SYLLABUS FOR WRITTEN ENTRANCE TEST

School of Advanced Studies in Industrial Pollution Control Engg.

1.0 Research Methodology
2.0 Subjective

- **Sustainable development, Acts, Rules**. Statutory standards, conceptual aspects of EIA, ES, EMP, Hazardous substances & Risk analysis.
- **Water and Atmospheric pollution** – types, causes sources, primary and secondary pollutants, effects, dispersion of Air pollutants, control measures, standards solid waste-classification, collection and disposal management,
- **Water Resources and water quality** for domestic, Industrial uses.
- **Water treatment methods**.
- Physical and chemical characteristics of waste water, measurement of organic content-BOD. COD, TOC etc. Biological Protista, characteristics of waste water, Waste water treatment and Physical,
- Unit Operations: Screening Floculation, Sedimentation Flotation, Filtration, Disposal of sludge, Chemical treatment, Chlorination, Liquid liquid extraction, Separation Technology, Membrane separation
- Biological treatment: aerobic and anaerobic cycles, growth kinetics, activated biological sludge process, trioxle filter, stabilization ponds and other processes and design considerations. Advanced waste water treatment, processes tor industrial effluents. Design of aerobic and anaerobic reactors and design of reactors.
- Treatment and disposal of sludge and solid wastes and design criteria.
- Sanitary landfill and composing.
- Incinerators design, Pyrolysis and other energy recovery processes. Treatment of agricultural wastes and manure.
- Biogas. Air environment and its management. Nature of air pollutants and their effects. Sampling and array methods. Particulars and their removal methods-removal devices of air pollutants and design considerations. Reduction of automobile engine exhaust emissions. Treatment of flue gases. Process design considerations for reducing emission.
- Case studies particularly from chemical process industries. Safety analysis.

SYLLABUS FOR WRITTEN ENTRANCE TEST

1. Basic Oceanography (Consult Sagar-Pocketbook on Oceans; freely available on the Internet)

2. Basic Research Methodology aptitude

SYLLABUS FOR WRITTEN ENTRANCE TEST

School of Cognitive Science

[IN ACCORDANCE TO THE CLAUSE NO. 5.4.1[1], 5.4.2[2] AND 5.5[3] OF THE GAZETTE OF INDIA REGD NO. D.L. -33004/99, PART III- SECTION 4 DATED JULY 5 2016 ON UNIVERSITY GRANTS COMMISSION (MINIMUM STANDARDS AND PROCEDURE FOR AWARD OF M.PHIL./PH.D. DEGREES) REGULATIONS, 2016]

The entrance examination will comprise of two sections-

a. Research Methodology - 50% of entrance test syllabus

b. Subject specific (the broad area of Cognitive Science) topics - 50% of entrance test syllabus

c. The interview/viva voce: In the Viva voce, the candidate is expected to discuss their research interest/area through a presentation (5 min) before the Panel.

The basics of topics included in Research Methodology

Qualitative & quantitative methods, Scientific Method, Purpose of statistics, Different kind of Variables, Probability, Distributions, Sampling, Experimental Designs (Independent samples design, Repeated measure design), Validity (Validity in Experiments and other research design, types of validity), Quasi-experiments, Analysis: Correlations, t-tests, non-parametric tests, ANOVA (factorial, mixed), Introduction to Regression mathematical Logic (First order predicate calculus)

Different methodologies used in Cognitive science, Reaction Time measurement and analysis, basics of Signal detection theory, Eye tracking, MRI, EEG, TMS.

The Broad area of topics included in Cognitive Science

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[1] 5.4.1 An Entrance Test shall be qualifying with qualifying marks as 50%. The syllabus of the Entrance Test shall consist of 50% of research methodology and 50% shall be subject specific. The Entrance Test shall be conducted at the Centre(s) notified in advance (changes of Centres, if any, also to be notified well in advance) at the level of the individual HEI as mentioned in clause 1.2; and

[2] 5.4.2 An interview/viva-voce to be organized by the HEI as mentioned in clause 1.2 when the candidates are required to discuss their research interest/area through a presentation before a duly constituted Department Research Committee.

