

**SYLLABI AND PATTERN OF ENTRANCE EXAMINATIONS FOR
ADMISSION TO PH.D PROGRAMS IN PHARMACEUTICAL
SCIENCES, FOOD TECHNOLOGY, IHTM AND ENGINEERING
(2025-26)**

1. In subjects (Pharmaceutical Sciences, Food Technology, IHTM and Engineering) where NET examination is not conducted by the UGC, an entrance test will be conducted. The syllabus of the Entrance Test is available on the University website.
2. Entrance Test will be of 100 marks of 100 questions and a candidate must secure 50% marks to qualify the same. In case of SC/ST / Differently-abled candidates of Haryana State, a relaxation of 5% of 50 i.e. 2.5% will be allowed. There shall be a deduction of 0.25 marks for each wrong answer.
3. Entrance test syllabus shall consist of 50% of Research Methodology and 50% shall be of subject specific.
4. Question papers shall be in English.

RULES AND GUIDELINES FOR ENTRANCE EXAMINATION / EXAMINATION FOR AWARD OF UNIVERSITY RESEARCH SCHOLARSHIP (URS)

1. The Entrance Examination is meant to assess the candidates' suitability for the Ph.D. Program.
2. No candidate will be admitted to the Entrance Examination Hall unless he/she produces the Admit Card.
3. No request for postponement of Entrance Examination will be entertained under any circumstances.
4. Question paper for the Entrance Examination will consist of objective type multiple-choice questions only with four choices each.
5. The candidates should refer to **"Syllabi for Entrance Examinations"** for outlines of syllabi and composition of Entrance Examination Question Papers.
6. The venue/centre for the Entrance Examination will be Rohtak unless otherwise changed by the University through a special notification.
7. Question Booklet
 - i) The examinees, immediately after taking their seats, will be given a sealed Test Booklet along with OMR Sheet. The examinees are advised to read and follow the instructions on the title and back-page of the question Booklet carefully.
 - ii) Booklet Number and a Booklet Code (A or B or C or D) are given on the front page of the Question Booklet. The examinees must write the Number and the Code carefully in the appropriate places on the OMR/ Answer Sheet.
 - iii) The examinee must affix his/her signature on the front page of the Question Booklet at the place earmarked for this purpose.
 - iv) The Question Booklet has paper seal pasted on it. The examinees should open the Question Booklet by breaking the paper seal only when they are asked to do so by the Invigilator.
 - v) The examinees must check immediately after breaking the seal that the Question Booklet contains the same number of questions as indicated in the instructions at the top. If any deficiency is noticed in the Question Booklet, the Invigilator may be requested to replace the same immediately.
 - vi) The Question Booklet and the Answer Sheet must be returned to the Invigilator before leaving the Examination Hall.
8. OMR/Answer Sheet
 - i) The examinees must check their Answer Sheets which are serially numbered. If any discrepancy is detected, the same should be brought to the notice of the Invigilator immediately.
 - ii) Use good quality ball point pen (blue or black) strictly as directed on the OMR Answer Sheet.
 - iii) Do not fold or put any stray mark or do any rough work on the Answer Sheet.
 - iv) Fill in the Roll No., Question Booklet No., and Booklet Code in the blocks provided for the purpose on the OMR Answer Sheet.

- v) The examinee must affix his/her signature with the ball point pen at the appropriate place on the OMR Answer Sheet.

9. Rough Work

The examinees should not do any rough work or writing work on the OMR Answer Sheet. Rough work, if any, may be done in the Test Booklet itself.

10. The following procedure shall be followed in the Examination Hall:

- i) No candidate will be allowed to enter the Examination Hall 15 minutes after the commencement of the examination.
- ii) No candidate will be allowed to leave the Examination Hall before the expiry of time.
- iii) The doors of Examination Hall will be opened 30 minutes before the time fixed for commencement of the Examination.
- iv) Each examinee will be given a sealed Test Booklet with an OMR Answer Sheet 10 minutes before the commencement of the Examination.
- v) The examinees, immediately on receipt of the Test Booklet, will fill in the required particulars with the ball point (black or blue) pen only on its cover page.
- vi) The examinees shall not open the Test Booklet until asked to do so by the Invigilator.
- vii) Use of calculators, slide rules or log tables, books, papers, cellular phones or any other electronic device, etc. is not allowed.
- viii) The Examination will start exactly at the appointed time. The Invigilator will make an announcement to this effect. The examinees should start writing only after the announcement of the Invigilator.
- ix) The Invigilator will check 'Admit Card' of each examinee during the Examination to satisfy himself about each of them.
- x) The Invigilator will also put his signature in the place provided in the question booklet and OMR Answer Sheet.
- xi) The examinees shall bring their own ball point pens (blue or black), eraser, and foot-rule. These items will not be supplied by the University.
- xii) After completing the test and before handing over the Test Booklet and Answer Sheet, the examinees must check again that all the particulars required in the Test Booklet and the Answer Sheet has been correctly written.
- xiii) A signal will be given at the beginning of the Examination and at half-time. A signal will also be given before the closing time when the examinees must stop marking responses.
- xiv) The candidates should mandatorily wear face mask for appearing in Entrance Exam. The candidates are also directed to bring their own Sanitizer and transparent water bottles.

11. Punishment for use of Unfair Means

If any candidate is found guilty of any breach of rules mentioned in the Prospectus or guilty of using unfair means, he/she will be liable to be punished according to the Act, Statutes, Ordinances, and Rules & Regulations of M.D. University, Rohtak.

