

**SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON
16TH MARCH 2013 FOR JULY 2013 SESSION**

**CANDIDATES ARE REQUESTED TO NOTE THAT THERE IS NO
ENTRANCE EXAMINATION IN THE DISCIPLINES OF:**

- **Child Development (PhD)**
- **Nutritional Sciences (PhD)**
- **Gender and Development Studies (PhD)**
- **Women's Studies (PhD)**
- **English (PhD)**
- **Law (PhD)**
- **Physics (PhD)**
- **Bio-Chemistry (PhD)**
- **Geography (PhD)**
- **Anthropology (PhD)**

**THE ENTRANCE EXAMINATIONS WILL BE HELD ONLY THE
FOLLOWING DISCIPLINES:**

- **Education (PhD)**
- **Civil (PhD)**
- **Mechanical (PhD)**
- **Arabic (PhD)**
- **French (PhD)**
- **History (PhD)**
- **Economics (MPhil/PhD)**
- **Sociology (MPhil/PhD)**
- **Political Science (PhD)**
- **Gandhian Thought and Peace Studies (MPhil/PhD)**
- **Psychology (PhD)**
- **Performing & Visual Arts (PhD)**
- **Theater Arts (MPhil)**
- **Translation Studies (MPhil /PhD)**
- **Distance Education (PhD)**
- **Vocational Education and Training (PhD).**

SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON 16TH MARCH 2013 FOR JULY 2013 SESSION

SCHOOL OF EDUCATION (SOE)

Format of Question paper

Entrance Test for PhD in Education

Time allowed – 3 hours

Total marks 100

Note: (i) All the questions are compulsory
(ii) Marks allotted to each question is mentioned against them.

Q. 1: Answer 20 questions in 50 words each. You must attempt 5 questions from each section.

(20 X 2 = 40 marks)

- | | |
|--|----------------------------|
| (1) Research methodology | (any 5 out of 8 questions) |
| (2) Statistical methods | (any 5 out of 8 questions) |
| (3) Educational Psychology | (any 5 out of 8 questions) |
| (4) Philosophical & Sociological Foundations | (any 5 out of 8 questions) |

Q. 2 Answer any 20 questions from any two of the following areas:

(40 X 1 = 40 marks)

- (i) Inclusive/ Special Education
- (ii) ET including ICT
- (iii) Teacher Education
- (iv) Adult education
- (v) Educational Leadership & Administration/ Educational Management
- (vi) Guidance and Counseling
- (vii) Distance Education/ Open Distance Learning
- (viii) School Education
- (ix) Higher Education
- (x) Educational Evaluation
- (xi) Curriculum Studies
- (xii) Comparative Education
- (xiii) Alternative Education

Q. 3. Write an essay on the following topic in about 600 words.

(20 marks)

Syllabus and Evaluation Scheme

Entrance Test for PhD in Education

The entrance test will be of 3 hours duration.

Total marks of the test would be 100.

There would be 3 questions. All the questions would be compulsory. The medium of test would be English.

The objective of the test is to assess the knowledge and understanding of Education as an area of study and as a discipline and also the analytical ability of the examinees.

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There would be three questions in the question paper. The format of the questions would be as follows:

Q. 1: Examinees would be expected to answer questions from all the four areas. Examinees would have to attempt any 20 questions in 50 words each. Areas to be covered:

- (1) Research Methodology
- (2) Statistical Methods
- (3) Educational Psychology
- (4) Philosophical & Sociological Foundations of Education

(20 X 2 = 40 marks)

Q. 2 Examinees would have to answer questions from any two of the following areas. The questions would be of objective type. Examinees would be expected to answer 20 out of the 25 questions from each of the areas. Areas to be covered:

- (i) Inclusive/ Special Education
- (ii) ET including ICT
- (iii) Teacher Education
- (iv) Adult education
- (v) Educational Leadership & Administration/ Educational Management
- (vi) Guidance and Counseling
- (vii) Distance Education/ Open Distance Learning
- (viii) School Education
- (ix) Higher education
- (x) Educational Evaluation
- (xi) Curriculum Studies
- (xii) Comparative Education
- (xiii) Alternative Education