[3] 5.5 The interview/viva voce shall also consider the following aspects, viz. whether:

    5.5.1 the candidate possesses the competence for the proposed research;

    5.5.2 the research work can be suitably undertaken at the Institution/College;

    5.5.3 the proposed area of research can contribute to new/additional knowledge.

SYLLABUS FOR WRITTEN ENTRANCE TEST

Basics in Cognitive Science

Different theoretical approaches to perception and attention.

Information processing approach, Marr's levels of processing, Representations, Dynamical approaches, Situated and Embodied cognition, Modularity, Culture and Cognition, Cognitive Development

Philosophy of Mind

Different views on mind-brain relationship, functionalism, eliminative materialism, fundamental issues on self and consciousness, representationalism, phenomenological approaches, Language and thought.

Logic and reasoning

Intuitive set theory, Axiomatic Set theory, Proof theory, Model theory, Mathematical constructivism. Informal logic – Critical thinking, different types of arguments.

Psycholinguistics/Biology of language

Introduction to Linguistics, Biological basis of language, language evolution, Design features of language, Foundations of Psycholinguistics, Levels of linguistic analysis: Phonology-phonetics, syntax, semantics, morphology, pragmatics, Word Recognition, Sentence processing, Language Acquisition, Comprehension, Bilingualism, Language-Vision interaction.

Computation

Values and their representation, operations on values, data-types, control statements, data structures, functions, pointers, Basic algorithms.

Basics of programming, algorithmic problem solving, data structures, associative structures, Basic algorithms (sorting, searching, etc)

Introduction to Computational Modeling, Types of learning mechanisms and learning rules, Introduction to neural networks, Probabilistic reasoning, Production Systems, Cognitive Architectures

Cognitive Neuroscience

Structure of neurons, glial cells, action potential, synapse, synaptic transmission, neurotransmitters, anatomical organization of the nervous system, sensory systems.

Functional organization of the cortex, Cognitive neuroscience of perception, language, learning and memory, motor systems, emotions, and hemispheric lateralization.

Cognitive Psychology

Decision making, Reasoning and Problem Solving.

SYLLABUS FOR WRITTEN ENTRANCE TEST

For Applicants of Ph.D. in Journalism and Mass Communication

<u>Subject Domain</u>

- History, growth and development of mass media.

- Different forms of mass media – characteristics, evolution, practices, comparative analysis, its audience.

- Print media, aural media, audio-visual media, electronic media – characteristics, practices, functioning, structure and organizations, rules and regulations

- Impact of mass media on society and impact of social changes on mass media

- Media criticism and media literacy

- Models and theories of mass communication

- Development Communication - concept, theories, paradigms, models, application

- International Communication -   concept, theories, models, critiques

- News writing for different media – characteristics, evolution, news value, journalistic ethics

- Advertising - concept, functions, evolution, standards and ethics, theories and models, brand management, campaign, market research

- Public Relations and Corporate Communication – concept, evolution, structure, tools and techniques, ethics, communication audit

- Press Laws of India – concept, evolution, relevance, ethical framework

- Government media organizations in India – structure, functions, rules and regulations

- Media Management – concept, evolution, theories and practices

- ICT and media – definition, characteristics, evolution, impact, different platforms, convergence

<u>Research Methodology</u>

- Communication research – definition, concept, types, constructs, approaches, software

- Designing research - research objectives, research methodology, types of research, research problem, literature review, primary and secondary sources, formulation of hypothesis,

- Data collection and analysis – sampling, different types of sampling, sample survey, observation and collection of data, data processing and analysis, strategies and tools, data analysis, testing, computing and statistics, framing questionnaire

- Research ethics – different issues, different laws, impact factor, citation and acknowledgement, plagiarism, accountability

