JC Bose University Of Science & Technology, YMCA Faridabad

(Established by Haryana State Legislative Act No.21 of 2009,
Approved by AICTE & Recognized by U.G.C. U/s. 2(f) and 12(B) of U.G.C. Act 1956)

ADMISSION SCHEDULE FOR Ph. D 2019-2020 (Even semester)

KEY DATES

1. Availability of Prospectus and online Application Form on University website: 24.12.2019 (Tuesday).
2. Last date for submission of online Application forms duly filled in for admission at the University website: 13.1.2020 (Monday).
3. Availability of the list of the candidates for entrance test and candidates exempted from entrance on University website: 15.1.2020 (Wednesday).
4. Date & Time of Entrance Test: 18.1.2020 (Saturday), 10:00 A.M. -12:00 noon.
5. Declaration of Results: 21.1.2020 (Tuesday).
6. Date of Interview & Counseling by respective Department Chairperson: 23.01.2020 (Thursday).
7. Display of list of selected candidates for Ph. D admission: 24.1.2020 (Friday)
8. Course fee submission by selected candidate: 27.01.2020 (Monday) & 28.01.2020(Tuesday)
9. Date of Commencement of the course work classes: 27.01.2020 (Monday)

NOTE:

Candidates are required to make the payment of Rs.1000/- (Rs.500/- for SC / ST Category) via online payment gateway for application form/registration fee through Debit/Credit Card, Net Banking or by E-Challan.

The candidate without depositing the fee, will not be allowed to appear in Entrance Test.

GENERAL INFORMATION

1. This prospectus/advertising is for full time/part time Ph.D. for 2019-20 sessions. The Application Form for admission would be available online on University website: www.ymcaust.ac.in.

2. The duly completed online application form along with all required enclosures should be submitted by the last date as specified. No application will be entertained thereafter.

3. A candidate who furnishes particulars which are found to be false or suppresses material information, will not be considered for admission and if he/ she is admitted on such information, his/ her admission shall be cancelled as per University rules and all fees deposited by him/ her will stand forfeited.

4. Before accepting the admission, the candidate must also ensure that he/ she fulfills the minimum eligibility conditions. Fee once paid will not be refunded.

5. A facility of downloading Admit Card is also being provided. The candidate is required to download the admit card from the website at his/her own level and follow the instructions given therein. It may please be noted that the admit card will not be sent by post separately.

6. All the admitted candidates will be governed by the Academic Regulation and/ or Ordinance as laid down by the University and amended from time to time.

7. In the case of any inconsistencies in the rules or any clarification thereof, the matter shall be referred to the competent authority for interpretation whose decision shall be final.

8. Detailed ordinance is available at University website.

9. Candidate without depositing the application fee shall not be considered for entrance test.

Introduction

Ph.D program was started in YMCA in the year 2010. Till now more than 200 students of different batches are enrolled for Ph.D. programmes in the discipline of Mechanical Engineering, Electrical Engineering, Electronics Engineering, Computer Engineering, Management, Physics, Environmental Sciences, Chemistry, English and Mathematics.

Fee Structure

At the time of admission:

Fee for Pre Ph.D. Course = Rs 10,000/-(Ten thousand only) (Candidates must bring a DD of Rs 10,000/- at the time of admission in the favour of "Registrar, YMCAUST, Faridabad" payable at Faridabad).

Consolidated list of Full Time and Part Time PhD seats for the session 2019-2020

S.No	Name of the Department	Total no of seats	Part-time	Full Time	Area(s) in which PhD is offered
1	Mechanical Engineering	50	25	25	Industrial Engg., Quality Management, Production, Advance Manufacturing, CAD/CAM/CAE, Design, Cutting Tool Design, Thermal Engg., Power Plants, Energy, Material Technology, Welding Materials and Manufacturing, Operations Research, Data Science, Decision Making, Lean, JIT, Supply Chain, Metal Forming, Powder Metallurgy, Mechanical Metallurgy
2	Computer Engineering	24+2(industry sponsored)	12	12	Information Retrieval, Software Testing, Wireless Sensor Networks, Software Testing, Security, Data Analysis, algorithms, IoT, Security, Database, m/c learning, Project Management, Deep learning, Web Mining, Big Data, Ontologies, Cloud Computing

3	Electrical Engineering	21	11	10	Power Electronics, Machine Drives, Renewable Energy, Power Quality, Smart Grid / Micro Grid, Electrical Machines
4	Electronics Engineering	04	02	02	Semiconductor Devices Embedded System, Communication System, Electromagnetic, Antenna, Wave propagation,
5	MBA	09	05	04	Finance, Finance and emerging trends, Marketing, HR, International business,
6	Mathematics	07	04	03	Operation Research, Quantum Optics& Quantum Information, , Non Linear optimization
7	English	02	01	01	Literature/ Interdisciplinary
8	Physics	07	04	03	Nanotechnology, Plasma Physics, Material Science, radiation physics.
9	Chemistry	05	02	03	Material Chemistry, Atmospheric Chemistry, Medicinal And Synthetic Organic Chemistry.
10	Environmental Sciences	01	01	--	Pollution Monitoring and Control
11	Interdisciplinary Research	05	05	--	
	Total seats		72	63	

Note:

Number of Ph.D. seats may increase or decrease in any of the above department. The broad areas of specialization mentioned against each of the department above is merely for the information of the candidates that research supervisor(s) are available in these areas. However, admission to Pre-Ph.D. course will be strictly as per procedure laid down in Ordinance of Doctor of Philosophy.

iii) The university may not fill available seats in case candidate's specialization/choice does not match with the requirement.