(40 X 1 = 40 marks)

Q. 3. Examinees would be expected to write an essay on a topic in 600 words. Through this question we intend to test the research and analytical skills through one of the contemporary issues. No specific area would be prescribed. (20 marks)

**SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON
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**STAFF TRAINING AND RESESARH INSTITUTE OF DISTANCE
EDUCATION (STRIDE)**

**Norms developed for M.Phil and PhD entrance examinations in
Distance Education, STRIDE**

DISTANCE EDUCATION (M.PHIL & PH.D)

Components of Entrance Examination

S. No	Nature of Questions and its Components	Marks weightage (in marks)	No of Q multiplied With marks	Total marks	Expected time to be consumed by student	Remarks
1	Language comprehension in Open and Distance Education	30	10 Q X 3	30	40 minutes	10 Q (3 marks each) questions
2	Short answers	40	10 Q X 4	40	40	10Q (4 marks each)
3	Objective Type	40	40 Q X 1	40	40	40 Q (1 marks each)
4	Critical Essay type • On any ODL institute	40	10	40	60	1200 (words critical essay)
		150 Marks	questions	150 marks	3 hours	

* Critical essay covers the following areas...

1. Structure and governance of Distance Education Institute
2. Design and development of course materials
3. On learners Support Services i
4. Learner's evaluation system

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SCHOOL OF TRANSLATION STUDIES AND TRAINING (SOTST)

**Syllabus for Entrance Examination for M.Phil/Ph.D Programme
(Translation Studies)**

The questions will be based on the following broad areas:

1. Theories of Translation (Nida, Catford, George Steiner).
2. Traditions of Translation (Indian and western).
3. Areas of Translation (Administrative, Scientific, Literary, Media).
4. Translation as Cultural Exchange.
5. The Role of Translation in India.
6. Translation, Colonization, Nationalization,
7. Research Aptitude and Method.
8. Applied Translation.
9. Translation in Today's India.

The question paper will be of 3 hrs. duration and carrying 150 marks in total. It will be divided into three equal segments with 50 marks each. Section-1 will have short notes on any four out of the six (in 250 words each), in Section-2 there will be three options out of which the candidates will have to attempt any two in about 500 words each, Section-3 will have two components; the first will be an essay type question to be answered in 600 words, while the other will be a passage for translation from Hindi to English and vice versa.

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SCHOOL OF FOREIGN LANGUAGES (SOFL)

**Following is the Entrance test syllabus for PhD Programme in
Arabic**

1. Origin and growth of Arabic Language
2. Significance of classical Arabic poetry
3. Development of Arabic Prose during Abbasid Period
4. Literary movements in Arabic and New Trends in Arabic literature
5. Development of Novel , Short Story, Drama & essay writing in Arabic
6. Prominent features of Mahjar (Migrant) literature
7. Arab culture and people.

Evaluation Methodology

1. The candidates will have to answer four subjective questions out of seven.
2. Duration for written test will be 3 hours
3. Maximum marks 80 for written test and 20 marks for viva voce.

**SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON
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SCHOOL OF FOREIGN LANGUAGES (SOFL)

2. FRENCH (PhD)

- A. Language competence (written)
- B. Awareness of general issues related to life and culture in France
- C. Ability to express general issues on India in French
- D. Coherence of expression in logical and systematic thinking required for research and thesis writing.

**SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON
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SCHOOL OF SOCIAL SCIENCES (SOSS)

HISTORY (PH.D)

- A. General Awareness – Questions will be on issues pertaining to social, economic, political developments in India in general
- B. History as a subject focusing on the following:
1. Historiography
 - i. Objectivity and Interpretation
 - ii. Ancient Indian Historiography
 - iii. Medieval Indian Historiography
 - iv. Modern Indian Historiography
 - v. Subaltern studies
 2. Ancient India
 - i. Indus Valley Civilization
 - ii. Polity in Ancient India
 - iii. Economy in Ancient India
 - iv. Social Systems
 - v. Religious Traditions
 3. Medieval India
 - i. Indian Feudalism
 - ii. Society & Economy
 - iii. Polity in Medieval India
 - iv. Bhakti & Sufi Movements
 - v. 18th Cent. Debate
 4. Modern India
 - i. Revolt of 1857
 - ii. National Movement
 - iii. Economic Impact of Colonial Rule
 - iv. Social and Intellectual Reform Movements
 - v. Gandhi and Gandhian Ideology

