

Course Descriptions

Aditya Gangula - EP20BTECH11001

Academic Pattern

The 2020 Engineering Physics curriculum at IIT Hyderabad requires me to complete 130 IITH credits over the course of 4 years. Hence, one year of studies is equivalent to completing 32.5 IITH credits.

ECTS credits for course Y = $60 \times (\text{credits for course Y at home university}) / (\text{Number of credits equivalent to one year of full-time studies})$

Following the above conversion formula : **1 IITH credit = 1.85 ECTS credit**

The highest possible grade point is 10 and the least passing grade point is 4. The Cumulative Grade Point Average (CGPA) is a weighted average of the grade points with courses' credits as the weights.

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1 Semester - I

1.1 CY1018 Environmental Chemistry Theory

Contents :

Know our environment (chemistry of lithosphere, energy balance, sustainability and recycle), Know about global warming (infrared absorption, molecular vibration, atmospheric window, residence time of greenhouse gases, evidences and effects of global warming), Deeper analysis of atmospheric pollution (Chemistry of CO, NO_x, VOCs, SO₂, Industrial smog, photochemical smog), Ozone depletion (production, catalytic destruction), Organic Chemicals in the Environment, Insecticides, Pesticides, Herbicides and Insect Control, Soaps, Synthetic Surfactants, Polymers, and Haloorganics. Fate of organic/inorganic chemicals in natural and engineered systems (fate of polymers after use, detergents, synthetic surfactants insecticides, pesticides etc. after use), Aspects of transformations in atmosphere (microbial degradation of organics-environmental degradation of polymers, atmospheric lifetime, toxicity). Green Chemistry and Industrial Ecology. Future challenges (CO₂ sequestering, Nuclear energy). A project on environment related topic.

IITH credits - 2

ECTS credits - 3.7

1.2 EP1108 Modern Physics

Contents :

Photo Electric Effect, Compton Effect, Atomic Spectra and Lasers, Bohr and deBroglie models, Stern-Gerlach and Entanglement experiments, Matter waves and Schrodinger Equation, Tunnelling, decay, STMs, Hydrogen Atom and Molecular Bonding, Conductivity, Semiconductors, BEC. Introduction to Special Relativity and Statistical Mechanics.

IITH credits - 2

ECTS credits - 3.7

1.3 EP1118 Maths for Physics

Contents :

Vector Algebra, Matrices and determinants, Vector calculus (gradient, divergence, curl and related theorems), Line, surface and volume integrals, Curvilinear coordinates (spherical and cylindrical polar, Jacobian, grad, divergence, curl, Laplacian)

IITH credits - 2

ECTS credits - 3.7

1.4 EP1128 Basic Electric Circuits

Contents :

Mesh and node analysis, Thevenin, Norton and other network theorems, two port Networks, Sinusoidal Steady state analysis of R-L-C circuits, Filters, Transient Circuit analysis through Laplace transform techniques.

IITH credits - 2

ECTS credits - 3.7

1.5 ID1063 Introduction to Programming

Contents :

Introduction to C and C++ programming. Problem solving and algorithms. Input and output operations, decision control structure, loop control structure, arrays, strings, etc. pointers, arrays, structures, functions, file operations. Lab is also included in this course.

IITH credits - 3

ECTS credits - 5.55

1.6 LA1760 Communication Skills

Contents :

Fill up

IITH credits - 2

ECTS credits - 3.7

1.7 MA1110 Calculus-I

Contents :

Sequences and Series: Limit of a sequence, monotone and Cauchy sequences and properties of convergent sequences, examples. Infinite series, positive series, tests for convergence and divergence, integral test, alternating series, Leibnitz test. Differential Calculus: Continuity and differentiability of a function of single variable, statement of Rolle's Theorem, Lagrange's mean value theorem and applications.

IITH credits - 1

ECTS credits - 1.85

1.8 MA1220 Calculus-II

Contents :

Integral Calculus: Definite Integrals as a limit of sums, Applications of integration to area, volume, surface area, Improper integrals. Functions of several variables: Continuity and differentiability, mixed partial derivatives, local maxima and minima for function of two variables, Lagrange multipliers.