The reservation policy of the Haryana Govt. shall be applicable and all the

reserved seats are meant for Haryana Domicile candidate only.

Reservation certificate must be signed by Tehsildar of concerned area of Haryana State. Format as per HSTES.

Eligibility

(i) A candidate for admission to the course of Ph.D. program shall have masters degree or a professional degree declared equivalent to the master's degree by the corresponding statutory regulatory body with at least 55% marks in aggregate or its equivalent grade B in the UGC 7 point scale (or an equivalent grade in a point scale where ever grading system is followed or an equivalent degree from a foreign educational institution accredited by an assessment and accreditation agency which is approved/recognized or authorized by an authority, established or incorporated under a law in its home country or any other statuary authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institution. The equivalence of the degree will be decided by the Board of Studies (BOS) in the University.

(ii) A relaxation of 5% of marks, from 55% to 50%, or an equivalent relaxation of grade, may be allowed for those belonging to SC/ST/OBC(non-creamy layer)/Differently-Abled and for those who had obtained their Master's degree prior to 19th September, 1991. The eligibility marks of 55% (or an equivalent grade in a point scale wherever grading system is followed) and the relaxation of 5% to the categories mentioned above are permissible based only on the qualifying marks without including the grace mark procedures.

(iii) Candidates possessing a Degree considered equivalent to M.Phil. Degree of an Indian Institution, from a Foreign Educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accrediting or assuring quality and standards of educational institutions, shall be eligible for admission to Ph.D. programme.

(iv) The candidates who appeared in regular master's level examination in the current session may also appear in the entrance test. But they must submit the proof of having passed the examination on the pre-designated date before admission to the Pre-Ph.D. course.

(v) The state reservation policy shall be followed in Ph.D. Admission.

(vi) A candidate provisionally registered for Ph.D. shall be required to attend classes for one semester for a Pre-Ph.D. course.

NOTES:

1. The eligible applicants will have to qualify the Ph.D. Entrance Test (PET). An Entrance Test shall be qualifying with qualifying marks as 50%. However for the candidates belonging to SC/ST/OBC (Non-creamy layers)/differently abled category, the qualifying marks are 45% as per UGC amendment dated 27th August 2018. The syllabus of the Entrance Test shall consist of 50% of research methodology and 50% shall be subject specific **(see syllabus attached).** The Entrance test will be of 2 hours duration having 80 questions of one mark each of concerned discipline / branch**.**
2. The applicants who have qualified and valid GATE/UGC/NET/CSIR (JRF)/SLET/ passed regular M.Phil Programme in the related discipline are exempted from entrance.
3. The successful applicants i.e. eligible applicants, who will qualify the entrance Test or otherwise exempted shall be tested by the DRC through seminar/ presentation/ interview.

Rules for Full Time Ph.D.

The full time PhD program will have following three categories of scholars admitted to program

(a) A research scholar getting University fellowship / scholarship.

(b) A research scholar receiving fellowship / scholarship from outside organizations such as CSIR, UGC, QIP, DST, AICTE etc.

(c) Self-financed A scholar who does not receive financial help like scholarship/assistant ship from university, or from any other source during his Ph.D. program.

(i) University Research Scholarship

Each department, running regular courses, may provide one University Research Scholarships. It will be awarded as per research scholarship rules of the University. The amount of the scholarship shall be 10000/- per month and contingency amount of ₹5000/- per annum.

(ii) Leave

Leave for a maximum of 15 days in a year in addition to general holidays may be allowed to a Research Scholar by the Chairperson of the Department on the recommendation of the Supervisor. The scholar will not be entitled to any vacations. No other leave of any kind with scholarship will be admissible to a Research Scholar.

A full time PhD program may be converted to a part time program at the completion of minimum two years. No scholarship will be provided on part time conversion.

The merit list for admission and allotment of scholarship shall be prepared by Department according to the following criteria:

For Sciences/Management/Humanities

a) 70% marks from the entrance*/70% marks to the candidates exempted from entrance.

b) 5% marks of the percentage of marks in the Master's degree M.Sc./MBA/M.A.

c) 10% marks in the interview to be conducted by the respective Department.

d) 5% marks for work experience (01 marks per year for experience subject to max.5 marks).

e) 5% marks (01 marks for each publication in UGC approved list of Journals subjected to max.5 marks)

f) 5% marks for entitlement of fellowship / scholarship from outside organizations such as CSIR, UGC, QIP, DST, AICTE etc.