12. Re-Checking:

There shall be no re-checking or re-evaluation of answer sheets of the Entrance Examination. No request in this regard shall be entertained.

13. If any person(s) or officer(s) or official(s) dealing with the conduct of Entrance Examination is found indulged in any act which may result in the leakage of the question paper(s) or render help directly or indirectly in the use of unfair means in the examination, he/she shall be liable to be prosecuted under the Indian Penal Code.

14. Legal Jurisdiction:

All disputes pertaining to the conduct of Entrance Examination and admissions shall fall within the jurisdiction of Rohtak only.

15. Enquiries regarding Entrance Examinations, if any, may be made till a day before the Entrance Examinations during office hours and not on the day of Entrance Examination with the Department concerned.

16. Question Booklet along with answer key of all the A,B,C and D code may be got uploaded on the University website by the Director, University Computer Centre immediately after the conduct of Entrance Examination with the help of a Committee duly constituted by the Head of the concerned department for preparation/declaration of result. However, in case of faculty of Life Sciences, the Dean will do the needful with help of the Committee constituted by him.

17. Candidate may raise/valid objection/complaint if any, with regard to discrepancy in the Question Booklet/Answer key within 24 Hours of uploading the same on the University website. The complaint be sent by the students to the Controller of Examinations by hand or through email (coe@mdurohtak.ac.in). Thereafter no complaint in any case, will be considered.

18. Confidential material of Entrance Examinations i.e. used OMR/Answer Sheet of the appeared candidates received from the examination Centres may be kept in safe custody by the concerned HODs/Deans for future reference.

19. The process for compilation of result may be started after consideration of complaints received from the examinees, if any with regard to discrepancy in the question booklet/answer key. The complaints received from the students with regard to discrepancy in question booklet/answer key be resolved normally in 48 hours.

20. Keeping in view of requests of the candidates from time to time for supplying copy of OMR/Answer Sheet of Entrance Examinations, the Committee recommended that carbonless OMR/Answer sheet be got printed by the Controller of Examinations so that the same to be retained by the candidate.

Ph.D Entrance Examination Syllabus: Civil Engineering

Note: 1. Entrance Test will be of 100 marks of 100 questions and a candidate must secure 50% marks to qualify the same. In case of SC/ST / Differently-abled candidates of Haryana State, a relaxation of 5% of 50 i.e. 2.5% will be allowed. There shall be a deduction of 0.25 marks for each wrong answer.

2. Entrance test syllabus shall consist of 50% of Research Methodology and 50% shall be of subject specific.

3. Candidates are permitted to use a scientific calculator during the examination.

Section-A (Research Methodology)

Meaning of Research, Research Process and Scope of Research in various disciplines, Scientific methods of research, selecting a topic of research, Ethics in Research, Methods of data collection – questionnaire/schedule; questionnaire designing, interview and observational Methods, Primary and Secondary sources of data collection, Writing of books and research papers, report writing; pre-writing consideration, thesis writing, format of report writing, formats of publication in research journals, bibliography, referencing and footnotes, major of central tendency, Data analysis using suitable quantitative techniques with application of computers, binary system, octal and hexadecimal system

Section-B (Subject Specific: Civil Engineering)

Structural Engineering

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion; buckling of column, combined and direct bending stresses.

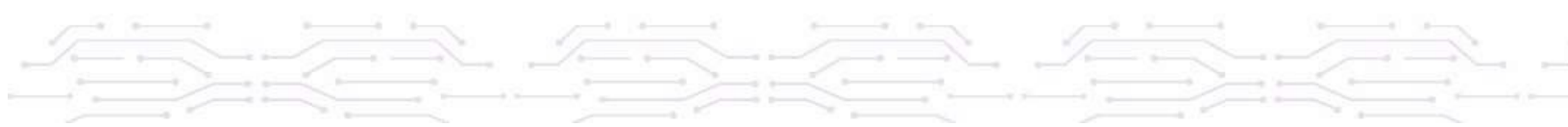
Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines.

Construction Materials and Management: Construction Materials: Structural Steel – Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis-PERT and CPM.

Concrete Structures: Working stress and Limit state design concepts; Design of beams, slabs, columns.

Steel Structures: Working stress and Limit state design concepts; Design of tension and

Compression members, beams and beam-columns, column bases; Connections- simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis-beams and frames.



Geotechnical Engineering

Soil Mechanics: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability-one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One- dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand.

Foundation Engineering: Sub-surface investigations-Drilling boreholes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils–Boussinesq's theory; Pressure bulbs, Shallow foundations– Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations–dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, negative skin friction.

Water Resources Engineering

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures.

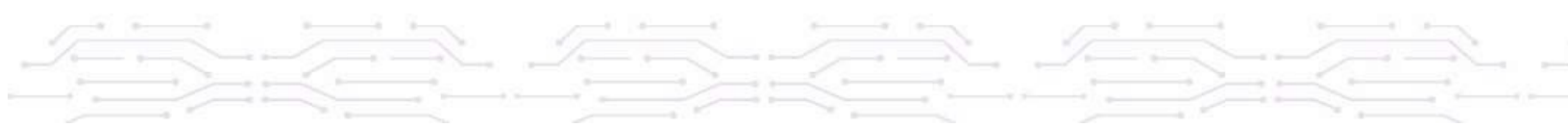
Environmental Engineering

Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment.

Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes,



engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

Transportation Engineering

Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments. Geometric design of railway Track – Speed and Cant. Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.

