

INDIAN INSTITUTE OF TECHNOLOGY INDORE



Courses of Studies
for
Preparatory Program
(for Students admitted through IIT-JEE)

May, 2013

Structure of the Preparatory Course

Semester-I

Sr. No.	Course code and Title	Weekly Contact hours (L-T-P)	Credits
1	PCH 101: Preparatory Chemistry-I	3-1-0	4
2	PMA 101: Preparatory Mathematics-I	3-1-0	4
3	PPH 101: Preparatory Physics-I	3-1-0	4
4	PHS 101: Preparatory English Language-I	2-2-0	4
Total		11-5-0	16

Semester-II

Sr. No.	Course code and Title	Weekly Contact hours (L-T-P)	Credits
1	PCH 102: Preparatory Chemistry-II	3-1-0	4
2	PMA 102: Preparatory Mathematics-II	3-1-0	4
3	PPH 102: Preparatory Physics-II	3-1-0	4
4	PHS 102: Preparatory English Language-II	2-2-0	4
Total		11-5-0	16

1.	Course Code	PCH 101
2.	Title of the Course	Preparatory Chemistry-I
3.	Credit Structure	L-T- P-Credits 3-1-0-4
4.	Name of the Concerned Discipline	Chemistry
5.	Pre-requisite, if any (for the students)	Nil
6.	Course Syllabus	<p>Inorganic Chemistry: Periodicity, general trends, blocks of periodic table, s-block, p-block and introduction to f-block, VSEPR, valence bond theory, electron deficient bonding, thermodynamics of reduction processes.</p> <p>Organic Chemistry: Classification and nomenclature of organic compounds, hybridization, dipole moment and bond energy, factors influencing electron availability: Inductive effect, electromeric effect, resonance, mesomeric effect or conjugative effect, hyperconjugative effect, steric effect, H-bonding force etc, concept of organic acid and base, substitution and elimination reactions.</p> <p>Physical Chemistry :</p> <p>Kinetic Theory: Idea of distribution functions, properties of gamma functions; transformation properties for Cartesian to polar coordinates. Maxwell's speed and energy distributions (derivations for 1, 2 and 3 dimensions); distribution curves; different types of speeds and their significance, frequency of collisions against a surface; frequency of binary collisions; mean free path.</p> <p>Thermodynamics: System and surroundings, walls; reversible and irreversible processes; isothermal, adiabatic and other processes; work, partial and total derivatives; exact differentials and state functions, definitions of thermodynamic functions: zeroth law (T), first law (U) and second law (S); other functions like H, A and G. Carnot's cycle and theorems; changes of thermodynamic functions in irreversibility and entropy, importance of H in thermo-chemistry, Maxwell's relations.</p> <p>Chemical Kinetics: Order and molecularity of reactions, first and second order reactions, average life period, concept of Arrhenius activation energy</p>
7.	Suggested Books	<ol style="list-style-type: none"> 1. J.D. Lee, Concise Inorganic Chemistry, (5th Edition), ELBS, 1996. 2. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990 3. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd. 4. D. A. McQuarrie and J. D. Simons, Physical Chemistry 1st Edn, Viva Books Private Limited, New Delhi, 1998. 5. Irving M. Klotz and Robert M. Rosenberg, Chemical Thermodynamics: Basic Concepts and Methods, Wiley, 2008.