IITH credits - 1

ECTS credits - 1.85

2 Semester - II

2.1 BT1010 Introduction to Life Sciences

Contents :

The course aims to introduce basic biological principles to engineering undergraduates. Content: (i) Biomimicry, (ii) Evolution, (iii) Basic Genetics (iv) Building blocks of life: Bio-molecules and their structure-function aspects (v) Cell structure and organelles and cellular transport and signaling (vi) Cell metabolism and its regulation; How does a cell sustain life? Cell energetic: harvesting chemical and solar energy (vi) DNA, RNA, DNA structure and packing, its replication, (vi) Protein, structure function (vii) Central dogma in Molecular Biology, Transfer of information from DNA to protein synthesis. (viii) Neurons, Synapses and Signaling (ix) Muscle movement (x) Biotechnology.

IITH credits - 1

ECTS credits - 1.85

2.2 CY1031 Chemistry Laboratory

Contents :

Synthesis and characterisation of Aspirin. Analysis of Organic Compound. Estimation of Phenol by Winkler's method. Estimation of Copper in Brass. Determination of Hardness of Water. Synthesis of Potash Alum from Scrap Aluminium a Recycling of Aluminium Waste. Reaction Kinetics: determination of First order Rate Constant. Conductometric/pH metric determination of Acid Strength in Citrus Fruit. Determination of the distribution coefficient and Formation Constant of KI₃.

IITH credits - 2

ECTS credits - 3.7

2.3 EE1201 Digital Systems

Contents :

Gate level design of Small Scale Integration (SSI) circuits, Modular combinational logic elements- Decoders, Encoders, Priority encoders, Multiplexers and Demultiplexers, Adders, Subtractors, Multipliers, division circuits, Complexity and propagation delay analysis of circuits, Sequential circuits - Latches, Flip-flops, Master-slave flip flops, Edge-triggered flip-flops, Models of sequential circuits - Moore machine and Mealy machine, Flip-flops - Characteristic table, Characteristic equation and Excitation table, Analysis and Design of sequential circuits, Modular sequential logic circuits- Shift registers, Registers, Counters and Random access memories, Design using programmable logic sequencers (PLDs), Serial adder for integers, Design of control units for multipliers/dividers

IITH credits - 3

ECTS credits - 5.55

2.4 EM3020 Introduction to Entrepreneurship

Contents :

Entrepreneurial Mindset, Idea Generation and Creativity, Problem identification and Market Analysis, Developing a Business Plan

IITH credits - 1

ECTS credits - 1.85

2.5 EP1031 Physics Lab

Contents :

Determination of young's modulus of wood using a strain gauge. Determination of rigidity modulus of a wire using torsional pendulum. Verification of stefan's law and planck's constant. Study of the principle of superposition using a cathode ray oscilloscope(CRO). Determination of refractive index of the material of the prism using a spectrometer. Determination of the radius of curvature of a plano-convex lens using newton's rings method. Determination of the wavelength of a laser by studying the diffraction from a scale. Study of the field along the axis of a coil and the earth's magnetic feild. Determination of energy gap of a semiconductor. Study of the characteristics of zener diode and bipolar junction transistor(BJT).

IITH credits - 2

ECTS credits - 3.7

2.6 EP1208 Electricity and Magnetism

Contents :

Coulomb's law, Electric field, Divergence and curl of electrostatic fields, electric potential, work and energy in electrostatics, conductors, Special techniques to solve Laplace's equations, Method of images, separation of variables and Multiple expansion, Polarization, Field of a polarized object, Electric displacement and linear dielectrics. Lorentz force law, Biot-Savart Law, Divergence and curl of B, magnetic vector potential, magnetization, field of a magnetized object, linear and nonlinear media

IITH credits - 2

ECTS credits - 3.7

2.7 ID1050 Artificial Intelligence

Contents :

Game playing, introduction to machine learning, speech technologies, natural language processing.

IITH credits - 1

ECTS credits - 1.85

2.8 ID1054 Digital Fabrication

Contents :

Complete process chain for design and subsequent realization of concepts making use of 3D modelling and additive manufacturing (3D printing) processes: Familiarization with 3D solid modelling for creation of engineering and freeform geometries; 3D Scanning using CMM and laser scanners. 3D Printing concepts for conversion of CAD model into real part: slicing, effect of part orientation. Project involving ideation, design and final fabrication using 3D printing.