For Engineering &Technology

a) 70% marks from the entrance*/70% marks to the candidates exempted from entrance.
b) 5% marks of the percentage of marks in the M.Tech.
c) 10% marks in the interview to be conducted by the respective Department.
d) 5% marks for work experience (01 mark per year for experience subject to max.5 marks).
e) 5% marks (01 marks for each publication in UGC approved list of Journals subjected to max.5 marks)
f) 5% marks for entitlement of fellowship / scholarship from outside organizations such as CSIR, UGC, QIP, DST, AICTE etc.

Where CGPA is awarded and percentage of marks is not mentioned,

Percentage of marks = 9.5 x CGPA

***These marks are calculated on the percentile basis i.e. candidate having maximum marks in the entrance will be given 70 marks.**

Rules for Part-Time Ph.D Admission

(i) The applicant should be an employee of an educational institute/organization/Industry and must produce No Objection Certificate (NOC) from his employer on or before the interview.
(ii) The candidate proves to the satisfaction of the DRC that his/her official duties permit him to devote sufficient time to research.
(iii) The candidate proves to the satisfaction of the DRC that facilities for pursuing research are available at his place of work in the chosen field of research.
(iv) He will be required to visit university (on working days) to meet his supervisor in the department at least twice in a month and such visit is to be reported to the chairman- DRC for record.

The LIST OF SUCCESSFUL APPLICANT will be displayed on University website and notice boards. The successful applicants will report to the **Chairperson of the respective teaching department on the scheduled date for interview/Admission**.

SYLLABUS FOR Ph.D. ENTRANCE-2019-20

Section-A

RESEARCH METHODOLOGY (Common for all branches)

Unit I
Meaning of Research, Research Process and Scope of Research in various disciplines, Scientific methods of research, selecting a topic of research, Ethics in Research, Different research designs and their role

Unit II
Sampling Design, Measurement and scaling techniques, Methods of data collection – questionnaire/schedule; questionnaire designing, interview and observational Methods, Primary and Secondary sources of data collection, Data Preparation, Editing, coding, tabulation, graphic and diagrammatic presentation of data

Unit III
Formulation of Hypothesis Concept; Test of Hypothesis, Parametric tests and non parametric test (chi-square test), Analysis of variance (one way classification)

Unit IV
Multivariate Analysis Techniques: Factor Analysis; Multiple Regression; Correlation Analysis, Cluster analysis, Discrimination Analysis and Conjoint Analysis, Style and Major Ingredients of a report format

Section- B

(I) MECHANICAL ENGINEERING

Applied Mechanics and Design

Engineering Mechanics:
Equivalent force systems, free-body concepts, equations of equilibrium, trusses and frames, virtual work and minimum potential energy. Kinematics and dynamics of particles and rigid bodies, impulse and momentum, energy methods, central force motion.

Strength of Materials:
Stress and strain, Elastic constants, stress-strain relationship, Mohr's circle, deflection of beams, bending and shear stress, shear force and bending moment diagrams, torsion of circular shafts, thin thick cylinders, Eulers theory of columns, strain energy methods, thermal stress.

Theory of machines:
Analysis of plane mechanisms, dynamic analysis of slider-crank mechanism, planer cams and followers, gear tooth profiles, kinematics and design of gears, governors and flywheels, balancing of reciprocating and rotating masses.

Vibrations:
Free and forced vibrations of single degree freedom systems, effect of damping, vibration isolation, resonance, critical speed shafts.

Design of Machine Elements:
Design for statics and dynamic loading, fatigue strength, failure theories, design of bolted, riveted and welded joints, design of shafts and keys, design of spur gears, brakes and clutches, rolling and sliding contact bearings, belt, ropes and chain drives.

Thermal Science/ Thermal Engineering

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

Turbo machines:
Velocity triangles Euler's equation, specific speed, Pelton wheel, centrifugal pump, Francis and Kaplan turbines.

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 layer, effect of turbulence, radioactive heat transfer, black and grey surfaces shape factors, network analysis, heat exchanger performance, LMTD and NTU methods.

Thermodynamics:
Zeroth, fact and second laws of thermodynamics, thermodynamic system and processes, irreversibility and availability, behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes.

Analysis of thermodynamics cycles related to energy conversion. Carnot, Rankine, Otto, Diesel, Brayton and Vapour compression cycle.

Steam engineering:

Steam generators, Steam engines, steam turbines-impulse and reaction, velocity diagrams, compounding, reheat factor.

I.C. Engines:

Requirements and suitability of fuels in IC engines, fuel ratings, fuel- air mixture requirements, normal combustion in SI and CI engines, engine performance calculations, components of gas turbine.

Reciprocating Air Compressor:

Isothermal, adiabatic and polytropic compression, staging the compression process, intercooling and aftercooling, minimum work requirement, volumetric efficiency. Centrifugal and aial flow compressors.

Refrigeration and air-conditioning:

Refrigerant compressors, expansion devices, condensers and evaporators, properties of moist air, psychometric chart, basic psychometric processes.