- Inferencing and report writing – techniques, precaution, referencing

For Applicants of Ph.D. in ENGINEERING: MECHANICAL / MECHATRONICS

RESEARCH METHODOLOGY

UNIT I – DESIGN AND PROBLEM OF RESEARCH

Research Objectives, Research Methodology, Types of Research, Defining and Formulating the Research Problem, Social Benefit of the Research, Educational Benefit of Research, Problem Selection, Necessity of Defining the Problem, Significance of Literature Review, Literature Review-Primary And Secondary Sources, Critical Literature Review, Identifying Gap Areas From Literature And Research Database, Working Hypothesis Development, Hypothesis, Different Types, Significance, Development of Working Hypothesis.

UNIT II – DATA COLLECTION AND ANALYSIS

Sample Survey, Inferences of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Different Types of Sample Designs, How to Select a Random Sample? Observation and Collection of Data, Accepts of Method Validation, Methods of Data Collection, Data Processing and Analysis, Strategies and Tools, Data Analysis With Statically Package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), Hypothesis Testing.

UNIT III – SOFT COMPUTING

Word Processing, Spread Sheet and Database Software. Plotting of Graphs, Internet and Its Applications, Web Browsing, Acquiring Technical Skills, Drawing Inferences From Data, Introduction of Statistics – Probability Theories, Estimates of Means and Proportions, Chi Square Test, Association of Attributes, Use of Statistical Software SPSS.

UNIT IV –RESEARCH ETHICS AND SCHOLARY PUBLISHING

Ethical Issues, Ethical Committees, Commercialization, Copy Right, Intellectual Property Rights And Patent Law, Preparing Research Papers for Journals and Conferences, Design of Paper using Template, Calculations of Impact Factor, Citation Index, Reproduction of Published Material, Plagiarism, Citation And Acknowledgement, Reproducibility And Accountability.

UNIT V – INTERPRETATION AND REPORT WRITING

Interpretation and its Technique, Precaution in Interpretation, Preparation of Project Proposal, Time Frame and Work Plan, Budget and Justification Structure and Components of Research Report, Types of Report, Title, Abstract, Introduction, Literature, Objectives, Methodology, Scientific Writing Results, Pictures and Graphs, Conclusions, References Documentation and Citation Styles, Bibliography.

SUBJECT DOMAIN

UNIT I – ENGINEERING MECHANICS & FLUID MECHANICS

Stress and Strain, Elastic Constants, Poisson's Ratio, Shear Force and Bending Moment Diagrams, Deflection of Beams, Torsion of Circular Shafts, Euler's Theory of Columns, Energy Methods, Theory of Failures, Kinematics and Dynamics of Particles, Rigid Bodies in Plane Motion, Impulse and Momentum, Center of Gravity, Moment of Inertia, Friction, Energy Formulations, Virtual Work.

UNIT II –ENGINEERING DESIGN

Design for Static and Dynamic Loading, S-N Diagram, Design of Machine Elements, Design of Shafts, Gears, Brakes and Springs, Kinematic and Dynamic Analysis of Linkages, Balancing of Reciprocating and Rotating Masses, Fly Wheel, Free Vibration and Forced Vibration of Single Degree of Freedom Systems, Effect of Damping; Critical Speeds of Shafts.

UNIT III – THERMAL ENGINEERING

Concepts and Definitions, Properties of Gas and Pure Substance, First Law of Thermodynamics, Closed and Open System, Application of Steady State Flow Process, Second Law of Thermodynamics; Carnot Cycle, Otto Cycle, Diesel Cycle, Rankine Cycle, Brayton Cycle, Vapour Compression Refrigeration Cycle, Modes of Heat Transfer, General Heat Conduction Equation, Steady and Unsteady Heat Conduction, Natural and Forced Convection, Laws of Radiation, Heat Exchanger Performance.

