Syllabus for Common Entrance Test (CET-2010)

for
M.Tech. (Engineering Physics) (M.Tech (EP)) and
M.Tech. (Nano Science & Technology) (M.Tech. (NST))

<u>Test Code - 91</u>

The CET will be of 2.5 hours with subject weightage as follows:

M.Tech (EP): 1. Physics (33.33%)
                 2. Chemistry (33.33%)
                 3. Mathematics (33.33%)

M.Tech(NST): 1. Physics (33.33%)
                 2. Chemistry (33.33%)
                 3. Mathematics (33.33%)
                      Or
                 Life Sciences (33.33%)

CET Syllabus for Physics, Chemistry, Mathematics and Life Sciences will be based on those of the B.Tech Programmes of GGS IP University as detailed below:

S.No.	Subject	Paper codes
1.	Physics	BA-111, BA-116
2.	Chemistry	BA-117, BA-211
3.	Mathematics	BA-108, BA-109
4.	Life Sciences	BA-112, BA-113

Code No.: BA 111, Paper: PHYSICS – I

I. OPTICS

Polarization:

Types of polarization, elliptically and circularly polarized light Brewsters law, Malu's Law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half shade polarimeter

Interference:

Coherence and coherent sources, interference by division of wave front (young's double slit experiment, Fresnel's biprism), interference by division of amplitude (thin films, Newton's rings, Michelson's interferometer, Fabry Perot interferometer)

Diffraction:

(Fresnel and Fraunhofer types of diffraction) Fraunhofer diffraction: Single slit, double slit, circular aperture and N-slit, diffraction wavelength determination, resolving power and dispersive power, Fresnel Diffraction: Zone plate, circular aperture, opaque circular disc, narrow slit.

II. LASER AND FIBRE OPTICS

Lasers:

Introduction, coherence, Einstein A and B coefficients, population inversion, basic principle and operation of a laser, type of lasers, He-Ne laser, Ruby laser semiconductor laser, holography theory and applications.

Fibre Optics:

Introduction to optical fibre, types of optical fibres and their characteristics, (Attenuation and dispersion step index and graded index fibres, principle of fibre optic communication–total internal reflection, numerical aperture, fibre optical communication network (qualitative) – its advantages.

III. THEORY OF RELATIVITY

Absolute and Inertial frames of reference, Galenlian transformations, Michelson-Morley experiment, the postulates of the special theory of relativity, Lorentz transformations, time dilation, length contraction, velocity addition, mass energy equivalence **5 hrs.**

Recommended Books:

1.Concepts of Modern Physics: A Beiser
2. Modern Physics: Kenneth Krane
3. Fundamentals of Optics: Jenkins and White
4.Optics: Ghatak
5. Fundamental of Physics: Resnick & Halliday

PHYSICS-II (CT)

BA-116

	L	T/P	Credits
	2	1	3

I   Quantum Mechanics

Wave particle duality, deBroglie waves, evidences for the wave nature of matter – the experiment of Davisson and Germer, electron diffraction, physical interpretation of the wave function and its properties, the wave packet, the uncertainty principle.

4 hrs.

The Schrodinger wave equation (1-dimensional), Eigen values and Eigen functions, expectation values, simple Eigen value problems – solutions of the Schrodinger's equations for the free particle, the finite well, tunneling effect, simple harmonic oscillator (qualitative), zero point energy.

6 hrs.

II   Quantum Statistics

The statistical distributions: Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics, their comparisons, Fermions and Bosons. Applications: Molecular speed and energies in an ideal gas. The Black body spectrum, the failure of classical statistics to give the correct explanations – the applications of Bose-Einstein statistics to the Black body radiation spectrum, Fermi-Dirac distribution, free electron theory, electronic specific heats. Fermi energy and average energy –its significance.

10 hrs.

III   Band Theory of Solids

Origin of energy bands in solids, motion of electrons in a periodic potential – the Kronig – Penny model, Brillouin zones, effective mass, metals, semi-conductors and insulators and their energy band structures.

7 hrs.