Manufacturing and Industrial Engineering

Engineering materials:

Structure and properties of engineering materials and their applications, heat treatment.

Metal casting:

Casting processes- pattern making, moulds and cores, solidification, design of casting, casting defects.

Metal working:

Stress-strain diagrams for ductile and brittle material, plastic deformation, mechanisms, fundamentals of hot and cold working processes-forging, extrusion, wire drawing, sheet metal working, punching, blanking, bending, deep drawing, coining and spinning.

Machining Processes and Machine Tool Operation:

Mechanics of metal cutting, single and multipoint cutting tools, geometry and machining aspects, tool life, machinability, economics of machining, non- traditional machining processes.

Metrology and Inspection:

Limits, fits and tolerances, linear and angular measurements, comparators, gauge design interferometry, form and finish measurement, measurement of screw threads, alignment and testing methods.

Tool Engineering:
Principles of work holding, design of jigs and fixtures, design of press working tools.

Manufacturing Analysis:
Part-print analysis, tolerance analysis in manufacturing and assembly, time and cost analysis.

Computer Integrated Manufacturing:
Basic concepts of CAD, CAM , Group technology.

Work Study:
Method study, work measurement time study, work sampling, job evaluation, merit rating.

Production planning and control:
Forecasting models, aggregate production planning, master scheduling, materials requirements planning.

Inventory control:
Deterministic and probabilistic models, safety stock inventory control systems.

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

(II) ELECTRICAL ENGINEERING

Electric Circuits

Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Passive filters, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Two-port networks, Three phase circuits, Power and power factor in ac circuits.

Electromagnetic Fields
Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits,Self and Mutual inductance of simple configurations.

Signals and Systems

Representation of continuous and discrete-time signals, Shifting and scaling operations, Linear Time Invariant and Causal systems, Fourier series representation of continuous periodic signals, Sampling theorem, Applications of Fourier Transform, Laplace Transformand z-Transform.

Electrical Machines

Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; three phase transformers: connections, parallel operation; Auto-transformer, Electromechanical energy conversion principles, DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Operating principle of single phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines.

Power Systems

Power generation concepts, ac and dc transmission concepts, Models and performance of transmission lines and cables, Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss- Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Control Systems

Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Stability analysis, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, State transition matrix.

Electrical and Electronic Measurements

Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multimeters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Analog and Digital Electronics

Characteristics of diodes, BJT, MOSFET; Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: Biasing, Equivalent circuit and Frequency response; Oscillators and Feedback amplifiers; Operational amplifiers: Characteristics and applications; Simple

active filters, VCOs and Timers, Combinational and Sequential logic circuits,

Multiplexer, Demultiplexer, Schmitt trigger, Sample and hold circuits, A/D and D/A converters, 8085Microprocessor: Architecture, Programming and Interfacing.

Power Electronics

Characteristics of semiconductor power devices: Diode, Thyristor, Triac, GTO, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation.

(III) ELECTRONICS AND COMMUNICATION ENGINEERING

Networks:

Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

Electronic Devices:

Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASERs. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process.

Analog Circuits:

Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.

Digital circuits:

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shiftregisters. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor(8085): architecture, programming, memory and I/O interfacing.

Signals and Systems:

Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

Control Systems:

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

Communications:

Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM.

Electromagnetics:
Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain.

(IV) COMPUTER ENGINEERING/ IT AND COMPUTER APPLICATIONS

Digital Logic: Logic functions, Minimization,; Number representation and computer arithmetic (fixed and floating point).

Programming and Data Structures: Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked lists, Trees, Binary search trees, Binary heaps.

Algorithms: Asymptotic notation & Analysis, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Basic concepts of complexity classes - P, NP, NP-hard, NP-complete.

Theory of Computation & Compiler Design: Regular languages and finite automata, Context free languages and Push-down automata, Lexical analysis, Parsing.

Operating systems: Processes, Threads, Inter-process communication, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory

Databases: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL)

Software Engineering: Process models, Software design concepts: coupling & cohesion, testing methods: white box, black box.

Computer Networks: ISO/OSI stack, TCP/IP model, Basic concepts of hubs, switches, gateways, and routers. Network security - basic concepts of public key and private key cryptography, digital signature, firewalls.

Web technologies: HTML, XML, basic concepts of client-server computing.

(VI) ENGLISH

Literature In English: 1550-1660

Philip Sidney: The following Sonnets from Astrophel and Stella **,** John Donne: from The Metaphysical Poets ed. Helen Gardner (Penguin) John Milton: Paradise Lost, Book-I**,** William Shakespeare: As You Like It and King Lear**,** Ben Jonson's Volpone, Francis Bacon's essays, Machiavelli excerpts from The Prince

Literature In English: 1660-1798

John Dryden: Absalom and Achitophel, Alexander Pope: The Rape of the Lock.**,** William Congreve: The Way of the World. Richard Sheridan: The School for Scandal. Daniel Defoe: Robinson Crusoe.Henry Fielding: Tom Jones. (i) Joseph Addison's articles (ii) Richard Steele articles (iii) Samuel Johnson: "On Fiction", "Cowley", "Milton" from Live the Poets.Jean Jacques Rousseau: Confessions.

