MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)

PhD ADMISSION SYLLABUS FOR PET

QUESTION PAPER FOR ALL DISCIPLINES WILL BE COMPRISING OF TWO SECTIONS

SECTION I: RESEARCH METHODOLOGY/QUANTITATIVE & LOGICAL APTITUDE/LANGUAGE SKILLS. (COMMON FOR ALL DISCIPLINES)

SECTION II: THE KNOWLEDGE OF SUBJECT OF SPECILIZATION. (THE SYLLABUS IS AS GIVEN BELOW FOR RESPECTIVE DISCIPLINES)

FACULTY:- ENGG & TECH **DISCIPLINE:- CIVIL ENGG.**

SYLLABUS FOR PhD ELIGIBILITY TEST (SECTION II /TECHNICAL SECTION):

Section 1: Structural Engineering

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Centre of mass; Euler's equations of motion; Impulse-momentum; Energy methods; Principles of virtual work.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; 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; Stiffness and flexibility methods of structural analysis.

Construction Materials and Management: Construction Materials: Structural steel - composition, material properties and behaviour; Concrete - constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber; Bitumen. Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis - PERT and CPM.

Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads.

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; Plastic analysis of beams and frames.

Section 2: Geotechnical Engineering

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field conditions; One-dimensional consolidation, time rate of consolidation; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand.

Foundation Engineering: Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, 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 - types

of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Section 3: Water Resources Engineering

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

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow

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

Irrigation: Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

Section 4: Environmental Engineering

Water and Waste Water: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

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

Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Section 5: Transportation Engineering

Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments; Geometric design of railway track; Airport runway length, taxiway and exit taxiway design.

Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

Traffic Engineering: Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.

Section 6: 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 - scale, flying height; Remote sensing - basics, platform and sensors, visual image interpretation; Basics of Geographical information system (GIS) and Geographical Positioning system (GPS).

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PhD ADMISSION SYLLABUS FOR PET

FACULTY:- ENGG & TECH **DISCIPLINE:- COMPUTER SCIENCE ENGG. (CSE)**

SYLLABUS FOR PhD ELIGIBILITY TEST (SECTION II/TECHNICAL SECTION):

Mathematical Logic: Propositional Logic; First Order Logic.
Probability: Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.
Set Theory & Algebra: Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.
Combinatorics: Permutations; Combinations; Counting; Summation; generating functions; recurrence relations; asymptotics.
Graph Theory: Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.
Digital Logic: Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point).
Computer Organization and Architecture: Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.
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: Analysis, Asymptotic notation, 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. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes P, NP, NP-hard, NP-complete.
Theory of Computation: Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability.
Compiler Design: Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.
Operating System: Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.
Databases: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.
Computer Networks: ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (ICMP, DNS, SMTP, POP, FTP, HTTP); Basic concepts of hubs, switches, gateways, and routers. Network security basic concepts of public key and private key cryptography, digital signature, firewalls.

FACULTY:- ENGG & TECH DISCIPLINE:- ELECTRONICS AND COMMUNICATION ENGG. (ECE)

SYLLABUS FOR PhD ELIGIBILITY TEST (SECTION II/TECHNICAL SECTION):

Section 1: Engineering Mathematics

Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness.

Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.

Differential Equations: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems.

Vector Analysis: Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stoke's theorems.

Complex Analysis: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.

Numerical Methods: Solution of nonlinear equations, single and multi-step methods for differential equations, convergence criteria.

Probability and Statistics: Mean, median, mode and standard deviation; combinatorial probability, probability distribution functions - binomial, Poisson, exponential and normal; Joint and conditional probability; Correlation and regression analysis.

Section 2: Networks, Signals and Systems

Network 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; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port network parameters: driving point and transfer functions; State equations for networks.

Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

Section 3: Electronic Devices

Energy bands in intrinsic and extrinsic silicon; 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; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Section 4: Analog Circuits

Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and op-amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.

Section 5: Digital Circuits

Number systems; 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 and PLAs; Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM, DRAM; 8-bit microprocessor (8085): architecture, programming, memory and I/O interfacing.

Section 6: 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 7: Communications

Random processes: autocorrelation 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, superheterodyne receivers, circuits for analog communications; Information theory: entropy, mutual information and channel capacity theorem; Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.

Section 8: Electromagnetics

Electrostatics; 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; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.