SCHEME OF SELECTION:

1. The question paper shall be of three hour duration. The questions shall be essay type.
2. The paper will consist of two parts. Part I will have questions from Section A of the Syllabus. The candidate will have to do one question from this Part. Part II will have questions from each sub-section of Section B of the Syllabus. The candidate will have to attempt four questions from this Part selecting at least one from sub-section 1 and three from any one sub-section related with the theme of the proposed research topic of the candidate. Thus the candidate will have to attempt FIVE questions in all, one from Part I, one from sub-section 1 of Part II and three from any one sub-section i.e. 2 or 3 or 4. All the questions will carry equal marks.

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3. The qualifying marks for appearing in the interview shall be decided by the Faculty. Only those candidates who obtain the qualifying marks shall be called for the interview before the Doctoral Committee. It may be noted that marks obtained in the Entrance Test are only of the qualifying nature enabling the candidate to appear for the interview.
 4. The final recommendation for admission in Ph.D. History Programme shall be accorded by the Doctoral Committee on the basis of the candidate's performance in the interview.
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SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON 16TH MARCH 2013 FOR JULY 2013 SESSION

ECONOMICS (M.PHIL & PH.D)

The syllabus includes topics from Microeconomics, macroeconomics and quantitative methods. All three components have one-third weightage each. The outline is given below.

Microeconomics

Consumer Behavior: theory of Demand, Recent Developments of Demand Theory

Producer Behaviour: Theory of Production, Theory of Cost

Price and Output Determination: Perfect Competition, Monopoly, Monopolistic Competition, Collusive and non-collusive Oligopoly, Alternative theories of Firm

Welfare Economics: Pigovian vs. Paretian Approach, Social Welfare Function, Externality and Public Goods, Social Choice and Welfare

General Equilibrium

Economics of Uncertainty: Choice in Uncertain Situations, Insurance Choice and Risk

Game Theory: Cooperative and non-cooperative games

Macroeconomics

Classical and Keynesian Approaches, Neoclassical Synthesis, Economic Growth - Solow Model, Endogenous Growth Model, Rational Expectations,

Inter-temporal decision-making - Ramsey Model, Overlapping Generations Model, Money and the Role of Monetary Policy,

Business cycles - traditional theories, Real Business Cycles

Unemployment - traditional theories, search theory, Nominal and Real Rigidities, New-Keynesian Theories of Unemployment

Open-Economy: Flexible and Fixed Exchange Rate Systems, Sluggish Price Adjustment

Quantitative Methods

Introduction to Differential Calculus - Functions, Limit and Continuity, Differential Calculus - Partial and total differentiation

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Extreme Values and Optimisation - Maxima and Minima, Unconstrained Optimisation, Constrained Optimisation

Integral Calculus and Economic Dynamics: Integration and Applications of Economic Dynamics, Difference Equations and Economic Dynamics

Linear Algebra and Economics Applications- Vectors and Matrices, Input-Output Analysis, Linear Programming

Descriptive Statistics and Data Presentation, Correlation and Regression, Probability and Probability Distributions,

Sampling Theory - Sampling Distribution, Statistical Inference.

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SOCIOLOGY (M.PHIL & PH.D)

- A. Sociological Concepts: Social Groups, Social Structure, Community, Association, culture, identity, tradition, modernity, social processes, social institutions- family, marriage, kinship, state, religion.
 - B. Sociological theories: Evolutionary- functional, Marxian, structural-functional, structural, symbolic interactionism, phenomenology, post modernism
 - C. Social Stratification-Castes, class, race, gender, ethnicity
 - D. Types of societies: Colonial, post colonial, simple, agrarian, industrial, post industrial, knowledge society
 - E. Social Change: theories of social Change, transformation, social movements, social development
 - F. Society in India: tribal, rural, urban, industrial, informational
 - G. Research Methodology: logic and philosophical foundations of social research, positivism, concepts, theory, hypothesis, research techniques, data collection and analysis.
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SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON 16TH MARCH 2013 FOR JULY 2013 SESSION