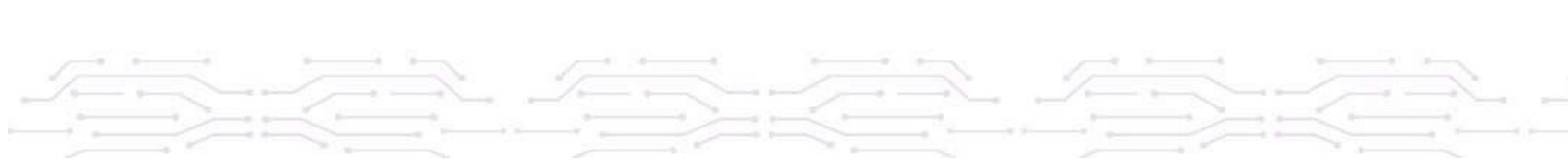
Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes.

Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity.

Geomatics Engineering

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves.

Photogrammetry and Remote Sensing - Scale, flying height; Basics of remote sensing and GIS.



Ph D Entrance Examination Syllabus: Electronics and Communication Engineering

Note:1 Entrance Test will be of 100 marks of 100 questions and a candidate must secure 50% marks to qualify the same. In case of SC/ST / Differently-abled candidates of Haryana State, a relaxation of 5% of 50 i.e. 2.5% will be allowed. There shall be a deduction of 0.25 marks for each wrong answer.

2. Entrance test syllabus shall consist of 50% of Research Methodology and 50% shall be of subject specific.

Section-A (Research Methodology)

Meaning of Research, Research Process and Scope of Research in various disciplines, Scientific methods of research, selecting a topic of research, Ethics in Research, Methods of data collection –questionnaire/schedule; questionnaire designing, interview and observational Methods, Primary and Secondary sources of data collection, Writing of books and research papers, report writing; pre-writing consideration, thesis writing, format of report writing, formats of publication in research journals, bibliography, referencing and footnotes, major of central tendency, Data analysis using suitable quantitative techniques with application of computers, binary system, octal and hexadecimal system

Section-B (Subject Specific: Electronics and Communication Engineering)

Section 1: Networks, Signals and Systems

Circuit Analysis: Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform.

Linear 2-port network parameters, wye-delta transformation.

Continuous-time Signals: Fourier series and Fourier transform, sampling theorem and applications.

Discrete-time Signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay.

Section 2: Electronic Devices

Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors.

Carrier Transport: Diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations.

P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.

Section 3: Analog Circuits

Diode Circuits: Clipping, clamping and rectifiers.

BJT and MOSFET Amplifiers: Biasing, AC coupling, small signal analysis, frequency response. Current mirrors and differential amplifiers.

Op-amp Circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

Section 4: Digital Circuits

Number Representations: Binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders.

Sequential Circuits: Latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay.

Data Converters: Sample and hold circuits, ADCs and

DACs. **Semiconductor Memories:** ROM, SRAM, DRAM.

Computer Organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

Section 5: Control Systems

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

Section 6: Communications

Random Processes: Auto correlation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog Communications: Amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers.

Information Theory: Entropy, mutual information and channel capacity theorem.

Digital Communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER. Fundamentals of error correction, Hamming codes, CRC.

Section 7: Electromagnetics

Maxwell's Equations: Differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector.

Plane Waves and Properties: Reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

Transmission Lines: Equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.

Ph D Entrance Examination Syllabus: Mechanical Engineering

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2. Entrance test syllabus shall consist of 50% of Research Methodology and 50% shall be of subject specific.

Section-A (Research Methodology)

Meaning of Research, Research Process and Scope of Research in various disciplines, Scientific methods of research, selecting a topic of research, Ethics in Research, Methods of data collection –questionnaire/schedule; questionnaire designing, interview and observational Methods, Primary and Secondary sources of data collection, Writing of books and research papers, report writing; pre-writing consideration, thesis writing, format of report writing, formats of publication in research journals, bibliography, referencing and footnotes, major of central tendency, Data analysis using suitable quantitative techniques with application of computers, binary system, octal and hexadecimal system

Section-B (Subject Specific: Mechanical Engineering)

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,

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 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.

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. Welding processes friction stir processing, friction stir welding, TIG welding, MIG welding, SAW welding and all advanced welding processes

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.

Ph D Entrance Examination Syllabus: Electrical Engineering

Note:1 Entrance Test will be of 100 marks of 100 questions and a candidate must secure 50% marks to qualify the same. In case of SC/ST / Differently-abled candidates of Haryana State, a relaxation of 5% of 50 i.e. 2.5% will be allowed. There shall be a deduction of 0.25 marks for each wrong answer.

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Section-B (Subject Specific: Electrical Engineering)

Electric Circuit Analysis:

Ideal voltage and current sources, R, L, C elements, Network solution methods: KCL, KVL, Node and Mesh analysis. Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem, two port networks, balanced three phase circuits, star-delta transformation, Complex power and power factor in AC circuits.

Analog and Digital Electronics:

Simple diode circuits: clipping, clamping, rectifiers, Amplifiers: biasing, equivalent circuit and frequency response, sample and hold circuits. Representation of continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Laplace Transform and Z transform.

Electrical Machines:

Single phase transformer: open circuit and short circuit tests, Three-phase transformers: connections, parallel operation conditions; Auto-transformer, Electromechanical energy

conversion fundamentals. DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics. Induction motor: operating principle of single-phase induction motors; Three-phase induction machines: Rotating Magnetic field, performance, torque-speed characteristics, starting and speed control. Synchronous machines: cylindrical and salient pole machines, performance and characteristics, Parallel operation of alternators, starting of synchronous motors.

