

Total hours: 42

PH2092 Physics Lab III (Electronics)

L	T	P	C
0	0	3	2

Pre-requisites: Nil
Brief Syllabus:
Experiments in analog and digital electronics.

Total hours: 42

PH3001 Applied Quantum Mechanics

L	T	P	C
4	0	0	4

Pre-requisites: Nil
Brief Syllabus:
Addition of angular momentum, identical particles, exchange, exclusion principle, stationary state perturbation theory, time dependent perturbation, transition rate, Fermi golden rule, scattering theory, variational theorem, Semi-classical radiation theory, absorption and emission, dipole transitions, spontaneous emission, simulated emission, Berry's phase, relativistic effects, Klien-Gordon equation, Dirac equation.

Total Hours: 56 hrs

PH3002 Condensed Matter Physics

L	T	P	C
4	0	0	4

Pre-requisite: Nil
Brief Syllabus:
Crystalline and noncrystalline materials, bonding and internal structure of solids, ionic and covalent bonds, metallic bond, hydrogen bond, cohesive energy, crystal structure, reciprocal lattice, X-Ray diffraction, Bragg condition, vibrations of lattice, heat capacity, thermal conductivity**,** free electron model, density of allowed wave vectors, Fermi distribution, band theory of solids**,** periodic potential, density of states, diamagnetism and paramagnetism, Weiss theory of ferromagnetism, superconductivity**,** Meissner effect, London equation, BCS theory.

Total hours: 56 hrs

PH3003 Computational Physics

L	T	P	C
3	0	0	3

Pre requisites: Nil
Brief Syllabus:

MATLAB programming basics, testing and debugging, finding the roots of a function, systems of linear equations, interpolation, least squares fitting, non linear least squares, integration, quadrature, ordinary differential equations, Runge-Kutta method, applications to physics, introduction to Monte Carlo and molecular dynamics.

Total Hours: 42hrs

PH3091 Physics Lab IV (Solid State)

L	T	P	C
0	0	3	2

Pre requisites: Nil
Brief syllabus:
Experiments in solid state physics – synthesis, characterization and measurements on materials.

Total Hours: 42hrs

PH3004 Semiconductor Physics and Technology

L	T	P	C
3	0	0	3

Pre requisites: Nil
Brief Syllabus:
Semiconductor materials, crystal growth and energy bands, carrier transport phenomena in semiconductors, oxidation and lithography, diffusion and ion implantation.

Total Hours: 42hrs

PH3005 Lasers and Applications

L	T	P	C
3	0	0	3

Pre-requisites: PH2004 - Electromagnetics
Brief Syllabus:
Einstein theory of laser, laser - rate equation, three and four level lasers, optical resonators, Q-switching and mode locking – pulsed lasers, different type of laser systems, gas lasers and solid state lasers, application of lasers in industry, medicine, communication, basic research etc.

Total Hours: 42 hrs

PH3006 Experimental Techniques in Physics

L	T	P	C
3	0	0	3

Pre-requisites: Nil
Brief Syllabus:
Data reduction and error analysis, probability distributions, probability densities, inferences concerning means, variances and proportions, non-parametric tests, curve fitting, analysis of variance, laser light scattering, SAXS, SANS, Spectroscopy - microwave, infra-red, Raman, NMR, ESR, Mossbauer, microscopy - SEM, TEM, confocal microscopy.

Total Hours: 42hrs

PH3007 Environmental Studies

L	T	P	C
3	0	0	3

Prerequisites: Nil
Brief Syllabus:
Resources, conservation, ecosystems, biodiversity, pollution, population, human rights

Total Hours: 42hrs

PH3092 Physics Lab V (Computational)

L	T	P	C
0	0	3	2

Pre-requisites: Nil
Brief Syllabus:
Programming with MATLAB/ C/ C++/ FORTRAN (Choice of student) algorithms for root extraction, solving linear equations, interpolation and extrapolation, curve fitting, numerical integration and solving ordinary differential equations with applications to physics problems.
Total Hours: 42hrs

PH3093 Mini Project / Industrial Training

L	T	P	C
0	0	3	1

Pre-requisites: Nil
Brief Syllabus:
Students may undertake short research projects or internship in the field of physics/applied physics/ technology

Total Hours: 42hrs

PH4001 Introduction to Photonics

L	T	P	C
3	0	0	3

Prerequisite: PH2004 – Electromagnetics, PH3005 - Lasers and Applications
Brief Syllabus:
Nonlinear optics - second order effect, second harmonic generation, phase matching, third order effect – optical Kerr effect, Raman and Brillouin scattering, wave mixing, electro - optic effect and applications, optical noise, measurement of optical power, detection of optical radiations, photomultipliers

Total Hours: 42 hrs

PH4002 Nuclear Science and Engineering

L	T	P	C
3	0	0	3

Pre-requisites: Nil
Brief Syllabus:
Nuclear decay, nuclear binding energies, forces, shell model, liquid drop model, nuclear decay, beta, gamma and alpha decay, nuclear reactions, neutron interactions, moderation, fission, chain reactions, reactors, fuels, fusion, fast breeders, shielding and safety, radiation detection, dating, isotope production

Total Hours: 42hrs

PH4051 Seminar

L	T	P	C
0	0	2	1

Pre-requisites: Nil
Brief Syllabus:
Each student shall prepare a technical paper and make a 30 minute oral presentation on a current research topic relevant to Physics / Applied Physics / Technology to the rest of the class, after scrutiny and approval of the faculty- in charge of seminar. The oral presentation and a final technical report are evaluated by faculty members in charge of seminar.

Total Hours: 42hrs

PH4052 Project

L	T	P	C
0	0	6	3

Pre-requisites: Nil
Brief Syllabus:
Students are required to take up an investigative project in physics / applied physics / technology in physics department or in any other department in NIT Calicut to complete the degree requirements.

PH4004 Physics of Nanostructures and Nanoscale Devices

L	T	P	C
3	0	0	3

Pre-requisites: Nil
Brief Syllabus:
Semiconductor homojunctions and heterojunctions, crystal growth, characterization, band engineering, layered structures, microscopy, lithography, pattern transfer, etching, selected area growth, dimensionality, quantum well structures, superlattices, lasers, modulators, detectors and solar devices, quantum well optical modulators, photodetectors, quantum well infrared photodetectors, solar cells.

Total Hours: 42hrs

PH4053 Project

L	T	P	C
0	0	12	6

Pre-requisites: Nil
Brief Syllabus:
Students are required to take up an investigative project in Physics / Applied Physics / Technology in Physics department or in any other department in NIT Calicut to complete the degree requirements.