1.	Course Code	PCH 102
2.	Title of the Course	Preparatory Chemistry-II
3.	Credit Structure	L-T- P-Credits 3-1-0-4
4.	Name of the Concerned Discipline	Chemistry
5.	Pre-requisite, if any (for the students)	Nil
6.	Course Syllabus	<p>Inorganic Chemistry: Chemistry of d-block elements, crystal field theory, magnetism in transition metal compounds, valence bond theory for prediction of molecular geometry, magnetic properties, metal-carbonyl chemistry, important elements of catalysis by transition metal compounds, chemistry of f-block elements.</p> <p>Organic Chemistry: Functional group inter-conversions, concept of stereochemistry, concept of aromaticity, aromatic electrophilic and nucleophilic substitution reactions.</p> <p>Physical Chemistry:</p> <p>Quantum Mechanics: Idea of eigenvalue equation of the form $\hat{A}\Psi = a\Psi$, construction of Hamiltonian operator; solution of $H\Psi = E\Psi$ for particle in a 1-d box: normalisation and orthogonality of Ψ, nodes in excited states, and calculation of average values like $\langle x \rangle$, $\langle x^2 \rangle$, $\langle p \rangle$ and $\langle p^2 \rangle$, demonstration of the uncertainty product inequality, $\Delta x \Delta p \geq h/4\pi$, discussion on the uncertainty principle, The H atom problem: Hamiltonian in Cartesian and polar coordinates; separation of radial and angular parts; emergence of magnetic quantum number; mathematical forms of orbital functions (ns and np) and degeneracy; shapes of orbitals (s, p). Spectroscopy and photochemistry: Einstein's law; primary photophysical processes; potential energy diagram; Franck-Condon principle; fluorescence and phosphorescence; photochemical reactions, quantum yield; photosensitisation; photochemical equilibrium; dimerisation of anthracene. Alkali-metal spectra (S, P, D, F series): its origin, multiplicity of spectral lines, idea of spin quantum number; physical idea of spin-orbit coupling, rotational (rigid rotator model) and vibrational (harmonic oscillator model) spectra of diatomics: frequency expressions, applications to estimate molecular parameters, idea of $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ electronic spectra; conjugated polyenes and 1-d box model. Dipole moment and intermolecular forces: Induced and orientation polarisation: Debye and Clausius-Mossotti equations (with derivations), dipole-dipole, dipole-induced dipole and van der Waals interactions in molecules, realistic intermolecular potential energy diagrams.</p>
7.	Suggested Books	<ol style="list-style-type: none"> 1. J.D. Lee, Concise Inorganic Chemistry, (5th Edition), ELBS, 1996. 2. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990 3. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd. 4. P.W. Atkins, Molecular Quantum Mechanics Oxford University Press, 1999.

1.	Course Code	PMA 101
2.	Title of the Course	Preparatory Mathematics-I
3.	Credit Structure	L-T- P-Credits 3-1-0-4
4.	Name of the Concerned Discipline	Mathematics
5.	Pre-requisite, if any (for the students)	Nil
6.	Course Syllabus	<p>Complex Numbers: Complex numbers as ordered pairs; Argand's diagram; Triangle inequality; De Moivre's Theorem.</p> <p>Algebra: Quadratic equations and expressions; Permutations and combinations; Binomial theorem for a positive integral index.</p> <p>Coordinate Geometry: Locus, Straight lines; Equations of circle, parabola, ellipse and hyperbola in standard forms; Parametric representation.</p> <p>Vectors: Addition of vectors. Multiplication by a scalar; Scalar product, cross product and scalar triple product with geometrical applications.</p> <p>Matrices and Determinants: Algebra of matrices; Determinants and their properties; Inverse of a matrix; Cramer's rule.</p>
7.	Suggested Books	<ol style="list-style-type: none"> 1. Shanti Narayan, P K Mittal: <i>A Textbook of Matrices</i>, S. Chand Group. ISBN: 8121925967 2. Shanti Narayan, <i>Theory of Functions of a Complex Variable</i>, S. Chand Group, ISBN: 8121902770 3. Fred Safier, <i>Schaum's Outline of Pre Calculus</i>, 2nd Edition, McGrawHill., 2008. ISBN: 9780071508643 4. S. L. Loney, <i>The elements of coordinate geometry</i>, Scholarly Publishing Office, University of Michigan Library, 2005, ISBN: 9781418184148 5. Murray R. Spiegel, <i>Schaum's Outlines Vector Analysis (And An Introduction to Tensor Analysis)</i>, McGrawHill; New edition edition, 1968, ISBN: 9780070602281 6. Murray R. Spiegel, <i>Schaum's Outlines: Complex Variables (With an Introduction to Conformal Mapping and Its Applications)</i>, McGrawHill (1964), ISBN: 9780070602304 7. Shanti Narayan and P K Mittal, <i>A Textbook Vector Algebra</i>, S. Chand Group, ISBN: 812190952X 8. Shanti Narayan, <i>A Textbook Of Vector Calculus</i>, S. Chand Group, ISBN: 8121901618