Power Systems:

Basic concepts of electrical power generation, AC and DC transmission concepts, Models and performance of transmission lines, 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, directional and distance protection, Circuit breakers, System stability concepts, Equal area criterion.

Power Electronics:

Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost Converters; Voltage and Current commutated Single phase and three-phase voltage and current source inverters, sinusoidal pulse width modulation.

Control Systems:

Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Routh-Hurwitz and Nyquist, Root loci.

Electrical and Electronic Measurements:

Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, multimeters, Oscilloscopes, Error analysis.

Syllabus for the Ph.D. Entrance examination in Food Technology

Note:- The entrance test will be of 100 marks with 100 multiple choice type questions with each question having 4 answer options. 50% of the total questions are to be set from subject specific portion and remaining 50% from Research Methodology section.

Subject specific

Unit 1

Introductory Food Technology Introduction to food technology. Food processing industries/institutions/food scientists of importance in India. Food attributes viz. colour, texture, flavour, nutritive value and consumer preferences. Causes of food spoilage, sources of microbial contamination of foods, food borne illnesses, water activity and its relation to spoilage of foods. Spoilage of processed products and their detection. Principles and methods of food preservation. Food fortification, Composition and related quality factors for processing. Methods of food preservation such as heat processing, pasteurization, canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives. Refrigerated and modified atmosphere storage. Aseptic preservation, hurdle technology, hydrostatic pressure technology and microwave processing. Use of non-thermal technologies (microfiltration, bacteriofugation, ultra high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating) and biological technologies (antibacterial enzymes, bacteriocins, proteins and peptides) in food processing.

Unit 2:

Technology of Foods of Plant Origin (a) Fruits and Vegetable Processing: Post harvest handling and storage of fresh fruits and vegetables. Preparation of fruits and vegetables for processing. Minimally processed products. Cold chain logistics. ZECC (Zero Energy Cool Chambers), CCSR (Charcoal cool storage Rooms) Thermal processing and process time evaluation for canned products, process optimization, aseptic canning, methods for canning of different fruits, and vegetables; Dehydration and associated quality changes during drying and storage of dehydrated products. Solar drying. Intermediate moisture foods. Preparation and utilization of fruits and vegetables juices in non-fermented/ fermented/ aerated beverages, health drinks. Membrane technology. Chemistry and manufacture of pectin, role in gel formation and products like jellies and marmalades. Technology of preservatives, pickles, chutney's and sauces. Nature and control of spoilage in these products. Re-structured fruits and vegetables. By products utilization of fruits and vegetable processing industry. Processing methods of frozen fruits and vegetables, IQF products, packaging, storage and thawing. Role of Pectinases. Tomato products such as juice,

puree, paste, soup, sauce and ketchup. Other convenience foods from fruits and vegetables. Beverages, tea, cocoa and coffee processing. Medicinal and aromatic plants: their therapeutic values. Spice Processing viz. cleaning, grading, drying, grinding, packaging and storage. Oleoresins and essential oils. (b) Food grain Processing: Structure, composition of different grains like wheat, rice, barley, oat, maize and millets. Anti-nutritional factors in food grains and oilseeds. Milling of grains. Wheat flour/semolina and its use in traditional/non-traditional foods like breads, biscuits, cakes, doughnuts, buns, pasta goods, extruded, confectionary products, breakfast and snack foods. Rheology of wheat and rice flour. Preparation of vital wheat gluten and its utilization. Instant ready mixtures. Enzymes (amylases and proteases) in milling and baking. Milling and parboiling of rice; by-products of rice milling and their utilization. Processed products from rice. Pearling, malting, brewing and preparation of malted milk feeds from barley. Significance of β -glucans. Milling of oats and its processing into flakes, porridge and oatmeal. Wet and dry milling of corn, manufacture of corn flakes, corn syrup, corn starch, corn steep liquor and germ oil. Structure and composition of pulses and their importance in Indian diet. Milling and processing of pulses viz. germination, cooking, roasting, frying, canning and fermentation. Use in traditional products, protein concentrates and isolates. Modified starches and proteins. Oilseeds: edible oilseeds, composition and importance in India. Oilseed processing. Oil extraction and its processing, byproducts of oil refining. Production, packaging and storage of vanaspati, peanut butter, protein concentrates, isolates and their use in high protein foods. Export of oilseed cakes. International market and consumer preferences for quality in cakes for use in textured vegetable proteins. Millets: composition, nutritional significance, structure and processing. Dairy analogues based on plant milk. Spices Processing: Oleoresin and essential oil extraction

Unit 3:

Technology of Foods of Animal Origin

(a) Technology of Milk and Milk Products: Milk and Milk production in India. Importance of milk processing plants in the country. Handling and maintenance of dairy plant equipment. Dairy plant operations viz. receiving, separation, clarification, pasteurization, standardization, homogenization, sterilization, storage, transport and distribution of milk. Problems of milk supply in India. UHT, toned, humanized, fortified, reconstituted and flavoured milks. Technology of fermented milks. Milk products processing viz. cream, butter, ghee, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice-cream, butter oil, khoa, channa, paneer and similar products. Judging and grading of milk products. Cheese spreads by spray and roller drying techniques. EMC (Enzyme modified cheese), Enzymes in dairy processing. Insanitization viz. selection and use of dairy cleaner and sanitizer. In plant cleaning system. Scope and functioning of milk supply schemes and various national and international organizations. Specifications and standards in milk processing industry. Dairy plant sanitation and waste disposal.