FACULTY:- ENGG & TECH **DISCIPLINE:- ELECTRICAL ENGG. (EE)**

SYLLABUS FOR PhD ELIGIBILITY TEST (SECTION II/TECHNICAL SECTION):

Section 1: Engineering Mathematics

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigenvalues, Eigenvectors.

Calculus: Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series, Vector identities, Directional derivatives, Line integral, Surface integral, Volume integral, Stokes's theorem, Gauss's theorem, Green's theorem.

Differential equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's equation, Euler's equation, Initial and boundary value problems, Partial Differential Equations, Method of separation of variables.

Complex variables: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, Laurent series, Residue theorem, Solution integrals.

Probability and Statistics: Sampling theorems, Conditional probability, Mean, Median, Mode, Standard Deviation, Random variables, Discrete and Continuous distributions, Poisson distribution, Normal distribution, Binomial distribution, Correlation analysis, Regression analysis.

Numerical Methods: Solutions of nonlinear algebraic equations, Single and Multi-step methods for differential equations.

Transform Theory: Fourier Transform, Laplace Transform, z-Transform.

ELECTRICAL ENGINEERING

Section 2: 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.

Section 3: 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.

Section 4: 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 Transform and z-Transform.

Section 5: 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.

Section 6: 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.

Section 7*:* 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.

Section 8*:* 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.

Section 9*:* 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.

Section 10*:* 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.

PhD ADMISSION SYLLABUS FOR PET

FACULTY:- ENGINEERING & TECHNOLOGY **DISCIPLINE:- MECHANICAL ENGG (ME)**

SYLLABUS FOR PhD ENTRANCE TEST (PET) (SECTION II/TECHNICAL SECTION)

ENGINEERING MATHEMATICS

Linear Algebra: Matrix algebra, Systems of linear equations, Eigen values and eigen vectors.

Calculus: Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

Complex variables: Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

Probability and Statistics: Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson,Normal and Binomial distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

APPLIED MECHANICS AND DESIGN

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, 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.

Vibrations: Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.
Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; *principles* of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

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.

Applications:*Power Engineering*: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. *I.C. Engines*: air-standard Otto, Diesel cycles. *Refrigeration and air-conditioning*: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. *Turbomachinery:*Pelton-wheel, Francis and Kaplan turbines — impulse and reaction principles, velocity diagrams.

MANUFACTURING AND INDUSTRIAL ENGINEERING

Engineering Materials: Structure and properties of engineering materials, heat treatment, stressstrain diagrams for engineering materials.

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

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

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

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

Inventory Control: Deterministic 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

PhD ADMISSION SYLLABUS FOR PET

FACULTY:- ENGG & TECH **DISCIPLINE:- TEXTILE ENGG.**

SYLLABUS FOR PhD ELIGIBILITY TEST (SECTION II/TECHNICAL SECTION):

Section 1: Textile Fibers

Classification of textile fibers; Essential requirements of fiber forming polymers; Gross and fine structure of natural fibers like cotton, wool, silk, Introduction to important bast fibres; properties and uses of natural and man- made fibres including carbon, aramid and ultra-high molecular weight polyethylene (UHMWPE) fibers; physical and chemical methods of fiber and blend identification and blend analysis.

Molecular architecture, amorphous and crystalline phases, glass transition, plasticization, crystallization, melting, factors affecting Tg and Tm; Production process of viscose and other regenerated cellulosic fibres such as polynosic, lyocell. Polymerization of nylon-6, nylon-66, poly (ethylene terephthalate), polyacrylonitrile and polypropylene; Melt Spinning processes for PET, polyamide and polypropylene; Wet and dry spinning processes for viscose and acrylic fibres; post spinning operations such as drawing, heat setting, tow- to-top conversion and different texturing methods.

Methods of investigating fibre structure e.g., Density, X-ray diffraction, birefringence, optical and electron microscopy, I.R. spectroscopy, thermal methods (DSC, DMA/TMA, TGA); structure and morphology of man-made fibres, mechanical properties of fibres, moisture sorption in fibres; fibre structure and property correlation.