IITH credits - 2

ECTS credits - 3.7

2.9 LA1800 Sociology of Sports - An Introduction

Contents :

The course intends to introduce sociological ways of thinking about sports to the students by highlighting the structural, institutional and relational dimensions that influence its organisation and promotion in the contemporary world. Organised around eight themes, the course will introduce discussions around the central axes of culture, inequality, communication and capitalism that dominate the practice of sport in

its various forms. The pedagogy will consist of discussion - style lectures organised around visual/audio or archival resources, complimented by academic and long-form reading material for each module.

IITH credits - 1

ECTS credits - 1.85

2.10 LA1830 Introduction to Cognitive Science

Contents :

Cognitive Science has raised fundamental questions about what the structure of the world is and how we perceive it, and how we make decisions and act in the world. This course covers introduction to building blocks of cognition which will include sensation, perception, sense of causality, time perception, reasoning, decision-making, language, and action. Reading materials discuss background of each concept and current advances in different fields of Cognitive Science.

IITH credits - 1

ECTS credits - 1.85

2.11 LA1850 Consumer Neuroscience

Contents :

Decision making is a ubiquitous part of our daily lives and we all make choices as a consumer on every-day basis. This course will offer a sneak-peak of processes underlying these decisions and choices. How do we attend certain types of information, how do we combine information from different sources? How much of these processes are unconscious? This course will provide an introduction of basic mechanisms and methods in the field of consumer neuroscience.

IITH credits - 1

ECTS credits - 1.85

2.12 MA1140 Elementary Linear Algebra

Contents :

Vector spaces, Subspaces, basis and dimension, linear transformations, representation of transformations by Matrices, linear functionals, transpose of linear transformations, canonical forms. Linear functionals and adjoints, Bilinear forms, symmetric bilinear forms, skew symmetric bilinear forms.

IITH credits - 1

ECTS credits - 1.85

2.13 MA1150 Differential Equations

Contents :

Ordinary Differential Equations: First order linear equations, Bernoulli's equations, Exact equations and integrating factor, Second order and Higher order linear differential equations with constant coefficients.

IITH credits - 1

ECTS credits - 1.85

3 Semester - III

3.1 EE1202 Digital Circuits

Contents :

Gate level design of Small Scale Integration (SSI) circuits, Modular combinational logic elements- Decoders, Encoders, Priority encoders, Multiplexers and Demultiplexers, Adders, Subtractors, Multipliers, division circuits, Complexity and propagation delay analysis of circuits, Sequential circuits - Latches, Flip-flops, Master-slave flip flops, Edge-triggered flip-flops, Models of sequential circuits - Moore machine and Mealy machine, Flip-flops - Characteristic table, Characteristic equation and Excitation table, Analysis and Design of sequential circuits, Modular sequential logic circuits- Shift registers, Registers, Counters and Random access memories, Design using programmable logic sequencers (PLDs), Serial adder for integers, Design of control units for multipliers/dividers

IITH credits - 3

ECTS credits - 5.55

3.2 EP2100 Classical Mechanics

Contents :

Mechanics of particles and systems of particles. Constraints. D'Alembert's principle and Lagrange's equations. velocity-dependent potentials and the dissipation function. Simple Applications of the Lagrangian Formulation. Hamilton's principle. Calculus of variations. Extending Hamilton's principle to nonholonomic systems. Conservation theorems and symmetry properties. Energy function and conservation of energy. Central force problem. The Kepler problem. Three body problem. Euler angles. Euler's Theorem on the motion of a rigid body. Finite and infinitesimal rotations.

IITH credits - 3

ECTS credits - 5.55

3.3 EP2108 Special Relativity

Contents :

Galilean transformations, postulates of special theory of relativity, Lorentz transformations, length contraction, time dilation, relativistic mass, relativistic energy and momentum, notion of space, time and space-time, space-time diagram. Lorentz transformations, Relativistic four-vector notation, Lorentz Group and Poincare Group: Lorentz tensors, Infinitesimal transformations: Generators and Lie-derivatives, Conservation laws for Lorentz symmetry: Noether charges, Lorentz Covariant laws of physics: Point Particle, Fluid mechanics, Electrodynamics and Lorentz force law, Relativistic Thermodynamics.