UNIT IV – MATERIALS SCIENCE AND MANUFACTURING

Types of Castings, Design of Patterns, Allowances, Origin of Defects, Plastic Deformation and Yield Criteria, Fundamentals of Hot and Cold Working Processes, Load Estimation for Bulk and Sheet, Volume, Stress and Strain in Metals, Molding of Composites. Tool Wear and Tool Life, Calculation of Machining Time, Lathe, Drilling and Milling Operations, Basic Concepts of CAD/CAM, Product Design and Development, Work System Design, Facility Design, Production Planning and Control, Inventory Control, Operations Management, Engineering Economy and Costing, Human Factor in Quality.

UNIT V - SMART SENSORS AND DIGITAL IMAGE PROCESSING

Radiation Sensors-Smart Sensors-Film sensor, MEMS & Nano Sensor-applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring. Amplification-Filtering-Sample and Hold circuits-Data Acquisition: Single channel and multi-channel data acquisition-Data logging. Steps in Digital Image Processing-Components-Elements of Visual Perception-Image Sensing and Acquisition-Image Sampling and Quantization-Relationships between pixels - color models. Wavelets-Subband coding-Multi resolution expansions - Compression: Fundamentals - Image Compression models -Error Free Compression-Variable Length Coding-Bit-Plane Coding-Lossless Predictive Coding – Lossy Compression-Lossy Predictive Coding-Compression Standards.

For Applicants of Ph.D. in MECHANICAL/AUTOMOBILE ENGINEERING

RESEARCH METHODOLOGY

UNIT I – DESIGN AND PROBLEM OF RESEARCH

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Ethical Issues, Ethical Committees, Commercialization, Copy Right, Intellectual Property Rights And Patent Law, Preparing Research Papers for Journals and Conferences, Design of Paper using Template, Calculations of Impact Factor, Citation Index, Reproduction of Published Material, Plagiarism, Citation And Acknowledgement, Reproducibility And Accountability.

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UNIT V – MANUFACTURING AND INDUSTRIAL ENGINEERING

Tool Wear and Tool Life, Calculation of Machining Time, Lathe, Drilling and Milling Operations, Metal Forming Processes, Blanking and Punching Force Measurement, Basic Concepts of CAD/CAM, Product Design and Development, Work System Design, Facility Design, Production Planning and Control, Inventory Control, Operations Management, Engineering Economy and Costing, Human Quality and Culture, Human Factor in Quality.

UNIT V – ENGINES, TRANSMISSION, STEERING AND ELECTRICAL

SI and CI engines, Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle. Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Need of Suspension System, Types of Suspension; Factors Influencing Ride Comfort, Sources of Atmospheric Pollution from the Automobiles, Emission Control Systems-Construction and Operation of Positive Crank Case Ventilation

SYLLABUS FOR WRITTEN ENTRANCE TEST

Fundamentals of Environmental Sciences, Environmental Chemistry, Environmental Biology, Environmental Geosciences, Environmental Pollution and Control Unit, Solid and Hazardous Waste Management, Environmental Management and Legislation, Statistical Approaches and data handling in Environmental Sciences, Contemporary Environmental Issues

SYLLABUS FOR WRITTEN ENTRANCE TEST

Topic 1

Identification of research problem- selection of problem, scope of research, designing a plan of work.

Topic 2

Statistical Techniques and Tools - standard error, regression, T test, F test

Topic 3

Research Ethics - intellectual property right, IPR laws, publication, plagiarism, impact factor

Topic 4

Biomechanics- basics of solid and fluid mechanics, concept of vector algebra and vector calculus, concept of equilibrium, Newton's laws of motion, inertia, bone and tissue biomechanics, concept of stress, strain under uniaxial and multiaxial loading

Topic 5

Biomaterials - structure and properties of bones, muscles and tissues, orthopaedic implants, fundamentals of orthopaedic surgery, endoprosthesis and exoprosthesis

Topic 6

Human anatomy - structure of bones and joints, structure and mechanics of joints, cartilage, tendons.