(b) Technology of Meat / Fish / Poultry Products: Scope of meat, fish and poultry processing industry in India. Chemistry and microscopic structure of meat tissue. Ante mortem inspection. Slaughter and dressing of various animals and poultry birds. Post mortem examination. Rigor

mortis. Retail and wholesale cuts. Factors affecting meat quality. Curing, smoking, freezing, canning and dehydration of meat, poultry and their products. Sausage making. Microbial factors influencing keeping quality of meat. Processing and preservation of fish and its products. Handling, canning, smoking and freezing of fresh water fish and its products. Meat tenderization and role of enzymes in meat processing. Utilization of by-products. Zoonotic diseases. Structure and composition of egg and factors affecting quality. Quality measurement. Preservation of eggs using oil coating, refrigeration, thermo stabilization and antibiotics. Packing, storage and transportation of eggs. Technology of egg products viz. egg powder, albumen, flakes and calcium tablets. Industrial and food user physiological conditions and quality of fish products.

Unit 4:

Food Quality Management Objectives, importance and functions of quality control. Quality systems and tools used for quality assurance including control charts, acceptance and auditing inspections, critical control points, reliability, safety, recall and liability. The principles and practices of food plant sanitation. Food and hygiene regulations. Environment and waste management. Total quality management, good management practices, HACCP and codex in food. International and National food laws. US-FDA/ISO-9000 and FSSAI. Food adulteration, food safety. Sensory evaluation, panel screening, selection methods. Sensory and instrumental analysis quality control. Quality control of food at all stages and for packaging materials. Non-destructive food quality evaluation methods.

Unit 5:

Food Engineering/Packaging and Labelling Unit operations of food processing viz. grading, sorting, peeling and size reduction machineries for various unit operations, energy balance in food processing. Packaging materials viz. properties and testing procedures, packaging of fresh and processed foods. Shelf life studies. Recent trends in packaging, aseptic, modified atmosphere, vacuum and gas packaging. Nutritional labelling requirements of foods. Requirements and functions of containers. Principles of package design.

Unit 6:

Food Microbiology & Biotechnology Fermentation technology, fermented food products (animal and plant based), microbial spoilage of foods, bacterial growth curve, hurdle technology. Role of biotechnology in productivity of plants, livestock and microbes of improved nutrition and quality. Use of biotechnology in production of food additives viz. preservatives, colorants, flavours. Use of biotechnologically improved enzymes in food processing industry, biomass production using industrial wastes. Single cell proteins, Food contaminants viz. aflatoxins. Food intoxication and infection. Consumer concerns about risks and values, Biotechnology and food safety.

Unit 7:

Flavour Chemistry Technology Flavour composition of foods/beverages (identification and quantitative analysis of the flavour precursors and their products, characterization of the staling

reaction using stable isotopes). Flavour composition of foods/beverages in relation with maturation and microbial activity/or the processing conditions (e.g. fermented dairy products, beer, wine, honey, fruits). Analysis of odour-active compounds of food/beverages (Charm analysis). Synthesis of flavour by microorganisms and plant cells. Lipid derived flavours. Investigation of equilibrium of key flavour compounds that govern the flavour stability of beverages. Natural antioxidant constraints in spices. Role of microorganisms in flavour development. Flavor emulsions, flavour composites, essential oils and oleoresins.

Unit 8:

Consumer Sciences / Food Product Development / Health Foods Socio-cultural, psychological economical consideration for food appearance, domestic and export marketing. Consumer trends and their impact on new product development. Product development viz. to conceive ideas, evaluation of ideas, developing ideas into products, test marketing and commercialization. Role of food in human nutrition. Nutritional disorders, natural contaminants and health hazards associated with foods. Diet therapy. Therapeutic / Engineered / Fabricated and Organic foods/ Nutraceutical and functional foods.

Research Methodology section

Unit 1

Research methodology and experimental design: Guidelines for design of experiments, materials and methods, designing experiments for food analysis, types of samples and sampling techniques, characteristics of a good sample, sampling and non-sampling errors, preparation of samples, performing experiments, compilation and documentation of data.

Unit 2

Thesis writing, presentation and research publication: Format of the research report, style of writing the report, references and bibliography, effective presentation and discussion of results/findings, significance of writing research papers and review articles, impact factor and citation index, intellectual property rights and plagiarism.

Unit 3

Publication ethics: definition, introduction and importance, best practices/ standard setting initiatives and guidelines: COPE, WAME, etc, conflict of interest, publication misconduct: definition, concept, problem that leads to unethical behaviour and vice versa , types, violation of publication ethics, authorship and contributorship, identification of publication misconduct, complaints and appeals, predatory publishers and journals.

Unit 4

Databases (Indexing databases, Citation databases: Web of Science, Scopus, etc), Research Metrics (Impact factor of journal as per journal citation report, SNIP, SIR, IPP, Cite Score)

Unit 5

Statistical applications and data analysis: An overview of application of central tendency and dispersion, standard deviation, standard error of mean, coefficient of variation, variance, population null hypothesis, level of significance and confidence, t-test for one and two sample means, F test for two variances, analysis of variance (ANOVA) (One way and two way), correlation and regression analysis.

Institute of Hotel & Tourism Management

M.D University Rohtak-Haryana

Subject : Hotel Management

Note: The examiner has to set a total of 100 multiple choice questions of 1 mark each. The distribution of questions should be as per the table given below:

Unit No.	Number of questions to be set
I	10
II	10
III	10
IV	10
V	5
VI	5
VII	50

Unit – I

Front Office

Hospitality-Introduction, concept, development over the ages in context of Indian and International hospitality Industry.