IV   Semiconductor devices

Extrinsic and Intrinsic semiconductors, doping-fermi energy for doped and undoped semiconductors, the p-n junction (energy band diagrams with fermi energy), the unbiased diode, forward and reverse biased diodes-tunnel diodes, zener diode, photo diode its characteristics, LED, the photovoltaic cell, the transistors and its characteristics, common base, common emmiter, common collector transistors, load line, relation between alpha and beta. Transistor as a current source and as a switch.

7 hrs.

Recommended Books

1. Concept of Modern Physics: A. Beiser
2. Modern Physics: Kenneth Krane
3. Solid State Physics by Kittle
4. Electronic Principles: Malvino
5. Statistical Mechanics by Garg Banswal and Ghosh (TMH)

Paper Code: BA-109　　　　　　　　　　　　　　　　　**L**　　**T/P**　　**C**

Paper ID: 99109　　　　　　**Paper : Mathematics – I**　　**3**　　**2**　　**4**

1(a)　　**Calculus of functions of One variable**

　　(i)　　Successive Differentiation, Leibnitz's theorem (without proof). Lagrange's Theorem, Cauchy Mean value theorems, Taylor's theorem (without proof), Remainder term, Asymptotes, Curvature, Curve Tracing.

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　　(ii)　　Infinite Series: Convergence, divergence, Comparison test, Ration Test, Cauchy n^{th} root test, Leibnitz's test (without proof), Absolute and Conditional Convergence, Taylor and Meclaurin series, Power Series, Radius of Convergence.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　5 hrs

　　(iii)　　Integral Calculus: Reduction Formulae of trigonometric functions, Properties of definite Integral, Applications to length, area, volume, surface of revolution, Definition of improper integrals, Beta-Gamma functions.

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1(b)　　**Calculus of Functions of several variables:**

Partial derivatives, Chain rule, Differentiation of Implicit functions, Exact differentials. Maxima, Minima and saddle points, Method of Lagrange multipliers. Differentiation under Integral sign, Jacobians and transformations of coordinates. Double and Triple integrals. Simple applications to areas, Volumes etc.

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II　　**Vector Calculus:**

Scalar and vector fields, Curves, Arc length, Tangent, normal, Directional Derivative, Gradient of scalar field, divergence and curl of a vector field. Line integral (independent of path), Green's theorem, Divergence theorem and Stoke's theorem (without proofs), Surface Integrals.

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Suggested Text Books & References

1.　　G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 6th edition, Addison-Wesley/Narosa, 1985.
2.　　Shanti Narayan, "Differential Calculus", S. Chand & Co.
3.　　Shanti Narayan, "Integral Calculus", S. Chand & Co.
4.　　Grewal B.S., "Higher Engineering Mathematics", Khanna Publ.
5.　　E. Kreyszig, "Advanced Engineering Mathematics", 5th Edition, Wiley Eastern, 1985.
6.　　Murray R. Spiegel, "Theory and Problems of Vectors Analysis", Schaum's Outline Series, Mc Graw Hill Ed.
7.　　S.C. Malik, "Mathematical Analysis", Wiley Eastern Ltd.
8.　　"Advanced Calculus", Schaum's Outline Series, Mc Graw Hill Ed.
9.　　Widder, "Advanced Calculus", 2nd Edition, Prentice Hall Publishers.

Mathematics - II

Paper Code: BA – 108

	L	T/P	Credits
	3	1	4

I.   Linear Algebra: Linear Independence and dependence of vectors, Systems of linear equations – consistency and inconsistency, Gauss elimination method, rank of a matrix, Bilinear, Quadratic, Hermitian, Skew – Hermitian Forms, Eigenvalues and Eigenvectors of a matrix, diagonalization of a matrix, Cayley – Hamilton Theorem (without proof).

10 hrs.