IITH credits - 2

ECTS credits - 3.7

3.4 EP2118 Analog Electronics

Contents :

Introduction to Analog Electronics and Application, Devices parameters: Analog perspective and significance, Macro-modelling: small signal and behavioral, Amplifiers: single stage and differential, Biasing: Voltage and current bias, Test board design

IITH credits - 2

ECTS credits - 3.7

3.5 ID2230 Data Structures and Applications

Contents :

Abstract data types, Big-Oh notation, Basic data types - Stacks, Queues, Trees. More data types. Dictionaries. Binary search trees, Balanced search trees, Hash tables; Heaps, Priority queues, Graphs. Algorithmic Design Paradigms, Divide and Conquer, Analysis for Divide and Conquer, Sorting, Greedy Algorithms. Dynamic Programming, Graph Algorithms (DFS, BFS, Topological Sort, Single Source Shortest Path, Spanning Trees, All Pair Shortest Path, Matching, Max Flow).

IITH credits - 3

ECTS credits - 5.55

3.6 LA1030 Introductory Economics

Contents :

Ten Principles of Economics, Thinking like an Economist, Interdependence and gain from trade, The Market Forces of Supply and Demand, Elasticity and Its Application, Supply, Demand, and Government Policies, Consumers, Producers, and Efficiency of Markets, The Costs of Production.

IITH credits - 1

ECTS credits - 1.85

3.7 LA1770 Personality Development

Contents :

The course aims to provide effective ways to develop soft skills to engage in more productive professional development.

IITH credits - 1

ECTS credits - 1.85

3.8 MA2110 Probability

Contents :

Sample space and events, definitions of probability, properties of probability, conditional probability. Random variables: distribution functions, discrete and continuous random variables, moments of random variables, conditional expectation, Chebyshev inequality, functions of random variables. Special Distributions: Bernoulli, Binomial, Geometric, Pascal, Poisson, Exponential, Uniform, Normal distributions, Limit Theorems: Law of large numbers.

IITH credits - 2

ECTS credits - 3.7

4 Semester - IV

4.1 EP2041 Physics Lab EP-2

Contents :

Amplitude Modulation And Demodulation. Applications of Diode as a rectifier (half wave, full wave) clipper and clamper. Applications of Transistor as a switch and amplifier. Characteristics of SCR and DIAC. Characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET). Operation of the Inverting and Non-Inverting Amplifiers, Comparator, Integrator and Differentiator using op-amp and trace the output wave forms for sine and square wave inputs.

IITH credits - 2

ECTS credits - 3.7

4.2 EP2200 Thermodynamics

Contents :

Kinetic theory of Gases, Maxwell-Boltzmann Distribution, molecular distribution, mean free path and collisions, transport and thermal diffusion, viscosity, thermal conductivity. Thermodynamic systems, First law of Thermodynamics, Second law of Thermodynamics, Clausius theorem, thermodynamics and statistical definition of Entropy, Gibbs paradox, Entropy and probability, internal energy and heat capacity equations and their applications.

IITH credits - 3

ECTS credits - 5.55

4.3 EP2228 Fluid dynamics

Contents :

Introduction - scope and relevance; Method of analysis - system vs control volumes - differential vs integral approach, Units and dimensions; Fluid properties - continuum, density, viscosity, surface tension, velocity, pressure, temperature; Fluid Statics - Hydrostatics, Fluid forces on planes and curved surfaces, submerged and floating bodies, Buoyancy and stability, Atmosphere as a fluid; Fluid Concepts - Streamlines, streaklines, pathlines, viscous vs inviscid flows, laminar vs turbulent flows, compressible vs incompressible flows; Engineering bernoulli equation; Control Volume analysis: Basic laws - Mass conservation law, thermodynamic laws, Newton's laws, Angular-Momentum principle; Buckingham Pi-theorem; Similitude and modeling - scaling effects; Flows in a pipes and channels - friction factor, flow measurement devices - Venturi meter, Orifice meter. Differential analysis to fluid flow: Conservation of Mass - Coordinate systems, Kinematics - Translation, Rotation, Deformation, derivation of Governing equations of fluid flows - continuity, Euler equations, Potential flows - Bernoulli equation and applications to external aerodynamics, Navier-Stokes equations, Non-dimensional analysis; Exact solutions of Navier-Stokes equations; Internal flows; External flows - Prandtl's Boundary layer theory - flow over a flat plate, concept of similarity; Approximate methods - von Karman Integral analysis; (Thwaites method); Flow separation; Brief introduction to turbulence - characteristics of turbulence, drag crisis.