POLITICAL SCIENCE (PH.D)

Syllabus

The admission process will consist of written test and interview. The students are expected to be familiar with the current trends and issues in the core areas of the discipline of Political Science - Political Theory, Comparative Politics, Indian Government and Politics and International Relations. The test is also intended to assess the research aptitude of the candidates and their ability to critically react to the issues.

The Evaluation Methodology

The entrance test question paper will consist of the both long and short answer questions. The maximum marks for the written test and interview will be 100 each. The combined marks of the written test and interview will determine the admission of the candidates.

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GANDHIAN THOUGHT & PEACE STUDIES (M.PHIL & PH.D) SYLLABI

Introducing Gandhi, Formative Years-Community: Family and Neighbourhood, Early Education, Study in England - An Overview, Indian Influences: Epics, Narratives, Gita, Raichand Bhai, Folklore, Western Influences: Ruskin, Thoreau, Tolstoy, Quakers, Gandhi in South Africa : Struggle against Racial Discrimination, From Passive Resistance to Satyagraha, Lessons Learned

Return of Gandhi (1915-1917): Champaran, Kheda, Labour strike in Ahmedabad, Rowlatt Satyagraha, Khilafat and Non-Cooperation Movement of 1920, Civil Disobedience Movement of 1930, Communal Award and Poona Pact, Constructive Programme, Quit India Movement, Partition of India, Moderates, Extremists and Revolutionaries (Gokhale, Tilak and Bhagat Singh)

Jinnah and Savarkar, Tagore, Nehru and Ambedkar, Gandhi and the Left (M N Roy, Ram Manohar Lohia and S A Dange, Indic Religions: Hinduism, Jainism and Buddhism, Semitic Religions : Christianity, Islam and Judaism, Western Philosophy (Greek Tradition, Ruskin, Tolstoy, Thoreau), Eastern Philosophy (Vedanta, Bhakti Movement – (Kabir, Tulsidas), Vaishnavism, Anasakti Yoga), Gandhi's views on Human Nature, Gandhi's views on Truth, Gandhi's views on Non-Violence, Gandhi's views on Religion, Gandhi's Critique of Modern Civilisation, Critical Understanding of Indian Civilisation, Towards a New Civilisation, Sarvodaya, Duties, Swaraj, Swadeshi, Satyagraha,

Introduction to Gandhian Political Thought, Gandhi's views on State and Citizenship (Ramrajya), Gandhi's views on Democracy (Gramswaraj), Gandhi's concept of Nationalism, Rights and Duties, Means and Ends, Liberty and Equality, Power and Authority, Gandhi's views on Colonialism and Imperialism, Gandhi's views on Liberalism and Constitutionalism, Anarchism, Gandhi's views on Socialism and Marxism, Gandhi on Structural Violence, Satyagraha as a Means of Conflict Resolution, Gandhi on Pacifism, World Order , What is Peace? Peace, Wellbeing and Justice, Peace and Participatory Democracy, Culture of Peace, Types and Levels of Conflict, Sources of Conflict: Perspectives Social Injustice, Economic Inequality and Exploitation, Western and Eastern Perspectives, Coercive Methods, Alternative Dispute

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Resolution (ADR), Gandhian Way, Comprehensive Human Development, Peace Education, Religious Harmony, Peace.

Critique of Modern Economics, Indigenous and External Influences, Encounter with Colonialism and Poverty, Bread Labour, Self-reliance and Self – sufficiency, Trusteeship, Preferences, Utilities and Wants, Machinery and Industrialisation, Economics of Non-Violence, Khadi and Village Industries, Gandhian Economists (J C Kumarappa, E F Schumacher J K Mehta and Sriman Narayan), Decentralisation, Agrarian Economy and Cooperatives, Sustainable Economy and Social Justice, Paradoxes of Development and Gandhian Alternatives, Post-Gandhian Scenario, Leadership and Organisational Patterns, Dynamics, Strategies and Outcomes

Social and Ecological Issues, Bhoodan Movement, Total Revolution, Prohibition Movements, Farmers' Movements, Chipko Movement, Narmada Bachao Andolan/Tehri Dam, Silent Valley, Water Conservation Movement, Civil Rights Movements in the United States, Green Peace Movements in Europe, Anti-Apartheid Movement in South Africa, Solidarity Movement in Poland.