The Hotel Industry: Organization of Hotels, Ownership structure:(Sole Proprietorship, Partnership, Franchisees and Management Contract). Major Hotel Chains in India.

Overview of major Hotel departments. Inter and Intra departmental relationships.

Introduction to Front Office: Layout of the front office, Different section of the front office and their Importance, Qualities of Front Office staff.

Organizational set-up of Front office Department in small, medium and large hotels. Job description and Job specification of different front office personnel.

Basic Information for Front Desk Agents

Different types of rooms. Numbering of rooms and food plan, Basis of charging a guest.

Tariff and tariff fixation, Terms used at Front Desk.

Reservation

Sources & Modes of Reservation, Types of Reservation, Systems of Reservation, Amendments and cancellations procedures, Group reservation, overbooking. Modes of Payments- Advantages and Disadvantages

Registration

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Pre-registration activities, Methods of registration, Room & rates assignment, Handling registration of Foreigners, Room change procedure.

Telephonic etiquettes/ manners, the need for developing the telephone skills

Guest Accounting

Types of Accounts maintained at the front office, Front office cashiering Guest check out procedures, Preparation of bills- manual, mechanical & fully automated system, Express check out (ECO), Presentation & settlement – Cash & credit note, handling foreign exchange.

Night Auditing, Control of cash & credit

Concept of Night Auditing, Purpose of night audit function, Night auditor's Job, Night audit process/ procedures, preparing the night auditor reports

Concept of cash & credit control, Objectives of credit control measures, Credit control- before arrival, during stay & after departure

Yield management

Concept of yield management, Measuring yield, Objectives & benefits of yield management, Tools & strategies of yield management.

Role of Front office in hotel security. Security Programme- Concept, developing a programme. Key control. Handling emergency situations.

Unit – II

Food and Beverage Service

Introduction to Food and Beverage Service

Introduction, Sections and their Importance. Types of F&B outlets. Ancillary departments. Qualities of F&B staff. Organizational set-up of F&B Service department in small, medium and large hotels. Job description and Job specification of different front office personnel. Career opportunities in F&B Industry. Latest trends in F&B Service Industry.

Food & Beverage Service Equipment

Types & Usage of Equipment - Furniture, Chinaware, Silverware. Glassware, Linen & Disposables, Special Equipment. Role of Kitchen stewarding department. Care and maintenance of F&B service equipments.

F&B Service Methods

Table Service –English / Silver, American, French, Russian Self Service – Buffet & Cafeteria. **Specialized Service** – Gueridon, Tray, Trolley, Lounge, Buffet service and Banquet procedures etc.

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Single Point Service – Take Away, Vending Kiosks, Food Courts & Bars, Automats. Mis-en-place & Mis-en-scene.

Breakfast: - Continental, English, American and Indian, Introduction, Types, layout, cover, Accompaniments and services; Latest trends in breakfast

Room Service: Introduction, types, importance, organizational structure & service procedure.

Menu: Introduction, types, importance. Menu Planning, considerations and constraints

French Classical menu. Classical Foods & its Accompaniments with Cover. Rules for waiting at a Table.

Non Alcoholic Beverages: Introduction, Classifications and Types.

Tea- History, types, production process, service and storage. **Coffee-** History, types, production process, service and storage.

Alcoholic Beverages: Introduction, classifications, types- a brief detail. **Beer-** History, types, production process, national and international brands, service and storage.

Spirits- History, types, production process, national and international brands, service and storage

Wine: Introduction, classifications, types, production process. Wine tasting and faults. Wine labelling. Pairing alcohol and food. Knowledge of Wine grapes, and wine regions. International wine brands. Old world wine and New world wine- a brief introduction. Professional wine service and storage.

Banquet management: Introduction, types, organizational structure, layout. Banquet booking procedure. Staff and space required for different kinds of banquet functions. Banquet menu. Banquet forms and formats.

Buffet – introduction, types, equipments and buffet presentation techniques. Current trends in banquet and buffet operations

Advance Bar Layout & Design – Types of Bar , Design of Bar, Major Bar Equipments, Bar Accessories, Consumable Supplies

Glassware – commonly used, Storage & Handling of Glassware

Cocktails and Mocktails; Emerging trends in bar operations

Beverage control: Introduction, Procedure, techniques and importance of beverage control, Purpose and standards of Beverage control: purchasing, receiving, storing and issuing. BOT. Inventory control. New trends in bar and beverage control operations.

Unit – III

Accommodation Operation & Management

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Accommodation Sector in India:

Hotel Classification, Types, Indian & Foreign Origin Hotel Chains in India, HRD perspective with special reference to India – Requirements, Training facilities, Constraints and scope, Hotel.

Introduction: Meaning and definition. Importance of Housekeeping; Housekeeping Department: Organizational framework of the Department (Large/Medium/Small Hotel), Roles of Key Personnel in Housekeeping, Job Description and Job Specification of staff in the department, Attributes and Qualities of the Housekeeping staff - skills of a good Housekeeper, Inter departmental Coordination with more emphasis on Front office and the Maintenance department.

Cleaning Science: Types of cleaning equipments, selection, general principles; Types of cleaning- daily, weekly spring and deep cleaning, Housekeeping control desk-importance, role; Types of registers and files maintained; Types of Keys and Keys control; Lost of Found procedure and formats

Cleaning of Public Areas: Cleaning process, Cleaning and upkeep of Public areas, (Lobby, Cloak rooms/ Restaurant/bar/banquet halls/Administration offices/Lifts and Elevators/Staircase/back areas/Front areas/ Corridor), Pest Control: Types of pests, Control procedures.