Literature In English: 1798-1914

Wordsworth, Keats, Coleridge, and Browning**,** Charles Dickens : Hard Times George Eliot:The Mill on the Floss. Thomas Hard: Tess of d Urbervilles. Bernard Shaw: Arms and the Man. Gustav Flaubert Madame Bovarv. S.T. Coleridge, Matthew Arnold, Thomas Carlyle, Wuthering Heights, Joseph Conrad's Heart of Darkness, Mary Shelley's Frankenstein, Sir Walter Scott's Ivanhoe, WM Thackeray Vanity Fair.

Literature In English: 1914-2000

T.S. Eliot: "The Waste Land"**,** Philip Larkin**,** Nissim Ezekiel**,**E.M. Forster: A Passage to India. Background Reading: To The Light house, The Power and the Glorv, The Serpent and the Rope, The Rainbow, July's People, Look Back in Anger, Vijay Tendulkar, Manohar Malgonkar, Ruth Jhabvala, My Experiments with Truth by M.K. Gandhi. George Orwell: Nineteen Eighty Four**.** R.K. Narayan: The Guide Arthur Miller: Death of a Salesman**,** Albert Camus: The Outsider

Critical Theory

Aristotle: Poetics, Bharatmuni : Natyashastra (Ed. Dr. N.P. Unni) Chapter-I and VII, Horace: Ars Poetica Dr. Johnson: Preface to Shakespeare, Background Reading Plato on Poetry, Neo-Platonism, Longinus on Sublime, Plotinus on Beauty, Apologie for Poetry ***by Philip Sidney***, Essay of Dramatic Poesy by John Dryden, Boccaccio on Poetry, French Neoclassicism, Essay on Criticism by Alexander Pope. William Wordsworth: Preface to Lyrical Ballads Matthew Arnold: Selections from Essays in Criticism "The Function of Criticism at the Present Time" "The Study of Poetry" "John Keats" T.S. Eliot: "Tradition and the Individual Talent" I.A. Richards: Chapters XXVII and XVIII of Principles of Literary Criticism ("Levels of Response and the Width of Appeal" and "The Allusiveness of Modern Poetry") Saussure: "The Object of Study" Jakobson: "The Metaphoric and Metonymic Poles" M.H. Abrams: "The Deconstructive Angel" T.S.Eliot's "The Function of Criticism", E.M.Forster on "Flat" and "Round" Characters, Foster on "Point of View", W.K.Wimsatt and M.C. Beardslay on "The Intentional Fallacy", Wimsatt and Beardslay on" The Affective Fallacy" , Raymond Williams' "Realism and the contemporary Novel" , "Lionel Trilling's "Freud and Literature", Psychoanalytical criticism, Post-structuralism, New Historicism.

American Literature

Walt Whitman; Emily Dickinson; Mark Twain: The Adventures of Huckleberry Finn; Henry James:The Portrait of a Lady Robert Frost's selected poems. Ernest Hemingway: The Sun Also Rises Eugene O'Neill: The Hairy Ape Tennessee Williams: A Streetcar Named Desire **INDIAN**

Writing In English

Sri Aurobindo: Savitri, Book IV, Kamala Das:Jayant Mahapatra's poems, Mulk Raj Anand:Coolie, NB: Assorted from Ten Twentieth Century Indian Poets Raja Rao: Kanthapura Anita Dasai: Voices in the City Asif Currimbhoy: Goa S. Radhakrishnan: The Hindu View of Life.

(VI) MATHEMATICS

Algebra

Groups, homomorphism, Sylow theorems. Rings and fields. Vector spaces, subspaces, linear dependence, basis and dimension. Linear transformation, range

space, null space, rank and nullity. Matrix representation of a linear transformation. Change of basis. Eigenvalues and eigenvectors. Inner product, orthogonality, Gram-Schmidt process, orthogonal expansion. Quadratic forms, reduction to normal form.

Analysis

The real number system. Sequences, series and uniform convergence. Continuity and differentiability of functions of real variable. Riemann and Lebesgue integrals. Analytic function, Cauchy Riemann equations, Cauchy's theorem and integral formula, singularities, Taylor's and Laurant's series. Cauchy's residue theorem and applications.

Metric spaces.Cauchy sequences and convergence. Completeness. Normed space. Banach space. Inner product space. Hilbert space.

Differential Equations

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations. Second order linear differential equations. Variation of parameters. Systems of linear equations. Solution by matrix method. Laplace transform methods. Applications. Sturm-Liouville problem. Green's function. First and second order partial differential equations. Method of separation of variables for Laplace, heat and wave equations.

Operations Research

Linear programming problems, convex set, convex functions, Simplex method and its variants, duality, sensitivity analysis. Transportation problems, initial basic feasible solution and optimal solution, degeneracy. Assignment problems, applications of TP and AP. Nonlinear programming problems, Kuhn-Tucker conditions.