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**SYLLABUS FOR ENTRANCE EXAMINATION OF PH. D
PROGRAMME IN PSYCHOLOGY**

1. General Psychology
2. Social Psychology
3. Research Methodology
4. Psychological Statistics
5. Psychological Testing
6. Clinical Psychology or Counselling Psychology or Industrial and Organizational Psychology

Books for Reference

1. Morgan, C; King R; Weisz, J; and Schopler, J. (2001). Introduction to Psychology. New Delhi: Tata Mc-Graw Hill Education.
2. Baron, R.A; Byrne, D&Brabscombe, N. R. (2006). Social Psychology. New Delhi: Pearson Education, Inc.
3. Kerlinger, F.N., & Lee, H.B. (2000). *Foundations of Behavioral Research*. Fort Worth, TX: Harcourt College Publishers.
4. Garrett, H. E. (2005). Statistics in Psychology and Education. India: Jain Publishing.
5. Anastasi A & Urbina, S. (1996). Psychological Testing, New York: Prentice Hall

SYLLABI FOR ENTRANCE EXAMINATION TO BE HELD ON 16TH MARCH 2013 FOR JULY 2013 SESSION

SCHOOL OF PERFORMING VISUAL ARTS (SOPVA)

Syllabus for Ph D Fine Arts Entrance Test

1. Principles of Aesthetics: Indian & Western

- Indian aesthetics and its scope.
- Principles of Painting with reference to *Shilpa shastra/Chitrasutra* etc.
- Concepts of the *Ras Sutra* and its commentaries.
- Western creative process :
 - (a) Emotion & Imagination,
 - (b) Inspiration & Intuition,
 - (c) Imitation & Expression.

2. History of Art: Western & Indian

- Introduction to Social & Historical background of Art of 20th century, with references of European periods (Romanticism, Realism, Impressionism, Post-impersonism, symbolism), Fauvism, Expressionism and Cubism.
- Post-Independence Indian art movements- Abstraction in Indian Painting: Post Independence Era, Progressive Group, Calcutta Group, Choramandal Artists Group, Baroda Group.
- Non representational Art: V.S. Gaitonde, Jeram Patel, Nasreen Mohammedi, S.H. Raza.
- Contemporary Indian art and Artist.
- Post modern Art in India.

3. Understanding of Art management and marketing:

- Public relation and media
- On line exhibition and Art marketing
- Art galleries, Art exhibition, publicity, invitation.
- Evaluation of Art work.

4. Computer Application

- Knowledge of software- Vector & Rector.

Syllabus for Entrance Test in PhD in Music

1. Elements and Principles of Indian Music- Naad, Shruti, Swara, Saptak, That, Alap, Taan, Gram, Murchana, Gamak, Meend, Gat, Jod, Jhala, Jamjama, Krintan, Laya, Taal and Dus prans, Matra, Kaal, Avartan, Peshkar, Kayda, Tukda, Paran, Rela

2. Evolution of Raga

3. Study of music and evolution of musical scales-Hindustani and Karnatak

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4. State of Music in Vedic period
5. Evolution and growth of various musical forms from Vedic to modern times-
Anibadh gaan, Nibadh gaan
6. Study of musical treatises from ancient to modern period
7. History and classification of musical instruments
8. Music and Aesthetics
9. Acoustics
10. Philosophy and Music
11. Psychology and Music
12. Role of Govt. and Non-Govt. organizations, Gharanas, Universities, AIR and SNA
in propagation of classical music
13. Study of ragas
14. Study of talas
15. Biographical study of the eminent personalities in the field of music

Syllabus for Entrance Test in PhD (Theatre Arts)