IITH credits - 2

ECTS credits - 3.7

4.4 EP2418 Electronic Device Physics

Contents :

Classification of materials, Basic Semiconductor: energy bands, donors and acceptors, carrier concen-

tration, carrier transport, generation recombination processes, basic equations for device operation, P-N junctions: electrostatics, space charge, abrupt and linearly graded, current-voltage and capacitance-voltage characteristics, junction breakdown, Metal-Semiconductor contact: Ohmic and non-ohmic, Schottky effect, current-voltage characteristics, Bipolar Transistor: transistor action, current gain, static characteristics, frequency response, transient behaviour, junction breakdown, metal-insulator-semiconductor (MIS), Metal-Oxide-Semiconductor (MOS) diode, C-V characteristics of MOS, Charge couple devices (CCD). Field Effect Transistor, MISFET, MOSFET, CMOS.

IITH credits - 2

ECTS credits - 3.7

4.5 EP3208 Advanced Mathematical Physics

Contents :

Infinite sequences and series - convergence and divergence, conditional and absolute convergence, ratio test for convergence, Special functions (Euler beta and gamma, Heaviside Step function, Dirac Delta function, Kronecker delta, Bessel equation and function, Legendre equation and function, Spherical harmonics, Green function, hermite, Laguerre, Chebyshev), Probability and Statistics (Various distributions e.g. Gaussian, Poisson, Binomial, Error analysis), Fourier Series and transforms, Laplace series and transforms, Ordinary differential equations, Partial differential equations: First order, second order, separation of variables, Laplace and Poisson equations, Wave equations.

IITH credits - 2

ECTS credits - 3.7

4.6 EP3220 Optics and Photonics

Contents :

Basics of Geometrical Optics and Diffraction Theory, Optical Components: Mirrors, Lens, Prisms, Thin lens theory, Aberrations, Basic Optical Instruments, Lens Design and evaluation, Introduction to Optical Instrument design. Polarization, Interference and Coherence of Light.

IITH credits - 3

ECTS credits - 5.55

4.7 EP3227 Nonlinear Dynamics

Contents :

Nonlinear methods and chaos, stability, logistic map, Nonlinear differential equations, application to physics and engineering, one dimensional system, bifurcations

IITH credits - 1

ECTS credits - 1.85

4.8 EP4210 Computational Physics

Contents :

Interpolation; Least square and spline approximation; numerical differentiation and integration; Numerical methods for matrices; Extremes of a function; Non-linear equations and roots of polynomials; Numerical methods for ordinary differential equations; Numerical solution of Sturm-Liouville and Schrodinger equation; Discrete and fast Fourier transforms; Molecular dynamics and Monte Carlo simulations; Numerical methods for partial differential equations; Applications of numerical methods in Physics

IITH credits - 3

ECTS credits - 5.55

4.9 MA2140 Statistics

Contents :

Fundamentals of Data: Collection, Summarization, and Visualization; Sampling and Sampling Distributions, Central Limit Theorem; Methods of Estimation, Unbiased estimators; Confidence Interval Estimation: Z-interval, t-interval; Hypothesis Testing, Types of Errors, Rejection Region Approach and p-value Approach.