Topic 7

Basics in computation, fundamental concepts on finite element analysis

School of Nuclear Studies and Application

Research Methodology

Basic Concepts of research

- Objective, motivation and types of research (fundamental, applied)
- Definition of research problem and associated literature survey
- Primary and secondary sources

Research Methodology

- Research methodology and research methods
- Basic principles of experimental design
- Introduction to hypothesis
- Sampling: Different types of sample design and steps in sampling

Measurement and Scaling Techniques

- Measurement in research
- Measurement scales
- Sources of error in measurement
- Tests of sound measurement
- Technique of developing measurement tools
- Scaling
- Meaning of Scaling
- Scale Classification Bases
- Important Scaling Techniques
- Scale Construction Techniques

Scientific Writing

- Preparation of reports, research manuscripts and thesis
- Citation of the sources
- Editing and proof reading
- Ethics and related issues in research

Core Subject: Mechanical Engineering (for candidates with Master's degree in Mech./Nuclear Engg.)

Engineering Mathematics

- **Linear Algebra**: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.

- **Calculus**: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.

- **Differential equations**: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

- **Complex variables**: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series.

- **Probability and Statistics**: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

- **Numerical Methods**: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

Fluid Mechanics and Thermal Sciences

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

- **Heat-Transfer:** Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of

turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

- **Thermodynamics:** Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

- **Applications:** *Power Engineering*: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. *I.C. Engines*: Air-standard Otto, Diesel and dual cycles. *Refrigeration and air-conditioning*: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. *Turbomachinery*: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Applied Mechanics 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; impulse and momentum (linear and angular) and energy formulations, collisions.

- **Mechanics of Materials:** Stress and strain, elastic constants, Poisson's ratio; 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; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

- **Theory of Machines:** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

- **Vibrations:** Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

- **Machine Design:** Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Materials, Manufacturing and Industrial Engineering

- **Engineering Materials**: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

- **Casting, Forming and Joining Processes:** Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. 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. Principles of welding, brazing, soldering and adhesive bonding.

- **Machining and Machine Tool Operations:** Mechanics of machining; basic machine tools; 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, design of jigs and fixtures.

- **Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

- **Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools.

- **Production Planning and Control:** Forecasting models, aggregate production planning, scheduling, materials requirement planning.

- **Inventory Control:** Deterministic models; safety stock inventory control systems.

- **Operations Research:** Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Core Subject: Computer Science and Engineering (for candidates with Master's degree in CSE/MCA)

Engineering Mathematics

SYLLABUS FOR WRITTEN ENTRANCE TEST

- Discrete Mathematics: Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Monoids, Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.

- Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition.

- Calculus: Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration.

- Probability and Statistics: Random variables. Uniform, normal, exponential, poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes

theorem.

Digital Logic

- Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

Computer Organization and Architecture

- Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining, pipeline hazards. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Programming and Data Structures

- Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Algorithms

- Searching, sorting, hashing. Asymptotic worst-case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths

Theory of Computation

- Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, pumping lemma. Turing machines and undecidability.

Compiler Design

- Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation. Local optimisation, Data flow analyses: constant propagation, liveness analysis, common subexpression elimination.

Operating System

- System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems.

Databases

- ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Computer Networks

- Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets;

Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

School of Natural Product Studies

A. Research Methodology (50% of total marks):

Linear and non linear algebraic equations. Concept of different numerical methods, integration by trapezoidal and Simpson's rules. Use of log-log and semi log papers. concept of independent & dependent variables; Data preparation and analysis : frequency tables, bar charts, pie charts, percentages, Error analysis. Concepts of accuracy, precision and resolution. Concept of mean, median, standard deviation ,curve fitting, correlation and regression. Concept of different numerical methods, integration by trapezoidal and Simpson's rules. Concept of units and dimensions, Objectives of Research, Main components of any research work. Use of tools like Microsoft Excel, Microsoft PowerPoint, Use of Internet and search engines . Writing a research report; Plagiarism, Intellectual Property Issues.