1. History and origins of Western and Indian Theatre
2. Elements of Theatre and Drama (Western and Indian)
3. Bharata's Natyasastra
4. Origin and development of Traditional Theatre Forms of India
5. Origins of development of Folk Theatrical Forms of India and Southeast Asia
6. History and Development of Modern Western Drama and Theatre
7. History and development of Modern Indian Drama and Theatre
8. Makers of Modern Theatre (Indian and Western)
9. Major acting theories

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10. Theatre Aesthetics(Western and Indian)
11. Indigenous Theatre Practices (Indian context)
12. Technical aspects of Theatre(Stage craft, design, lighting, costumes and make-up and direction)
13. Theatre Semiotics
14. Post modern theories of theatre
15. Theatre Research methodologies

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SCHOOL OF ENGINEERING AND TECHNOLOGY (SOET)

Syllabus for Entrance Test for admission in PhD Mechanical Engineering

1. There are four sections in the syllabus
2. Candidate has to choose two sections out of four sections.
3. All sections have fifty objective type questions.

SECTION A

APPLIED MECHANICS, STRENGTH OF MATERIALS AND DESIGN

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

SECTION B

FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat

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transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle, irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

SECTION C

PRODUCTION ENGINEERING and MANUFACTURING TECHNOLOGY

Metal Casting: Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations. Forming: Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Joining: Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding. Machining and Machine Tool Operations: Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, principles of design of jigs and fixtures, Non-conventional machining.

SECTION D

INDUSTRIAL ENGINEERING

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning. Inventory Control: Deterministic and probabilistic models; safety stock inventory control systems. Operations Research: Linear programming, simplex and graphical method, transportation model, assignment model, network flow models, simple queuing models, PERT and CPM. Supply Chain Management.

NOTE: Candidate is required to take any two sections out of four sections. In each section there will be fifty questions. All questions will be objective type.

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**SYLLABUS FOR Ph.D ENTRANCE EXAMINATION 2013
(CIVIL ENGINEERING)**

Part-I is compulsory for all students. Any two sections are to be selected from Part-II.

PART-I

(Compulsory Section)

SYLLABUS FOR ENGINEERING MATHEMATICS

Linear Algebra:

Algebra of matrices, inverse, rank, system of linear equations, symmetric, skew symmetric and orthogonal matrices. Hermitian, skew-Hermitian and unitary matrices. Eigen values and Eigen vectors, diagonalisation of matrices, Cayley-Hamilton Theorem.

Calculus:

Functions of single variable, limit, continuity and differentiability, Mean value theorems, Indeterminate forms and L'Hospital rule, Maxima and minima, Taylor's series, Fundamental and mean value-theorems of integral calculus. Evaluation of definite and improper integrals, Beta and Gamma functions, Functions of two variables, limit, continuity, partial derivatives, Euler's theorem for homogeneous functions, total derivatives, maxima and minima, Lagrange method of multipliers, double and triple integrals and their applications, sequence and series, tests for convergence, power series, Fourier Series, Half range sine and cosine series.

Complex variables:

Analytic functions, Cauchy-Riemann equations, Application in solving potential problems, Line integral, Cauchy's integral theorem and integral formula (without proof), Taylor's and Laurent' series, Residue theorem (without proof) and its applications.

Vector Calculus:

Gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, Stokes, Gauss and Green's theorems (without proofs) applications.

Ordinary Differential Equations:

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First order equation (linear and nonlinear), Second order linear differential equations with variable coefficients, Variation of parameters method, higher order linear differential equations with constant coefficients, Cauchy- Euler's equations, power series solutions, Legendre polynomials and Bessel's functions of the first kind and their properties.

Partial Differential Equations:

Separation of variables method, Laplace equation, solutions of one dimensional heat and wave equations.

Probability and Statistics:

Definitions of probability and simple theorems, conditional probability, Bayes Theorem, random variables, discrete and continuous distributions, Binomial, Poisson, and normal distributions, correlation and linear regression.