IITH credits - 1

ECTS credits - 1.85

5 Semester - V

5.1 EE3900 Linear Systems and Signal Processing

Contents :

Introduction: The communication process, Sources of information, Communication channels, Baseband and pass band signals, Representation of signals and systems, The modulation process, Information theory and coding, Analog versus digital communications Representation of signals and systems: Notation of energy and power, Dirac delta function, Continuous-time LTI systems and their properties, The Fourier transform and its properties, Transmission of signals through linear systems, Filters, Hilbert transform, Pre-envelope, Canonical representation of band-pass signals, Phase and group delay. Modulation: Amplitude modulation, Double sideband-suppressed carrier modulation, Single sideband modulation, VSB, Frequency modulation, Phase- locked loop. Review of LTI systems and their properties, Convolution sum, Sampling of continuous-time signals, Discrete-time Fourier transform (DTFT) and its properties, Sampling in frequency domain, Discrete Fourier transform (DFT) and its properties, Z-transform and its inverse, region of convergence, pole-zero locations and frequency response, stability analysis, implementation of discrete-time systems, design of FIR filters and IIR filters, linear phase filters, group delay, response of first and second order filters, Computational issues in DFT, FFT algorithm

IITH credits - 3

ECTS credits - 5.55

5.2 EP3051 Physics Lab (EP)

Contents :

Determination of elastic constants by cornu's method. Study of dielectric constant of material. Electron charge to mass ratio. Faraday effect. Study of hall effect. Study of magnetic hysteresis. Millikan's oil drop experiment. Determination of magnetic mass susceptibility of a liquid by quincke's method. Ultrasonic interferometer. Young's modulus of a wooden beam by method of flexure.

IITH credits - 2

ECTS credits - 3.7

5.3 EP3100 Quantum Mechanics-1

Contents :

Group Theory : Reducible and Irreducible representations, Lie groups, SU(2), SU(3), SO(N), SU(N), representations, Applications of group theory in Physics. Classical to quantum cross-over, basic principles of quantum mechanics, wave function and uncertainty principle, probability wave amplitude, probability density, wave equation and Schrodinger formalism, time-independent and time-dependent Schrodinger equations, Dirac formulation of quantum mechanics, linear vector spaces, bra and ket vectors, completeness and orthonormalization of basis vectors, basis sets, change of basis, eigenstate and eigenvalues, expectation values.

IITH credits - 3

ECTS credits - 5.55

5.4 EP3105 Project-1

Contents :

Description and report in CV.

IITH credits - 3

ECTS credits - 5.55

5.5 EP3110 Electrodynamics

Contents :

Electromotive force, Electromagnetic induction, Maxwell's equations, conservation laws, Poynting theorem, Maxwell's stress tensor, conservation of momentum, angular momentum, and electromagnetic waves, Electromagnetic waves in vacuum, Electromagnetic waves in matter, Absorption and Dispersion, Wave Guides, Potentials and fields, Gauge transformations, Coulomb Gauge and Lorentz Gauge, Dipole radiation, Power radiated by point charge. Relativistic electromagnetism.

IITH credits - 3

ECTS credits - 5.55

5.6 EP3120 Statistical Mechanics

Contents :

Liouville's theorem, ensembles: microcanonical, canonical and grand canonical; mixing entropy and Gibbs's paradox, equilibrium distributions, partition functions, fluctuations and response, equivalence of ensembles; Quantum statistical mechanics: density matrix, quantum ensembles, quantum ideal gas, Fermions and Bosons, occupation number, equation of state, ideal Fermi gas, Pauli paramagnetism, ideal Bose gas, black body radiation, Bose-Einstein condensation.

IITH credits - 3

ECTS credits - 5.55

5.7 LA1860 Psychology for Everyday Life

Contents :

This course will present psychological perspectives in explaining and understanding everyday life situations. The students will learn about key psychological concepts, theories and practical applications from selected subdisciplines such as developmental psychology, clinical psychology, social psychology and positive psychology. Commonly experienced situations and behaviour pertaining to the self, relationships, and community will be discussed. The objective is to present the students with psychological tools that may be applied in understanding and adapting to everyday life situations.

IITH credits - 1

ECTS credits - 1.85

6 Semester - VI

6.1 EP3061 Physics Lab EP-3

Contents :

Diffraction Experiments : Single Slit, Grating, Circular Aperture. Fabry-Perot Interferometer. Fourier optics. Geometrical Optics : Parallel beam method, u-v method, laser beam expander, collimator, simple and compound microscopes. Laser beam Parameters. Michelson Interferometer. Optical fiber characteristics. Polarization experiments.