Cleaning of Guest Rooms: Daily cleaning of (Occupied/Departure vacant Under repair VIP rooms, Weekly cleaning/spring cleaning, Evening service, Systems & procedures involved, Forms and Formats, Guest room cleaning - Replenishment of Guest supplies and amenities

Housekeeping Supervision: Importance of inspection, Check-list for inspection, typical areas usually neglected where special attention is required, Degree of discretion/delegation to cleaning staff.

Linen/Uniform Tailor Room: Layout, Types of Linen, sizes and Linen exchange procedure, Selection of linen, Storage Facilities and conditions, Par stock: Factors affecting par stock, calculation of par stock, Discard Management, Linen Inventory system, Uniform designing: Importance, types, characteristics, selection, par stock

Interior Decoration:- Importance, Definition & Types, Classification, Principles of Design: Harmony, Rhythm, Balance, Proportion, Emphasis, Elements of Design: Line, Form, Colors, Texture. Colour: Color Wheel, Importance & Characteristics, Classification of colors, Color Schemes. Lighting: Classification, Types & Importance

Laundry Management: In-house Laundry vis contract Laundry: merits & demerits, Layout, Laundry Flow process, Equipment (Washing machine, Hydro extractor, Tumbler,

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Calendar/Flat work Iron, Hot head/Steam press, Cooler press, Pressing tables), Stains and Stain removal

Unit – IV

Food Production

Introduction to cookery and evolution. Aims and objectives of cooking food.

Qualities of Kitchen staff. Kitchen Staff organization & liaison of kitchen with other departments. Duties and attributes of kitchen staff.

Handling kitchen accidents e.g. burns, cuts, fractures and Heart attack.

Fire: Introduction, Types and how to extinguish different types of fire.

Various types of fuels used in kitchen. Kitchen equipment- types and selection.

Basic food nutrients, their importance and effect of heat on these.

Ingredients used in cooking: Cereals and Grains, Fruits and Vegetables, and Sweeteners, Egg, Milk, and Milk Products, Salt and Oil & Fat - Types, Purchasing and Storing considerations.

Pre-preparation techniques of ingredients.

Cooking methods- introduction and types.

Stocks, Soups and Sauces – Introduction, classification, important considerations and recipes.

Fish, Poultry, Lamb/Mutton, Beef and Pork- Introduction, cuts, selection points.

Bakery- Introduction, and importance of baking ingredients.

Cake – Cake making methods, Cake Faults- reason for faults

Pastry – Pastry making methods, Pastry Faults- reason for faults

Indian Cuisine: Introduction, ingredients used, unique features and famous dishes.

French Cuisine: Introduction, main ingredients used, special features and famous dishes.

UNIT -V

Marketing

Core concepts in marketing; Needs, wants, demands, products, markets. Marketing management philosophies - Production, product, selling, marketing and societal perspectives. Economic importance of marketing

Hospitality marketing: service characteristics of Hospitality & Tourism Business, Unique feature of tourist demand and hospitality/tourism product, marketing mix. Market segmentation and positioning, consumer buying behaviour, product life cycle, interactive and relationship marketing

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Planning marketing programmes : Product and product strategies; product line product mix; branding and packaging; pricing; considerations, approaches and strategies. Distribution channels and strategies

UNIT-VI

Management

Management: concept, nature, process and function. Management levels managerial skills and roles. The external environment social responsibilities and ethics.

Planning: nature, purpose, types and process. Management by objectives strategies and policies. Decision making process, tools, and techniques Decision making models.

Organizing: concept of organizing and organization. Line and staff, Authority and responsibility, span of control, delegation. Decentralization, conflict and coordination organization structure and design management of change innovation and organization development.

Directing: communication-process, type, barriers, and principles of effective communication. Motivation- Theories and practices, leadership- concept-theories and styles.

Controlling: Process, methods and techniques. Managing international business.

UNIT-VII

Research Methodology

Research: Meaning; types; trends and challenges with special reference to hotel business. Guiding principles in selection of research problem.

Research methodology: meaning; procedural guidelines; and research design field procedure for data collection and analysis techniques: nature, sources of data techniques of data collection. Frequency distribution: meaning; problems and considerations in construction numerical frequency distributions. Measures of central tendency and variation. Correlation and regressions analysis Probability and probability distributions sampling and statistical testing Parametric and non parametric testing

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DEPARTMENT OF PHARMACEUTICAL SCIENCES
MAHARSHI DAYANAND UNIVERSITY ROHTAK
Syllabus for Entrance Examination for admission to
PhD in Pharmaceutical Sciences

Note: The Syllabus consists of six sections (A-F). The examiner will set 50 multiple choice questions from Section-A and 10 multiple choice questions each from section B to F.