Section 2: Yarn manufacture, Yarn structure and Properties

Principles of opening, cleaning and mixing/blending of fibrous materials, working principle of modern opening and cleaning equipment; the technology of carding, carding of cotton and synthetic fibres; Drafting operation, roller and apron drafting principle, causes of mass irregularity introduced by drafting; roller arrangements in drafting systems; principles of cotton combing, combing cycle, mechanism and function, combing efficiency, lap preparation; recent developments in comber; Roving production, mechanism of bobbin building, roving twist; Principle of ring spinning, forces acting on yarn and traveler, ring

& traveler designs, mechanism of cop formation, causes of end breakages; Working principle of ring doubler and two for one twister, single and folded yarn twist, properties of double yarns, production of core spun yarn; Principles of compact, rotor, air jet, air vortex, core, wrap, twist less and friction spinning.

Yarn contraction, yarn diameter, specific volume & packing coefficient; Twist factor, twist strength relationship in spun yarns; Fibre configuration and orientation in yarn; Cause of fibre migration and its estimation; Irregularity index; Structure property relationship of compact ring, rotor, air-jet and friction spun yarns.

Section 3: Fabric manufacture, Structure and Properties

Principles of winding processes and machines, random, precision and step precision winding, package faults and their remedies; Yarn clearers and tensioners; Different systems of yarn splicing; Features of modern cone winding machines; Different types of warping creels; features of modern beam and sectional warping machines; Different sizing systems, sizing of spun and filament yarns, sizing machines; Principles of pirn winding processes and machines.

Primary and secondary motions of loom, cam design & kinematics of sley, effect of their settings and timings on fabric formation, fabric appearance and weaving performance; Dobby and jacquard shedding; Mechanics of weft insertion with shuttle, warp and weft stop motions, warp protection, weft

replenishment; Principles of weft insertion systems of shuttle-less weaving machines; Principles of multiphase and circular looms.

Principles of weft and warp knitting, basic weft and warp knitted structures; Classification, production, properties and application of nonwoven fabrics, principle of web formation & bonding.

Basic woven fabric constructions and their derivatives; crepe, cord, terry, gauze, leno and double cloth constructions. Peirce's equations for fabric geometry; elastica model of plain woven fabrics; thickness, cover and maximum set of woven fabrics.

Section 4: Textile Testing

Sampling techniques, sample size and sampling errors; Measurement of fibre length, fineness, crimp; measurement of cotton fiber maturity and trash content; High volume fibre testing; Measurement of yarn count, twist and hairiness; Tensile testing of fibers, yarns and fabrics; Evenness testing of slivers, rovings and yarns; Classimat fault analysis; Testing equipment for measurement of fabric properties like thickness, compressibility, air permeability, wetting & wicking, drape, crease recovery, tear strength, bursting strength and abrasion resistance; Instruments and systems for objective evaluation of fabric hand. Statistical analysis of experimental results, frequency distributions, correlation, significance tests, analysis of variance and control charts.

Section 5: Chemical processing

Impurities in natural fibre; Chemistry and practice of preparatory processes for cotton, wool and silk; Mercerization of cotton; Preparatory processes for manmade fibres and their blends.

Classification of dyes; Dyeing of cotton, wool, silk, polyester, nylon and acrylic with appropriate dye classes; Dyeing of polyester/cotton and polyester/wool blends; Dyeing machines; Dyeing of cotton knitted fabrics and machines used; Dyefibre interaction; Introduction to thermodynamics and kinetics of dyeing; Methods for determination of wash, light and rubbing fastness.

Styles of printing; Printing thickeners including synthetic thickeners; Printing auxiliaries; Printing of cotton with reactive dyes, wool, silk, nylon with acid and metal complex dyes, Printing of polyester with disperse dyes; Pigment printing; Resist and discharge printing of cotton, silk and polyester; Transfer printing of polyester; Inkjet printing.

Mechanical finishing of cotton. Stiff, soft, wrinkle resistant, water repellent, flame retardant and enzyme (bio-polishing) finishing of cotton; Milling, decatizing and shrink resistant finishing of wool; Antistatic and soil release finishing; Heat setting of synthetic fabrics; Minimum application techniques; Pollution control and treatment of effluents.