IITH credits - 2

ECTS credits - 3.7

6.2 EP3200 Solid State Physics

Contents :

Specific Heat of Solids: Boltzmann, Einstein, and Debye Calculations. Drude Theory. Sommerfeld Free electron theory. Chemical Bonding : Ionic, Covalent, Tight Binding theory, Van der Waals, Fluctuating Dipole Forces, or Molecular Bonding, Metallic Bonding, Hydrogen Bonds. One-Dimensional Model of Compressibility, Sound, and Thermal Expansion. Vibrations of a One-Dimensional Monatomic and Diatomic Chain. Tight Binding Chain. Crystal Structure. Reciprocal Lattice, Brillouin Zone, Waves in Crystals. Wave Scattering by Crystals

IITH credits - 3

ECTS credits - 5.55

6.3 EP3205 Project-2

Contents :

Description and report in CV.

IITH credits - 3

ECTS credits - 5.55

6.4 EP3210 Quantum Mechanics-II

Contents :

Schrodinger and Heisenberg pictures, interaction picture, unitary transformations, symmetry principle and conservation laws, translation along spatial and temporal directions, spatial rotation and conservation of angular momentum, space reflection and parity conservation, time reversal invariance. Elements of relativistic quantum mechanics, the Klein-Gordon equation, the Dirac equation, Dirac matrices, spinors, positive and negative energy solutions, physical interpretations, non-relativistic limit of Klein-Gordon and Dirac equations, equation of continuity and probability current density.

IITH credits - 3

ECTS credits - 5.55

6.5 EP3230 Atomic and Molecular Physics

Contents :

The Schroedinger equation for One-electron Atoms, Special Hydrogenic systems, Interaction of one electron atoms with Electromagnetic Radiation, One-electron atoms: Fine Structure and Hyperfine Structure

IITH credits - 3

ECTS credits - 5.55

6.6 EP4120 Astronomy and Astrophysics

Contents :

Introduction to astronomical and astrophysical nomenclature and concepts. Coordinate systems, celestial orbits, radiation, stars, stellar structure and evolution, galaxies and galaxy clusters, Cosmology

IITH credits - 3

ECTS credits - 5.55

6.7 EP4130 Data Science Analysis

Contents :

Measurement, analysis; Probability distributions; Parameter Estimation; Hypothesis testing; Model Comparison; Confidence Intervals; Bayesian Analysis; Markov Chain Monte Carlo techniques; Dimensionality Reduction; Time-series analysis

IITH credits - 3

ECTS credits - 5.55

7 Semester - VII

7.1 EP4108 Nuclear Physics

Contents :

Alpha decay: Tunnelling effect and probability, Geiger-Nuttall law, Electron and positron spectra, Neutrino mass, Kurie plot, Fermi theory of beta decay, Gamma decays, Nuclear models, Nuclear reactions, Direct reactions, Compound nucleus reactions.

IITH credits - 2

ECTS credits - 3.7

7.2 EP4710 Particle Physics

Contents :

Classification of particles, Quark contents of Hadrons, Particle quantum numbers, Gell-Mann Nishijima formula, Relativistic kinematics, scattering amplitudes, Cross sections, decay rate and life-time. Breit-Wigner formula, Continuous symmetries and conservation laws. Discrete symmetries. CPT theorem, Weak processes, pion decay, GIM mechanism, Parity violation, CP violation, Quark mixing, CKM matrix, Neutrino Physics, Elements of Quantum Chromodynamics, Electroweak interaction, Symmetry breaking and Higgs mechanism, Standard Model of Particle Physics and Physics beyond the standard model.

IITH credits - 3

ECTS credits - 5.55

7.3 EP5201 EP Lab

Contents :

X-Ray Diffraction - Crystal Spectroscopy. Electron diffraction. Zeeman effect. CCD based spectrometer. Measurement of dielectric constant of sample with microwaves. Measurement of dielectric constant of sample with microwaves. Four probe method to measure the resistivity of a sample. Electron Spin Resonance (ESR) and Nuclear Magnetic Resonance (NMR). Mach zehnder interferometer.

IITH credits - 2

ECTS credits - 3.7

7.4 LA1260 Fundamentals of Organizational Structure

Contents :

Defining organizations, Fundamental concepts in organizational design, Elements of organizational structure, Factors influencing organizational structure, Role of organizational structure in organizational effectiveness.