S.N.		Questions
1	Section A: Research Methodology	50
	General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques. Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests(students “t” test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxon rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values. Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality. CCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals. Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.	
	Section B: Analytical Techniques	10
	UV-Visible Spectroscopy: Theory, Beer-Lambert’s Law, Instrumentation of UV-Visible Spectrophotometer, choice of solvents and solvent effect, Woodward- Fieser rules for 1,3-Butadienes, cyclic dienes and α, β unsaturated carbonyl compounds IR Spectroscopy: Theory, modes of molecular vibrations, instrumentation of IR spectrometers, factors affecting vibrational frequency, Interpretation of IR spectrum of organic compounds. NMR spectroscopy: Theory of NMR spectroscopy, role of quantum	

	numbers in NMR, instrumentation, relaxation process in NMR, solvent requirement in NMR, chemical shift, factors influencing chemical shift, spin-spin coupling and coupling constant, interpretation of NMR spectrum of simple organic compounds. Mass Spectrometry: Principle, theory and instrumentation of mass spectrometry, resolution of mass spectrometers, ionization techniques and mass analyzers used in mass spectrometry, mass fragmentation and its rules, isotopic peaks. Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Affinity chromatography	
2	Section C: Pharmaceutics	10
	Introduction to dosage form: Definition of the drug. New drug and dosage form. The desirable properties of a dosage form, the need of dosage form. Ideas about the available type of dosage forms and new drug delivery system. Dosage Form Necessities and Additives: Antioxidants, preservatives, coloring agents, flavoring agents and diluting agents, emulsifying agents, suspending agents, ointment bases, solvents, and others. Capsules: Hard gelatin capsules, shell formulation and manufacturing, capsule sizes, storage, filing, cleaning process general formulation contents and evaluation. Soft gelatin capsules, shell formulation, formulation contents, filing, sealing and storage. Microencapsulation, advantages, encapsulation materials, methods of microencapsulation, I.P. formulations Tablets: Types, ideal requirement, classification, granulation methods, general formulation, compression machines, different types of tooling's, difficulties in tableting, evaluation, sugar coating, compression coating, film coating, problems in tablet coatings and their troubleshooting aspects. IP formulations. Parenterals - product requiring sterile packaging: Definition, types advantages and limitations, general formulation, vehicles, production procedure, production facilities, controls, tests, selected IP injections, sterile powders, implants, emulsions, suspensions. Suspensions and Emulsions: Formulation, preparation and evaluation Suppositories: Ideal requirements, bases, manufacturing procedure, evaluation methods, IP products. Semisolids: Definitions, bases, general formulation, manufacturing procedure, evaluation methods, IP products. Liquids (solutions, syrups, elixirs, spirits, aromatic water, liquid for external uses): Definition, types, general formulation, manufacturing procedure, evaluation methods, IP products. Preformulations: Importance, objectives, physical properties and chemical properties characterization such as solubility, particle size, flow characterization, hydrolysis, oxidation, racemization etc.	

	Stability of formulated products: Requirements, drug regulatory aspects, pharmaceutical products stability, shelf life, overages, containers, closures. Reaction rate and order, acid-base catalysis, destabilization and accelerated stability testing. Novel Drug delivery system: Transdermal drug delivery system, controlled drug delivery system, nanoparticles, targeted drug delivery system	
3	Section D: Pharmaceutical Chemistry	10
	Importance of fundamentals of organic chemistry in pharmaceutical sciences: Structure and Properties: Atomic structure, Atomic orbitals, Molecular orbital theory, wave equation, Molecular orbitals, Bonding and Anti-bonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, Structure and physical properties, Intermolecular forces, Acids and bases. Stereochemistry: Nomenclature, isomerism, stereoisomerism, conformational and configurationally isomerism, optical activity, specification of configuration, Reactions involving stereoisomers, chirality, conformations; Stereoselective and stereospecific reactions. Physico-chemical and stereoisomeric (Optical, geometrical) aspects of drug molecules and biological action, Bioisosterism, Drug-receptor interactions including transduction mechanisms; Drug metabolism and Concept of Prodrugs; Principles of Drug Design (Theoretical Aspects): Traditional analog and mechanism based approaches, QSAR approaches, Applications of quantum mechanics, Computer Aided Drug Designing (CADD) and molecular modeling General Anesthetics, Hypnotics and Sedatives, Anticonvulsants, Anti-Parkinsonian drugs, Psychopharmacological agents (Neuroleptics, Anti-depressants, Anxiolytics), Opioid analgesics, Anti-tussives, CNS stimulants; Chemotherapeutic Agents used in bacterial, fungal, viral, protozoal, parasitic and other infections, Antibiotics: β-Lactam, macrolides, tetracyclines, aminoglycosides, polypeptide antibiotics, fluoroquinolones, Anti-metabolites (Including sulfonamides); Anti-neoplastic agents; Anti-viral agents (including anti-HIV).	
4	Section E: Pharmacology	10
	Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Significance of Protein binding. Pharmacodynamics: Mechanism of drug action and the relationship between drug concentration and effect. Receptors, structural and functional families of receptors. Neurotransmission: General aspects and steps involved in neurotransmission. Neurohumoral transmission in autonomic nervous system (study about neurotransmitters - Noradrenaline and Acetylcholine). Neurohumoral transmission in central nervous system (study about neurotransmitters - histamine, serotonin, dopamine, GABA, and glutamate).	

	Drug Screening: General principles of preclinical screening. Principles and applications of cell viability assays. Toxicokinetics.	
5	Section F: Pharmacognosy	10
	1. Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, micrometers and camera lucida. 2. Extraction and Phytochemical Studies: Recent advances in extractions with emphasis on selection of method and choice of solvent for extraction, successive and exhaustive extraction and other methods of extraction including ultrasonic, microwave assisted & supercritical fluid extraction, method of fractionation. Detection and analysis of different classes of phytoconstituents by HPTLC, HPLC and Flash column chromatography. 3. Traditional System of Medicine & evaluation using animal models: Different dosage forms of Indigenous System of Medicine. Screening of plant extracts/ phytochemicals for anti-diabetic, hepatoprotective, analgesic, anti-inflammatory, diuretic, anti-epileptic, anticancer, cardiovascular and antimicrobial activity through <i>in vitro</i> and <i>in vivo</i> models.	