II.   Ordinary Differential Equations: Formation of ODE's, definition of order, degree and solutions. ODE's of first order: Method of separation of variables, homogeneous and nonhomogeneous equations, exactness and integrating factors, linear equations and Bernouilli equations, operator method, method of undetermined coefficients and nonhomogenous, operator method, method of undetermined coefficients and variation of parameters. Solutions of simple simultaneous ODE's. Power series method of solution of DE, Legendre's Equation, Legendre's Polynomials, Bessel's equation, Bessel's function.

10 hrs.

III.   Complex Variables: Curves and Regions in the Complex Plane, Complex Functions, Limits, Derivative, Analytic Function, Cauchy-Riemann Equations, Laplace's Equation, Linear Fractional Transformations, Conformal Mapping, Complex Line Integral, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Function, Power Series, Taylor Series, Laurent Series, Methods for obtaining Power Series, Analyticity at Infinity, Zeroes, Singularities, Residues, Residue Theorem, Evaluation of Real Integrals.

18 hrs.

IV.   Probability: Definition of Sample Space, Event, Event Space, Conditional Probability, Additive and Multiplicative law of Probability, Baye's Law theorem, Application based on these results.

5 hrs.

Suggested Text Books & References

1.   M. K. Singhal & Asha Singhal "Algebra", R. Chand & Co.
2.   Shanti Narayan, "Matrices" S. Chand & Co.
3.   G. B. Thomas and R. L. Finney, "Calculus and Analytic Geometry" Addison Wesley / Narosa.
4.   E. Kreyszig, "Advanced Engineering Mathematics", 5th Edition, Wiley Eastern Ltd. 1985.
5.   N. M. Kapoor "Differential Equations" Pitamber Pub. Co.
6.   Schaum Outline Series "Differential Equations" Mc. Graw Hill.
7.   Schaum Outline Series "Complex Variables" Mc. Graw Hill.
8.   Schaum Outline Series "Linear Algebra" Mc. Graw Hill.
9.   Schaum Outline Series "Probability" Mc. Graw Hill.

Paper Code: BA-211   Physical Chemistry

	L	T	P
Credit			
	3	1	0	4

1. **Gaseous State:** Kinetic theory, molecular velocity, Probable distribution of velocities, mean free path, collision frequency. Distribution of energies of molecules translational, rotational & vibrational, Law of equipartitions of energies, Equation of State of a real gas. Critical phenomenon & principle of corresponding states.

2. **The phase rule:** Derivation of phase rule, significance of various terms involved in the definition of phase rule. Phase diagrams of one component systems (Water, Sulphur and CO_2). Two component system: Eutectic, congruent and incongruent systems with examples:
    Partial miscible liquids: Lower and upper consolute point.

3. **Chemical Kinetics:** Rate, mechanism, steady state concept, Kinetics of complex reactions, concept of energy barrier/energy of activation. Theories of reaction rates, Lindemann theory of unimolecular reaction and reactions in flow system.

4. **Electrochemistry:** Concept of electrolysis, Electrical current in ionic solutions. Kohlrausch's law and migration of ions. Transference number. Hittroff and moving boundary methods. Applications of conductance measurements.
    Strong electrolytes: Onsager equation: Activity and activity coefficients of strong electrolyte.

5. **Surface Chemistry:** Adsorption, adsorbate and adsorbents. Types of adsorption. Freundlich adsorption isotherm, Langmuir adsorption isotherms. B.C.T. Isotherm: Surface area of the adsorbent. Changes in entropy, enthalpy and free energy on adsorption. Gibbs adsorption equation.

6. **Catalysis:** Types of catalysis, homogenous/heterogeneous, enzyme catalysis, acid/base catalysis and their kinetics. Mechanism of heterogeneous catalysis. Kinetics of surface reactions: unimolecular and bimolecular. pH-dependence of rate constants of catalysed reactions. Autocatalysis

7. **Colloids:** Classification of colloids. Color of sols, Electrochemical properties of sols, Molecular weight v/s particle weight of colloidally dispersed particles, viscosity & plasticity. Gels and their properties: isobars and adsorption, isotherm, syneresis, thixotropy and diffusion in jellies. Emulsions, emulsifiers, theory of emulsification, properties and stability of emulsions.