B. Syllabus on relevant subject (50% of total marks):

i. Food Science:

Fermentative production of valuable products (amylase, alcohol, Baker's yeast, lactic acid, vinegar); microscope; Pasteurization; sterilization; bacterial growth curve; structural and physicochemical properties of carbohydrate, protein, lipid ,vitamin and natural pigment; units and dimensions; mass and energy balance; basic concept of chemical kinetics; Newtonian and non-Newtonian fluids; introduction to rheology of food materials; concept of canning; drying; freezing; irradiation and chemical preservative; Bioreactors (types and applications); Raw material and process steps for manufacturing of Bread , biscuit and ice-cream; objectives of food packaging and types of food packaging materials; food laws and regulations (FSSAI, FPO,AGMARK).

ii. Pathophysiology:

Basic principles of cell injury and adaptation, Neoplastic diseases, Pathophysiology of common diseases, Laboratory tests for Liver function tests and kidney function tests, Immunopathology including amyloidosis, Infectious diseases, Basic mechanisms of inflammation and repair, Disorders of fluid, electrolyte and acid-base balance, Disorders of homeostasis: white blood cells, lymphoid tissues, and red blood cells related diseases

iii. Microbiology:

Historical Perspective – Discovery of microbial world; Landmark discoveries relevant to the field of microbiology; Controversy over spontaneous generation; Role of microorganisms in transformation of organic matter and in the causation of diseases.

SYLLABUS FOR WRITTEN ENTRANCE TEST

Methods in Microbiology – Pure culture techniques; Theory and practice of sterilization; Principles of microbial nutrition; Enrichment culture techniques for isolation of microorganisms; Light-, phase contrast- and electronmicroscopy.

Microbial Taxonomy and Diversity – Bacteria, Archea and their broad classification; Eukaryotic microbes: Yeasts, molds and protozoa; Viruses and their classification; Molecular approaches to microbial taxonomy.

Prokaryotic Cells: Structure and Function – Prokaryotic Cells: cell walls, cell membranes and their biosynthesis, mechanisms of solute transport across membranes, Flagella and Pili, Capsules, Cell inclusions like endospores and gas vesicles; Bacterial locomotion, including positive and negative chemotaxis.

Microbial Growth – Definition of growth; Growth curve; Mathematical expression of exponential growth phase; Measurement of growth and growth yields; Synchronous growth; Continuous culture; Effect of environmental factors on growth.

Control of Micro-organisms – Effect of physical and chemical agents; Evaluation of effectiveness of antimicrobial agents.

Microbial Metabolism – Energetics: redox reactions and electron carriers; An overview of metabolism; Glycolysis; Pentosephosphate pathway; Entner-Doudoroff pathway; Glyoxalate pathway; The citric acid cycle; Fermentation; Aerobic and anaerobic respiration; Chemolithotrophy; Photosynthesis; Calvin cycle; Biosynthetic pathway for fatty acids synthesis; Common regulatory mechanisms in synthesis of amino acids; Regulation of major metabolic pathways.

Microbial Diseases and Host Pathogen – Interaction Normal microbiota; Classification of infectious diseases; Reservoirs of infection; Nosocomial infection; Emerging infectious diseases; Mechanism of microbial pathogenicity; Nonspecific defense of host; Antigens and antibodies; Humoral and cell mediated immunity; Vaccines; Immune deficiency; Human diseases caused by viruses, bacteria, and pathogenic fungi.

Chemotherapy/Antibiotics – General characteristics of antimicrobial drugs; Antibiotics: Classification, mode of action and resistance; Antifungal and antiviral drugs.

Microbial Genetics – Types of mutation; UV and chemical mutagens; Selection of mutants; Ames test for mutagenesis; Bacterial genetic system: transformation, conjugation, transduction, recombination, plasmids, transposons; DNA repair; Regulation of gene expression: repression and induction; Operon model; Bacterial genome with special reference to *E. coli*; Phage λ and its life cycle; RNA phages; RNA viruses; Retroviruses; Basic concept of microbial genomics.