1.	Course Code	PMA 102
2.	Title of the Course	Preparatory Mathematics-II
3.	Credit Structure	L-T- P-Credits 3-1-0-4
4.	Name of the Concerned Discipline	Mathematics
5.	Pre-requisite, if any (for the students)	Nil
6.	Course Syllabus	<p>Function, Inverse function, Elementary functions and their graphs, Limit, Continuity, Derivative and its geometrical significance.</p> <p>Differentiability, Derivatives of sum, difference, product and quotient of functions.</p> <p>Derivatives of polynomial, rational, trigonometric, logarithmic, exponential, hyperbolic, inverse trigonometric and inverse hyperbolic functions. Differentiation of composite and implicit functions. Tangents and Normals, Increasing and decreasing functions. Maxima and Minima.</p> <p>Integrations as the inverse process of differentiation, Integration by parts and by substitution. Definite integrals and its application to the determination of areas.</p>
7.	Suggested Books	<ol style="list-style-type: none"> 1. Fred Safier: Schaum's Outline of Pre Calculus, 2nd Edition, McGrawHill., 2008. ISBN: 9780071508643 2. Elliott Mendelson and Frank Ayres, Schaum's Outline of Calculus (Fourth Edition), McGraw Hill, 1999, ISBN: 9780070419735. 3. Shanti Narayan, A Textbook of Calculus Part-I, S. Chand Group, ISBN: 8121906091 4. Shanti Narayan, A Textbook of Calculus Part-II, S. Chand Group, ISBN: 8121912180 5. Shanti Narayan, A Textbook of Calculus Part-III, S. Chand Group, ISBN: 8121908566 6. Shanti Narayan, Integral Calculus, S. Chand Group, ISBN: 8121906814 7. Elliott Mendelson, Schaum's Outline of 3000 Solved Problems in Calculus, McGraw Hill, ISBN: 9780071635349 8. Shanti Narayan, Differential Calculus, S. Chand Group, ISBN: 8121900395 9. Shanti Narayan, Differential Calculus For Competition, S. Chand Group, ISBN: 8121925134 10. Shanti Narayan, Integral Calculus For Competition, S. Chand Group, ISBN: 8121925355 11. S.L. Loney, Plane Trigonometry (Part-I), G. K. Publications Pvt. Ltd (2010). 12. S.L. Loney, Plane Trigonometry (Part-II), G. K. Publications Pvt. Ltd (2008).

1.	Course Code	PPH 101
2.	Title of the Course	Preparatory Physics-I
3.	Credit Structure	L-T- P-Credits 3-1-0-4
4.	Name of the Concerned Discipline	Physics
5.	Pre-requisite, if any (for the students)	Nil
7.	Course Syllabus	<p>General: Units and dimensions, dimensional analysis.</p> <p>Electricity and magnetism: Coulomb's law; Electric field and potential; Electrical Potential energy of a system of point charges and of electrical dipoles in a uniform electrostatic field, Electric field lines; Flux of electric field; Gauss's law and its application in simple cases, such as, to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell.</p> <p>Capacitance; Parallel plate capacitor with and without dielectrics; Capacitors in series and parallel; Energy stored in a capacitor.</p> <p>Electric current: Ohm's law; Series and parallel arrangements of resistances and cells; Kirchhoff's laws and simple applications; Heating effect of current.</p> <p>Biot-Savart law and Ampere's law, magnetic field near a current-carrying straight wire, along the axis of a circular coil and inside a long straight solenoid; Force on a moving charge and on a current-carrying wire in a uniform magnetic field.</p> <p>Magnetic moment of a current loop; Effect of a uniform magnetic field on a current loop; Moving coil galvanometer, voltmeter, ammeter and their conversions.</p> <p>Electromagnetic induction: Faraday's law, Lenz's law; Self and mutual inductance; RC, LR and LC circuits with d.c. and a.c. sources.</p>
7.	Suggested Books	Halladay and Resnick "Physics volume I & II"