Books & References
1. Principles of Physical Chemistry, Maron, Samuel H. Prutton, Carl. E., Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Textbook of Physical Chemistry, Glasstone Samuuel, Macmillan and Co. Ltd.
3. Principles of Physical Chemistry, Puri, B.R., Sharma L.R. and Pathania, Mada.
4. Physical Chemistry, Moore W.J., Orient Longman
5. D. Tabor: Solids, liquids & gases, Penguin Press Paper back

6. A text Book of Physical Chemistry, Atkin P.W., Oxford University Press, oxford
7. Introduction to Chemical Reaction Engineering & Kinetics, Missen, Ronald W, Mims, Charles A, Sacelli, Bradley A, John Wiley & Sons Inc,. NY.
8. A text book of Physical Chemistry, Negi A.S. and Anand, S.C. Wiley Eastern Ltd., New Delhi.

ORGANIC CHEMISTRY

Paper Code: BA-117   **L**   **T/P**   **Credits**

                                                        3   **1**   **4**

1. **Classification of Organic compounds** IUPAC nomenclature, Structural isomerism, Cis-trans isomerism, shapes and molecular orbital structures of compounds containing C,N and O conformation of alkanes, structures of dienes, pyridine, pyrrole, aromatic compounds, delocalisation, concept of aromaticity, stability of cycloalkanes, resonance concept, inductive and mesomeric effects, directive effects, activating and deactivating groups, hydrogen-bonding, organic reagents and reaction intermediates.

2. **Chemistry of hydrocarbons** House synthesis halogenation of alkanes, free radical mechanism, cracking effect of structure on Physical properties of compounds, alkenes catalytic hydrogenation, dehydration of alcohols, dehydrogenation, Saytzeff rule, electrophilic addition reactions, peroxide effect, mechanism of allylic substitution, acidity of 1-alkynes, conjugated dienes,1,2 and 1,4 additions, free radical and ionic mechanisms of addition polymerisation reactions. Ring opening reactions of cyclopropane and cyclobutane, chemistry of benzene and alkyl benzenes. Aromatic electrophillic substitution reaction, Friedel-Crafts reaction.

3. **Chemistry of functional groups** Alkyl and aryl halides, nucleophilic substitution, synthetic utility of Grignard reagents and alkallithiums, Mechanism of Gringnartion of alcohols, Benzyl alcohol, acidity of phenols, Epoxy compounds, Anisole nucleophilic addition, Benzaldehyde, acetophene, benzophenone, aldol condensation, acidity of acids, alkyl and aryl amines.

4. **Synthetic utility of diazonium salts** basicity of amines, Multistep synthesis.

Suggested Text Books & References

1. Text book of Organic Chemistry by B.S. Bahl and Arun Bahl, S. Chand and Company Ltd. Delhi.

2. Fundamentals of Organic Chemistry by T.W.G. Solomons, John Wiley and Sons, Inc., New York

Syllabus of life Sciences
(For B.Tech/M.Tech. Biotechnology)
(Section A=Botany, Section B=Zoology)