Numerical Analysis

Approximation of functions, their derivatives and integrals by interpolation. Finite and divided differences. Iterative methods for solving nonlinear and linear equations, convergence. Power method for largest eigenvalue. Numerical Solution of ordinary differential equations. Initial value problems by Runge-Kutta and predictor-corrector methods. Boundary value problems by finite difference methods and method of weighted residuals. Numerical Solution of Laplace and Poisson equations.

(VII) PHYSICS

1. **Mathematical Physics**

Linear vector space; matrices; vector calculus; linear differential equations; elements of complex analysis; Laplace transforms, Fourier analysis, elementary ideas about Tensors.

2. **Classical Mechanics**

Conservation laws; central forces, Kepler problem and planetary motion; collisions and scattering in laboratory and centre of mass frames; mechanics of system of particles; rigid body dynamics; moment of inertia tensor; non inertial frames and pseudo forces, Lagrange's and Hamilton's formalisms; equation of motion, cyclic coordinates, Poisson bracket; periodic motion, small oscillations, normal modes; wave equation and wave propagation; Lorentz transformations, relativistic kinematics, mass-energy equivalence.

3. **Electromagnetic Theory**

Solution of electrostatic and magnetostatic problems Laplace and Poisson equations; conductors and dielectrics; boundary value problems; Ampere's and Biot-Savart's laws; Faraday's law; Maxwell's equations, Electromagnetic waves and their reflection, refraction, interference, diffraction and polarization, dispersion relations in plasma; Lorentz invariance of Maxwell's equations; Transmission lines and wave guides; Dynamics of charged particles in static and uniform electromagnetic fields; radiation from moving charges, Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves. Special theory of relativity; Lorentz transformations, relativistic kinematics, mass-energy equivalence.

4. **Quantum Mechanics**

Physical basis of quantum mechanics; Wave-particle duality; uncertainty principle; Schrodinger equation; one, two and three dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta, Time-independent perturbation theory and applications; variational method; WKB approximation; Time dependent perturbation theory and Fermi's Golden Rule; Selection rules; Semi-classical theory of radiation; elementary scattering theory, phase shifts, partialwaves, Born approximation; Identical particles, Pauli's exclusion principle, spin-statistics connection, Relativistic quantum mechanics: Klein Gordon and Dirac equations.

5. **Atomic and Molecular Physics**

Spectra of one- and many-electron atoms; Stern-Gerlach experiment, LS and JJ coupling; hyperfine structure; Zeeman and Stark effects; electric dipole transitions and selection rules; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR; Lasers-spontaneous and stimulated emission, optical pumping, population inversion, coherence (temporal and spatial) simple description of Ruby laser, CO_2 and He-Ne Lasers, optical fibers.

6. **Thermodynamics and Statistical Physics**

Laws of thermodynamics and their consequences; macrostates and microstates; phase space; probability ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck's distribution law; Bose-Einstein condensation; first and second order phase transitions, critical point, Random walk and Brownian motion; Introduction to non-equilibrium processes; Diffusion equation.

7. **Condensed Matter Physics**

Crystal classes and systems, 2d & 3d lattices, Bonding of common crystal structures, unit cells, Miller indices, reciprocal lattice, diffraction methods for structure determination; concept of amorphous, single and polycrystalline structures and their effect on properties of materials. crystal growth techniques, elastic properties of solids; defects in crystals; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids; metals, semiconductors and insulators; transport properties; optical, dielectric and magnetic properties of solids; elements of superconductivity, meissner effect, Type – 1 and Type – 2 super conductions, BCS, paining mechanism, nanomaterials.

Dielectric properties - dielectrics ; polarization mechanisms, Clauslus – equation, plezo, pyto and ferro – electricity.

Magnetism in materials - dia and para magnetism; exchange interactions, magnetic order, ferro, anti – ferro and ferrimagnetism.

8. **Nuclear and Particle Physics**

Basic nuclear properties: size, shape, charge distribution, spin and parity; Binding energy, semi-empirical mass formula; Liquid drop model; Fission and fusion; nature of the nuclear force, form of nucleon-nucleon potential; charge-independence and charge-symmetry of nuclear forces; Isospin; deuteron problem; evidence of shell structure, single-particle shell model, its validity and limitations; rotational spectra;

elementary ideas of alpha, beta and gamma decays and their selection rules; nuclear reactions, reaction mechanisms, compound nuclei and direct reactions; classification of fundamental forces; elementary particles (quarks, baryons, mesons, leptons); Spin and parity assignments, iso-spin, strangeness; Gell-Mann-Nishijima formula; C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction; Relativistic kinematics.

9. **Electronics**

Semiconductor devices, including diodes, junctions, transistors, field effect devices, homo and hetero junction devices, device structure, device characteristics, frequency dependence and applications; optoelectronic devices, including solar cells, photo detectors, and LEDs; high-frequency devices, including generators and detectors; operational amplifiers and their applications; digital techniques and applications (flip-flops, registers, counters, comparators and similar circuits); basic digital logic circuits, A/D and D/A converters; microprocessor and microcontroller basics.