1.	Course Code	PPH 102
2.	Title of the Course	Preparatory Physics-II
3.	Credit Structure	L-T- P-Credits 3-1-0-4
4.	Name of the Concerned Discipline	Physics
5.	Pre-requisite, if any	Nil
6.	Course Syllabus	<p>Optics: Rectilinear propagation of light; Reflection and refraction at plane and spherical surfaces; Total internal reflection; Deviation and dispersion of light by a prism; Thin lenses; Combinations of mirrors and thin lenses; Magnification.</p> <p>Wave nature of light: Huygen's principle, interference limited to Young's double-slit experiment.</p> <p>Modern physics: Atomic nucleus; Alpha, beta and gamma radiations; Law of radioactive decay; Decay constant; Half-life and mean life; Binding energy and its calculation; Fission and fusion processes; Energy calculation in these processes. Photoelectric effect; Bohr's theory of hydrogen-like atoms; Characteristic and continuous X-rays, Moseley's law; de Broglie wavelength of matter waves.</p>
7.	Suggested Books	Halladay and Resnick "Physics volume I & II"

1.	Course Code	PHS 101
2.	Title of the Course	Preparatory English Language-I
3.	Credit Structure	L-T- P-Credits 2-2-0-4
4.	Name of the Concerned Discipline/School	English/HSS
5.	Pre-requisite, if any (for the students)	Nil
6.	Course Syllabus	<p>1. Basic Grammar: Tenses (present, past, future), Speech (Direct, Indirect), Voice (Active, Passive), Subject – Verb Agreement, Parts of Speech, Articles, etc.</p> <p>2. Spoken English: Introduction to vowels and consonants, Stress and intonation, Greetings, Introductions, Making request, Suggestions, Invitations, Acceptance, Refusal, Seeking permission, Giving a description, Stating likes and dislikes, Agreeing and disagreeing, Stating performances, Conversing on telephones, Inquiries, Complains, Compliments, Encouragements, Expressing thanks and apologies etc. Giving direction.</p> <p>3. Written English: Report writing on general and scientific topics, information transfer, Business letters and essays,</p> <p>4. Reading Comprehension</p>
7.	Suggested Books	<p>1. Meenakshi Raman and Sangeeta Sharma, Technical Communication: English Skills for Engineers, Oxford University Press, 2011</p> <p>2. Krishna Mohan and Meera Banerji, Developing Communication Skills, McMillan Co., 1990.</p> <p>3. Oxford Advanced Learner's Dictionary, Oxford University Press, 2010(8th edition) (with CD).</p> <p>4. Michel Swan, Practical English Usage, Oxford University Press, 1996.</p>

1.	Course Code	PHS 102
2.	Title of the Course	Preparatory English Language-II (Technical Communication) as named by School of HSS
3.	Credit Structure	L-T- P-Credits 2-2-0-4
4.	Name of the Concerned Discipline/School	English/HSS
5.	Pre-requisite, if any (for the students)	Nil
6.	Course Syllabus	<ol style="list-style-type: none"> 1. Nature of Technical Communication <ul style="list-style-type: none"> - Organization - Style - Barriers to Effective Communication 2. Listening Comprehension <ul style="list-style-type: none"> - Process - Barriers to Listening - Improving Listening comprehension - Listening and Note Taking 3. Study Skills <ul style="list-style-type: none"> - Note Making - Summarizing and Paraphrasing - Referencing 4. Professional Writing <ul style="list-style-type: none"> - Resume - Job-applications - Cover-letter - Reports and Proposals 5. Speaking <ul style="list-style-type: none"> - Job Interviews - Importance of Group Discussion Skills - Characteristics of Successful Group Discussion - Group Discussion Strategies - Techniques for Individual Contribution - Group Interaction Strategies - Group Discussion in Action (video recording) - Debate - JAM 6. Soft Skills <ul style="list-style-type: none"> - Self-management - Time Management - Presentation - Social Intelligence - Decision Making <p>Goal Setting</p>
7.	Suggested Books	<ol style="list-style-type: none"> 1. Carmine Gallo, <i>The Presentation Secrets of Steve Jobs: How to Be Insanely Great in Front of Any Audience</i>, McGraw-Hill, 2010. 2. Jeff Butterfield, <i>Teamwork & Team Building - Soft Skills for a Digital Workplace</i>, Delmar Learning, 2011. 3. Krishna Mohan and Meera Banerji, <i>Developing Communication Skills</i>, McMillan Co., 1990. 4. Meenakshi Raman and Sangeeta Sharma, <i>Technical Communication: English Skills for Engineers</i>, Oxford University Press, 2011.