BA-113

	L	T/P	Credits
	3	1	4

Section	Unit		Topics
(A+B)	Origin of Life	-	History of earth, theories of origin of life nature of the earliest organism.
(A+B)	Varieties of life	-	Classification, Five kingdoms, viruses (TMV, HIV, Bacteriophage), Prokaryote (Bacteria cell structure, nutrition, reproduction), Protista, Fungi, Plantae and Animalia.
(A+B)	Chemical of life	-	(Biomolcules), Carbohydrates, lipids, amino acids, proteins, nucleic acids, identification if biomolecules in tissues.
(A+B)	Cell	-	The cell concept, structure of prokaryotic and eukaryotic cells, plant cell and animal cells, cell membranes, cell organelles and their function. Structure and use of compound microscope.
A	Histology	-	Meristems (apical, inrercalary, lateral) and their function; Simple tissue (parenchyma, collenchyma, sclerenchyma); Complex tissue (xylem and phloem); Tissue systems (epidermal, ground, vascular); primary body and growth (root, stem, leaf); Secondary growth.
B		-	Animal Epithelial tissue, connective tissue, muscle tissue and nervous tissue and their function in body.
A	Nutrition	-	Autotrophic (Photosynthesis)- Pigment systems, Chloroplast, light absorption by chlorophyll and transfer of energy, two pigment systems, photosynthetic unit, phosphorylation and electron transport systems, Calvin-Benson Cycle (C_3), Hatch Slack Pathway (C_4), Crassulacan Acid Metabolism (CAM), factors affecting photosynthesis; Mineral Nutrition in plants.
B		-	Heterotrophic- Forms of heterotrophic nutrition, elementary canal in humans, nervous and hormonal control of digestive systems, fate of absorbed food materials, Nutrition inn humans and Reference values.
(A+B)	Energy Utilization	-	(Respiration)- Structure of mitochondria, cellular respiration, relationship of carbohydrate metabolism to other compounds, Glycolysis, fermentation, formation of acetyl co-A, Krebs cycle, Electron Transport System and Oxidative Phosphorylation, ATP, factors affecting respiration.
A	Transport	-	Plant water relationships, properties of water, diffusion, osmosis imbibition, movement of water in flowering plants, uptake of water by roots, the ascent of water in xylem, apoplast symplast theory, Transpiration-structure of leaf and stomata in plants opening and closing mechanism of stomata factors affecting transpiration, significance of transpiration.
B		-	General characteristics of blood vascular system, development of blood systems in animals, Composition of blood, circulation in blood vessels, formation of tissue fluids, the heart, functions of mammalian blood, the immune system.

BOS held on 7.7.2001
w.e.f. Batch

Dean (USBAS)

(Rita Singh)
Life Sciences

Syllabus of Life Sciences
(For B.Tech. Chemical Technology)

Course Code: BA 112 L T/P Credits

	Topics		Periods
Unit-I	Origin of Life	History of earth, theories of origin of life, nature of earliest organism	8
	Diversity of life	Basic rules of classification and nomenclature, Classification-two kingdom, five kingdom- brief introduction to kingdoms, three domain Introduction and structure of viriods, prions and virus (HIV, TMV, Bacteriophage), Structure and reproduction of bacteria and their economic importance	
Unit-II	Chemical basis of life	Biomolecules-carbohydrates, proteins, fats and lipids, nucleic acids (DNA and RNA)	10
	Enzymes	Definition, Properties, Types, Mechanism of action, factors affecting kinetics and their industrial applications	
	Cell- Structure and function	Prokaryotic and eukaryotic cells, plant and animal cells, structure and function of cell membrane, nucleus, chloroplast, mitochondria, golgi apparatus, endoplasmic reticulum.	
Unit-III	Histology -Plants	Meristem (apical, intercalary and lateral), simple tissue (parenchyma, collenchyma, and sclerenchyma), complex tissue (xylem and phloem)-structure and function; Tissue systems (epidermal, ground and vascular); primary body and growth (root, stem and leaf), secondary growth.	12
	-Animals	Epithelial, connective, muscular, and nervous tissue-structure and function.	
	Economic Biology	Food- Cereals (wheat, rice, maize), Beverages (tea, coffee, cocoa), Sugarcane, Medicinal plants (Taxus, Catharanthus, Salix, Azadirachta); and Rubber (Hevea) Apiculture, Sericulture, Vermiculture, and Leather	

Books/References:
1. **Taylor, D. J., Green, N. P. O, and Stout G. W. 2000.** Biological Science. Cambridge low price edition.
2. **Singleton, P. 1999.** Bacteria. John Wiley and Sons, ltd.
3. **Power C. B. 2003.** Cell Biology. Himalayan Publication.
4. **Berry A. K. 1993.** Animal Histology. Emkay Publications.
5. **Nelson, D. L. and M. M. Cox. 2000.** Lehninger Principles of Biochemistry. W. H. Freeman Costom Pub

BOS held on 22.8.2008
w.e.f Batch 2008

Dean (USBAS)

(Rita Singh)
Life Sciences