Numerical Methods:

Solution of a system of linear equations by L-U decomposition, Gauss-Jordan and Gauss-Seidel Methods, Newton's interpolation formulae, Solution of a polynomial and a transcendental equation by Newton-Raphson method, numerical integration by trapezoidal rule, Simpson's rule and Gaussian quadrature, numerical solutions of first order differential equation by Euler's method and 4th order Runge-Kutta method

PART-II

(Any two sections optional)

SYLLABUS FOR FLUID MECHANICS (SECTION A)

(Optional Section)

Fluid Properties:

Relation between stress and strain rate for Newtonian fluids.

Hydrostatics:

Buoyancy, manometry, forces on submerged bodies. Eulerian and Lagrangian description of fluid motion, concept of local and convective accelerations, steady and unsteady flows, control volume analysis for mass, momentum and energy.

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Differential equations of mass and momentum (Euler equation), Bernoulli's equation and its applications.

Concept of fluid rotation, vorticity, stream function and potential function.

Potential flow: elementary flow fields and principle of superposition, potential flow past a circular cylinder.

Dimensional analysis:

Concept of geometric, kinematic and dynamic similarity, importance of non-dimensional numbers. Fully-developed pipe flow, laminar and turbulent flows, friction factor, Darcy-Weisbach relation.

Qualitative ideas of boundary layer and separation, streamlined and bluff bodies, drag and lift forces. Basic ideas of flow measurement using venturimeter, pitot-static tube and orifice plate.

SYLLABUS FOR MATERIALS SCIENCE (SECTION B)

(Optional Section)

Structure:

Atomic structure and bonding in materials. Crystal structure of materials, crystal systems, unit cells and space lattices, determination of structures of simple crystals by x-ray diffraction, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Concept of amorphous, single and polycrystalline structures and their effect on properties of materials. Crystal growth techniques. Imperfections in crystalline solids and their role in influencing various properties.

Diffusion:

Fick's laws and application of diffusion in sintering, doping of semiconductors and surface hardening of metals.

Metals and Alloys:

Solid solutions, solubility limit, phase rule, binary phase diagrams, intermediate phases, intermetallic compounds, iron-iron carbide phase diagram, heat treatment of steels, cold, hot working of metals, recovery, recrystallization and grain growth. Microstructure, properties and applications of ferrous and non-ferrous alloys.

Ceramics:

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Structure, properties, processing and applications of traditional and advanced ceramics.

Polymers:

Classification, polymerization, structure and properties, additives for polymer products, processing and applications.

Composites:

Properties and applications of various composites.

Advanced Materials and Tools:

Smart materials, exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials, synthesis, properties and applications, biomaterials, superalloys, shape memory alloys. Materials characterization techniques such as, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, scanning tunneling microscopy, atomic absorption spectroscopy, differential scanning calorimetry.

Mechanical Properties:

Stress-strain diagrams of metallic, ceramic and polymeric materials, modulus of elasticity, yield strength, tensile strength, toughness, elongation, plastic deformation, viscoelasticity, hardness, impact strength, creep, fatigue, ductile and brittle fracture.

Thermal Properties:

Heat capacity, thermal conductivity, thermal expansion of materials.

Electronic Properties:

Concept of energy band diagram for materials - conductors, semiconductors and insulators, electrical conductivity effect of temperature on conductivity, intrinsic and extrinsic semiconductors, dielectric properties.

Optical Properties:

Reflection, refraction, absorption and transmission of electromagnetic radiation in solids.

Magnetic Properties:

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Origin of magnetism in metallic and ceramic materials, paramagnetism, diamagnetism, anti-ferro magnetism, ferromagnetism, ferrimagnetism, magnetic hysteresis.

Environmental Degradation:

Corrosion and oxidation of materials, prevention.

SYLLABUS FOR SOLID MECHANICS (SECTION C)

(Optional Section)

Equivalent force systems; free-body diagrams; equilibrium equations; analysis of determinate trusses and frames; friction; simple relative motion of particles; force as function of position, time and speed; force acting on a body in motion; laws of motion; law of conservation of energy; law of conservation of momentum.