IITH credits - 1

ECTS credits - 1.85

7.5 LA1740 Sociology of Population and Demography

Contents :

This course is keen to map the importance of studying population and demography in the context of its social framing. This means investing a more robust study of what exactly demographic figures and statistics involve. Beyond numbers, demography and population is about people, and that remains the core focus of this course.

IITH credits - 1

ECTS credits - 1.85

7.6 ME5120 Dynamics and Vibration

Contents :

Particle and system of particle dynamics. State space representation. Approaches for describing systems in various coordinate systems and accounting for relative motion between systems. Analytical Dynamics. Principle of Virtual Work. D'Alembert's principle. Extended Hamilton's principle. Introduction to vibration. Vibration parameters. Lumped-element model. Response of single degree of freedom systems. Damping/Quality Factor. Responses for harmonic and non-harmonic excitations. Describing and solving two degrees of freedom systems for string, rod and shaft like systems.

IITH credits - 3

ECTS credits - 5.55

7.7 PH5320 Concepts and Hands-On Observational Astrophysics

Contents :

Concepts of Astrophysics and Cosmology. Major concentration on using HEASoft and DS9, astronomical imaging and data visualization applications for spectral analysis.

IITH credits - 3

ECTS credits - 5.55

8 Semester - VIII (Ongoing)

8.1 ID4006 Ethics and Values

Contents :

Defining Values and Ethics, Personal and social values, Theories on Ethics, Ethical decision making, Managerial Ethics and Corporate Social Responsibility.

IITH credits - 1

ECTS credits - 1.85

8.2 LA1160 Cultures of the World

Contents :

This course will introduce students to the field of social and cultural anthropology and sociology. They will be exposed to different cultures of the world, and how social and cultural attitudes and behaviours are so different and yet so similar, across cultures. The course will enable them to understand cultures in the Americas (north and south America), Asia, Europe and Africa. Students will also learn to understand and appreciate ethnography as a method and an approach to study world cultures. It will give them an

international exposure to some major issues of interest in the 21st century- about environment, globalisation, media and health. Students will read chapters from the assigned textbook, as well as articles, and will watch documentaries in class. Assessment will be based on response papers written regularly about the readings, and a research paper. based on a topic chosen by the student.

IITH credits - 1

ECTS credits - 1.85

8.3 ME2220 Kinematics and Dynamics of Machinery

Contents :

Brief introduction to Mechanical Engineering, Machinery, Machines, and Mechanisms. Basic kinematic concepts: links, kinematic pairs, kinematic chains, degree of freedom, Kutzbach criterion, Grübler's equation, and kinematic inversions; Introduction to Geogebra and Matlab. Introduction to four-bar mechanisms; Grashof's linkages; Kinematic analysis of mechanisms, loop-closure equations, implementation in Matlab/python; Analysis in Simscape. Graphical analysis of mechanisms; Instantaneous center of rotation, Kennedy's theorem; Velocity and acceleration diagrams. Four-bar synthesis, Freudenstein's equations; Path generation; Motion Generation; Function generation; Graphical synthesis. Cams: terminology, classification, analytical and graphical synthesis of translating flat-face, translating roller and oscillating roller follower cams; Fundamental law of gearing, involute profile; Gears: terminology, classification, interference and undercutting, minimum number of teeth, contact ratio; Gear trains: simple, compound and epicyclic. Introduction; dynamics of rigid bodies in plane motion; dynamic force analysis of machines; flywheels, balancing of rotors and in-line internal combustion engines; chain and belt drive.

IITH credits - 3

ECTS credits - 5.55

8.4 ME5610 Fracture Mechanics

Contents :

Modes of loading, Classification as LEFM and EPFM, Crack growth and fracture mechanisms, Energy release rate, Crack branching, Equivalence between SIF and G, Various methods for evaluating Stress Intensity Factors, Modeling plastic zone at the crack-tip.

IITH credits - 3

ECTS credits - 5.55

9 Validation

Certified by Prof. Kirit Makwana, Faculty Advisor for BTech Engineering Physics batch of 2020-24.



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Dr Kirit Makwana
Assistant Professor
Dept. of Physics, IIT Hyderabad