Microbial Ecology – Microbial interactions; Carbon, sulphur and nitrogen cycles; Soil microorganisms associated with vascular plants.

SYLLABUS FOR WRITTEN ENTRANCE TEST

School of Laser Science & Engineering

Subject

Laser Fundamentals and Fabrication. Phenomenon of population inversion. The Nature of Electromagnetic Radiation. Interaction of Electromagnetic Radiation with Matter. Absorption and Emission of Radiation by atoms, ions and molecules.

Laser medium (solid state medium: srystals, glass, semiconductor, gaseous medium). Types of lasers: He-Ne laser, CO_2 laser, Argon laser, Nd:YAG, Excimerlaser, Diode laser, Fiber laser etc. Application of lasers, Optical parametric oscillator (OPO), Laser Electronics.

Laser Beam Characteristics, Wavelength, Coherence, Mode and Beam Diameter, Polarisation.

Laser Material Processing e.g. machining, welding, sintering, forming etc. Laser Fracture &Damage.

Laser Communication.

Research Methodology

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Scientific Methods, Research Process,Selecting the Problem, Developing a Research Plan,

Measurement and Scaling Techniques, Sources of Error in Measurement, Methods of Data Collection, Processing and Analysis of Data, Interpretation of Results and Report Writing, Role of computer in Research.

Statistics in Research, Regression Analysis, Analysis of Variance (ANOVA), DOE, Taguchi Methodology, Measurements of operating parameters and response in laser processing, microscopy, SEM, TEM, Spectroscopic techniques

HRTEM, UV-vis absorption spectrophotometer, Steady state and Time resolved Spectroscopic techniques, Nuclear Magnetic Resonance (NMR) spectrophotometer, Time correlated single photon counting technique to measure fluorescence lifetimes of the organic/inorganic samples using different excitation sources of LEDs and diode lasers.

SYLLABUS FOR WRITTEN ENTRANCE TEST

School of Water Resources Engineering

Please see the School's website link for syllabus –

http://www.jaduniv.edu.in/view_department.php?deptid=149

School of Water Resources Engineering

Please see the School's website link for syllabus –

==School of Materials Science and Nano Technology==

Research Methodology: 50 marks

Definition of the Problem: Identifying and formulating the problem.

Techniques involved in solving the problem: a) Exact analytical solution of equations involved.

 b) Numerically solving equations.

 c) Stimulating the problem on a computer.

 d) Experimental observations and theoretical modelling

Developing a research plan: Research objective: information required for solving the problem: defining each major concept in operational terms: an overall description of approach, clearly stating any assumptions; details of techniques.

Methods of data collection: Experimental data, field data, data from other sources.

Analysing data: Error analysis, statistical analysis

Subjective: 50 marks

Botany: classification of plant kingdom, diversity of Pteridophytes and Gymnosperms, diversity of Algae, Lichens, and Bryophytes, Photosynthesis and Respiration, plant tissue culture, plant taxonomy, Embryology and Pharmacognosy.

Microbiology: Bacterial cell wall, Microbial growth, Bacterial genetics, Regulation of gene expression

Cell biology: Cell wall and their structural organization- Mitochondria, chloroplast, nucleus and other organelles.

Molecular biology: Prokaryotic and eukaryotic DNA replication- DNA polymerases and proteins involved in DNA synthesis and their specific roles. Structure and properties of RNA polymerases in prokaryotes and eukaryotes. General and specific transcription factors, mechanisms of transcription and post transcriptional modifications of RNAs, RNA editing.

Biochemistry: Metabolism of Carbohydrates, Proteins, Lipids, Amino acids, nucleotides. Immunology.

Pharmaceutics: Synthesis and characterization of nanomaterials, Targeted Drug Delivery using nanomaterials.

SYLLABUS FOR WRITTEN ENTRANCE TEST

Research Methodology and basic comprehension.