10. **Characterization techniques**

X-ray diffraction, scanning electron microscopy, differential scanning calorimetry.

(VIII) ENVIRONMENTAL SCIENCE

- Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere.
- Natural resources, conservation and sustainable development
- Chemical compositions of Air: Classification of elements, Particles, Ions and radicals in atmosphere, chemical processes for formation of inorganic and organic particulate matter, thermo-chemical and photochemical reaction in atmosphere, Oxygen and Ozone chemistry, chemistry of air pollutants , photochemical smog
- Water Chemistry: Chemistry of water, Concept of DO, BOD, COD.
- Soil Chemistry: Inorganic and organic components of soil, Nitrogen pathways and NPK in soils
- Toxic Chemicals in the environment- Arsenic, Cadmium, Lead, Mercury, Carbon monoxide, Ozone and PAN, pesticides, insecticides and carcinogens.

- Ecosystem: Structure and functions, Abiotic and biotic components, energy flows, food chains, Food web, Ecological pyramids, types and diversity; Ecological succession, population, community ecology ad Parasitism, Prey predator relationships
- Common Flora and fauna in India; Endangered and Threatened Species
- Biodiversity and its conservation: definition, Hotspots of biodiversity, Strategies for biodiversity conservation, National parks and Sanctuaries, gene pool
- Earth Process and Geological hazards, including floods, landslide, earthquakes, volcanism and avalanche.
- Mineral Resources and environment; Trace elements and health, Epidemiological issues (Goitre, Fluorosis and Arsenic)
- Principles of remote sensing and its application of environmental science; Application of GIS in environmental Management
- Non-conventional sources of energy: Hydroelectric power, tidal, Ocean thermal energy conversion, Wind, Geothermal energy, Solar collector, Photovoltaic, solar pond, nuclear energy-Fission and fusion, Bio-energy from biomass and biogas, Anaerobic digestion, energy use pattern in different parts of the World; Environmental implication of energy uses. Fossil fuels.
- AIR: Natural and anthropogenic source of pollution, Primary and Secondary pollutants, Methods of monitoring and control of air pollution SO_2, NOx, CO, SPM, effects of pollutant on human beings, plants, animals, material and on climate, Acid rain, Air Quality standards; Vehicular pollution
- Global environmental problems-Ozone depletion, global warming and climatic change
- Water: types, Sources and consequences of water pollution, Physico-chemical and Bacteriological sampling and analysis of water quality, Sewage waste water treatment and recycling .Water quality standards; Eutrophication and restoration of Indian lakes; Rain water harvesting
- Soil: Physico-chemical and Bacteriological sampling as analysis of soil quality, Soil pollution control, Desertification and it's control; Wet lands conservation
- Noise: Sources of noise pollution Measurements of noise and indices, Noise exposure levels and Standards. impact of noise on human health
- Marine pollution and control, Radioactive and thermal Pollution
- Impact Assessment Methodologies; Guidelines for Environmental Audit

- Concept and strategies of sustainable development; Environmental priorities in India and Sustainable development
- Sources and generation of solid waste, their characteristics, chemical composition and classification, Different methods of disposal and management of solid waste (Hospital Waste and Hazardous waste) recycling of waste material. Waste minimization technologies

(IX) MANAGEMENT STUDIES

Unit—I

Managerial Economics-Demand Analysis
Production Function
Cost-output relations
Market structures
Pricing theories
Advertising
Macro-economics
National Income concepts
Infrastructure—Management and Policy
Business Environment
Capital Budgeting

Unit—II

The concept and significance of organisational behaviour—Skills and roles in an organisation—Classical, Neo-classical and modern theories of organisational structure—Organisational design—Understanding and Managing individual behaviour personality—Perception—Values—Attitudes—Learning—Motivation.
Understanding and managing group behaviour, Processes—Inter-personal and group dynamics—Communication—Leadership—Managing change—Managing conflicts.
Organisational development

Unit—III

Concepts and perspectives in HRM; HRM in changing environment
Human resource planning—Objectives, Process and Techniques
Job analysis—Job description
Selecting human resources
Induction, Training and Development
Exit policy and implications
Performance appraisal and evaluation
Potential assessment
Job evaluation
Wage determination
Industrial Relations and Trade Unions
Dispute resolution and Grievance management
Labour Welfare and Social security measures

Unit—IV

Financial management—Nature and Scope
Valuation concepts and valuation of securities
Capital budgeting decisions—Risk analysis
Capital structure and Cost of capital
Dividend policy—Determinants
Long-term and short-term financing instruments
Mergers and Acquisitions

Unit—V

Marketing environment and Environment scanning; Marketing Information Systems and Marketing research; Understanding consumer and industrial markets; Demand Measurement and Forecasting; Market Segmentation—Targeting and Positioning; Product decisions, Product mix,

Product Life Cycle; New product development; Branding and Packaging; Pricing methods and strategies.