Stresses and strains; principal stresses and strains; Mohr's circle; generalized Hooke's Law; thermal strain; theories of failure. Axial, shear and bending moment diagrams; axial, shear and bending stresses; deflection (for symmetric bending); torsion in circular shafts; thin cylinders; energy methods (Castigliano's Theorems); Euler buckling. Free vibration of single degree of freedom systems

SYLLABUS FOR THERMODYNAMICS (SECTION D)

(Optional Section)

Basic Concepts:

Continuum, macroscopic approach, thermodynamic system (closed and open or control volume); thermodynamic properties and equilibrium; state of a system, state diagram, path and process; different modes of work; Zeroth law of thermodynamics; concept of temperature; heat.

First Law of Thermodynamics:

Energy, enthalpy, specific heats, first law applied to systems and control volumes, steady and unsteady flow analysis.

Second Law of Thermodynamics:

Kelvin-Planck and Clausius statements, reversible and irreversible processes, Carnot theorems, thermodynamic temperature scale, Clausius inequality and concept of

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entropy, principle of increase of entropy; availability and irreversibility.

Properties of Pure Substances:

Thermodynamic properties of pure substances in solid, liquid and vapor phases, P-V-T behaviour of simple compressible substances, phase rule, thermodynamic property tables and charts, ideal and real gases, equations of state, compressibility chart.

Thermodynamic Relations:

T-ds relations, Maxwell equations, Joule-Thomson coefficient, coefficient of volume expansion, adiabatic and isothermal compressibilities, Clapeyron equation.

Thermodynamic cycles:

Carnot vapor power cycle, Ideal Rankine cycle, Rankine Reheat cycle, Air standard Otto cycle, Air standard Diesel cycle, Air-standard Brayton cycle, Vapor-compression refrigeration cycle.

Ideal Gas Mixtures:

Dalton's and Amagat's laws, calculations of properties, air-water vapor mixtures and simple thermodynamic processes involving them

SYLLABUS FOR POLYMER SCIENCE AND ENGINEERING (SECTION E)

(Optional Section)

Chemistry of high polymers:

Monomers, functionality, degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness, polymerization methods: addition and condensation; their kinetics, metallocene polymers and other newer techniques of polymerization, copolymerization, monomer reactivity ratios and its significance, kinetics, different copolymers, random, alternating, azeotropic copolymerization, block and graft copolymers, techniques for copolymerization-bulk, solution, suspension, emulsion.

Polymer Characterization:

Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights, polymer crystallinity, analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques.

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Synthesis and properties:

Commodity and general purpose thermoplastics: PE, PP, PS, PVC, Polyesters, Acrylic, PU polymers. Engineering Plastics: Nylon, PC, PBT, PSU, PPO, ABS, Fluoropolymers
Thermosetting polymers: PF, MF, UF, Epoxy, Unsaturated polyester, Alkyds. Natural and synthetic rubbers: Recovery of NR hydrocarbon from latex, SBR, Nitrile, CR, CSM, EPDM, IIR, BR, Silicone, TPE.

Polymer blends and composites:

Difference between blends and composites, their significance, choice of polymers for blending, blend miscibility-miscible and immiscible blends, thermodynamics, phase morphology, polymer alloys, polymer eutectics, plastic-plastic, rubber-plastic and rubber-rubber blends, FRP, particulate, long and short fibre reinforced composites.

Polymer Technology:

Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, crosslinking and vulcanization, vulcanization kinetics.

Polymer rheology:

Flow of Newtonian and non-Newtonian fluids, different flow equations, dependence of shear modulus on temperature, molecular/segmental deformations at different zones and transitions. Measurements of rheological parameters by capillary rotating, parallel plate, cone-plate rheometer. viscoelasticity-creep and stress relaxations, mechanical models, control of rheological characteristics through compounding, rubber curing in parallel plate viscometer, ODR and MDR.

Polymer processing:

Compression molding, transfer molding, injection molding, blow molding, reaction injection molding, extrusion, pultrusion, calendaring, rotational molding, thermoforming, rubber processing in two-roll mill, internal mixer.

Polymer testing:

Mechanical-static and dynamic tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tear, resilience, impact, toughness. Conductivity-thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress cracking resistance.

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