Promotion decisions—Promotion mix; Advertising; Personal selling; Channel management; Vertical marketing systems; Evaluation and control of marketing effort; Marketing of services; Customer relation management;

Uses of internet as a marketing medium—other related issues like branding, market development, Advertising and retailing on the net.

New issues in Marketing.

Unit—VI

Role and scope of production management; Facility location; Layout planning and analysis; Production planning and control—production process analysis; Demand forecasting for operations; Determinants of product mix; Production scheduling; Work measurement; Time and motion study; Statistical Quality Control.

Role and scope of Operations Research; Linear Programming; Sensitivity analysis; Duality; Transportation model; Inventory control; Queueing theory; Decision theory; Markov analysis; PERT/CPM.

Unit—VII

Probability theory; Probability distributions—Binomial, Poisson, Normal and Exponential; Correlation and Regression analysis; Sampling theory; Sampling distributions; Tests of Hypothesis; Large and small samples; *t*, *z*, *F*, Chi-square tests.

Use of Computers in Managerial applications; Technology issues and Data processing in organizations; Information systems; MIS and Decision making; System analysis and design; Trends in Information Technology; Internet and Internet-based applications.

Unit—VIII

Concept of corporate strategy; Components of strategy formulation; Ansoff's growth vector; BCG Model; Porter's generic strategies; Competitor analysis; Strategic dimensions and group mapping; Industry analysis; Strategies in industry evolution, fragmentation, maturity, and decline; Competitive strategy and corporate strategy; Transnationalization of world economy; Managing cultural diversity; Global Entry strategies; Globalisation of financial system

and services; Managing international business; Competitive advantage of nations; RTP and WTO.

Unit—IX

Concepts—Types, Characteristics; Motivation; Competencies and its development; Innovation and Entrepreneurship; Small business—Concepts Government policy for promotion of small and tiny enterprises; Process of business opportunity identification; Detailed business plan preparation; Managing small enterprises; Planning for growth; Sickness in Small Enterprises; Rehabilitation of sick enterprises; Intrapreneurship (organisational entrepreneurship).

(X) CHEMISTRY

Physical Chemistry:

1. Basic principles and applications of quantum mechanics – hydrogen atom, angular momentum.
2. Variational and perturbational methods.
3. basics of atomic structure, electronic configuration, shapes of orbitals, hydrogen atom spectra.
4. Theoretical treatment of atomic structures and chemical bonding.
5. Chemical applications of group theory.
6. Basic principles and application of spectroscopy – rotational, vibrational, electronic, Raman, ESR, NMR.
7. Chemical thermodynamics.
8. Phase equilibria.
9. Statistical thermodynamics.
10. Chemical equilibria.
11. Electrochemistry – Nernst equation, electrode kinetics, electrical double layer, Debye-Hückel theory.
12. Chemical kinetics – empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental techniques for fast reactions.
13. Concepts of catalysis.
14. Polymer chemistry. Molecular weights and their determinations. Kinetics of chain polymerization.
15. Solids - structural classification of binary and ternary compounds, diffraction techniques, bonding, thermal, electrical and magnetic properties.
16. Collids and surface phenomena.
17. Data analysis.

Inorganic Chemistry

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules. 3. Concepts of acids and bases.
4. Chemistry of the main group elements and their compounds. Allotropy, synthesis, bonding and structure.
5. Chemistry of transition elements and coordination compounds – bonding theories, spectral and magnetic properties, reaction mechanisms.
6. Inner transition elements – spectral and magnetic properties, analytical applications.
7. Organometallic compounds - synthesis, bonding and structure, and reactivity. Organometallics in homogenous catalysis.
8. Cages and metal clusters.
9. Analytical chemistry- separation techniques. Spectroscopic electro- and thermoanalytical methods.
10. Bioinorganic chemistry – photosystems, porphyrines, metalloenzymes, oxygen transport, electron- transfer reactions, nitrogen fixation.
11. Physical characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-, NQR, MS, electron spectroscopy and microscopic techniques.
12. Nuclear chemistry – nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Organic Chemistry

1. IUPAC nomenclature of organic compounds.
2. Principles of stereochemistry, conformational analysis, isomerism and chirality.
3. Reactive intermediates and organic reaction mechanisms.
4. Concepts of aromaticity.
5. Pericyclic reactions.
6.Named reactions.
7. Transformations and rearrangements.
8. Principles and applications of organic photochemistry. Free radical reactions.
9. Reactions involving nucleophotic carbon intermediates.
10. Oxidation and reduction of functional groups.
11. Common reagents (organic, inorganic and organometallic) in organic synthesis.
12. Chemistry of natural products such as steroids, alkaloids, terpenes, peptides, carbohydrates, nucleic acids and lipids.
13. Selective organic transformations – chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity. Protecting groups.
14. Chemistry of aromatic and aliphatic heterocyclic compounds.

15. Physical characterisation of organic compounds by IR, UV-, MS, and NMR.

Interdisciplinary topics

1. Chemistry in nanoscience and technology.
2. Catalysis and green chemistry.
3. Medicinal chemistry.
4. Supramolecular chemistry.
5. Environmental chemistry.