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PhD ADMISSION SYLLABUS FOR PET

FACULTY:- COMMERCE & MANAGEMENT

SYLLABUS FOR PhD ENTRANCE TEST (PET) (SECTION II/TECHNICAL SECTION)

BUSINESS MANAGEMENT

Unit 1

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

Unit – II

- Classical and Modern Theories of Organisational Structure
- Organisational Design
- Organisational Development
- Skills and Roles in an organization
- The concept and significance of organisational behaviour
- Understanding and Managing individual behaviour personality –Attitudes, Learning, Motivation, Perception, Values
- Understanding and Managing Group Behaviour – Communication, Interpersonal and group dynamics, Leadership, Managing change, Managing conflicts, Processes

Unit – III

- Human Resource Management (HRM)- A diagnostic model, External and Internal environment, Forces and Influences, Functions, Objectives, Organizing HRM function, Significance
- Job analysis and Job Evaluation
- Recruitment, Selecting Human Resources- Induction, Training, Development
- Dispute Resolution and Grievance Management
- Exit policy and Implications
- Industrial Relations and Trade Unions
- Labor Welfare and Social Security Measures
- Performance Appraisal and Evaluation
- Career Planning and Development- Career planning and development methods, Concept of career
- Compensation and Benefits- Fringe Benefits, Human resource records and audit, Job evaluation techniques, Wage and salary administration
- Employee Discipline- Causes and forms, Disciplinary action, Domestic enquiry, Importance
- Collective Bargaining – Concept, New trends in collective bargaining, Pre-requisites, Process
- Industrial Democracy and Employee Participation - Employee Participation (Objectives, Forms of Employee Participation)
- Need for industrial democracy, Pre – requisites for industrial democracy

- Future of Human Resource Management

Unit – IV

- Nature and Scope of Financial Management
- Capital Budgeting Decisions
- Capital Structure and Cost of Capital
- Pricing Theories
- Dividend Policy
- Financial Management – Nature, Scope
- Long – Term and Short – Term Financing Instruments
- Foreign exchange markets, Determination of exchange rates, Exchange risk measurement
- Mergers and Acquisitions
- Valuation Concepts and Valuation of Securities
- Corporate risk management
- Elements of Derivatives

Unit – V

- Marketing - Concept, Different environments and their influences on marketing, Marketing mix, Marketing myopia, Nature and Scope, Understanding the customer and competition
- Marketing Environment - Environment Scanning
- Marketing Information Systems - Marketing Research
- Branding and Packaging
- Demand Measurement and Forecasting
- New Product Development
- Market Segmentation - Targeting and Positioning
- Pricing Methods and Strategies
- Product Decisions
- Product Life Cycle
- Product mix
- Consumer Behaviour theories
- Export Marketing
- Advertising
- Channel Management
- Customer Relation Management
- Evaluation and Control of Marketing Effort
- Marketing of Services
- New issues in Marketing
- Personal Selling
- Uses of Internet as a Marketing Medium
- Wholesaling and Retailing
- Vertical Marketing Systems

Unit – VI

- Demand Forecasting for Operations
- Determinants of Product mix
- Faculty Location
- Layout Planning and Analysis
- Production Planning and Control
- Production Scheduling
- Role and Scope of Production Management
- Statistical Quality Control
- Time and Motion Study
- Work measurement
- Decision Theory
- Duality
- Inventory Control
- Linear Programming

- Markov Analysis
- PERT / CPM
- Queuing Theory
- Role and Scope of Operations Research
- Sensitivity Analysis
- Transportation Model

Unit – VII

- Correlation and Regression analysis
- Probability Theory
- Probability distributions - Normal and Exponential, Binomial, Poisson
- Sampling theory - Large and small samples, Sampling distributions, t z, F, Chi – square tests, Tests of Hypothesis
- Use of Computers in Managerial applications- Information systems, Internet and Internet – based applications, MIS and Decision making; System analysis and design, Technology issues and Data processing in organizations, Trends in Information Technology

Unit – VIII

- Ansoffs Growth Vector
- BCG Model
- Competitor Analysis
- Components of Strategy Formulation
- Concept of Corporate Strategy
- Industry Analysis
- Porter's Generic Strategies
- Strategic Dimensions and Group Mapping
- Strategies in Industry Evolution- Fragmentation, Maturity, Decline
- Competitive Advantage of Nations
- Competitive strategy and Corporate Strategy
- Global Entry Strategies
- Globalisation of Financial System and Services
- Managing Cultural Diversity
- Managing International Business
- RTP and WTO
- Transnationalization of World Economy

Unit – IX

- Competencies and its development
- Detailed business plan preparation
- Innovation and Entrepreneurship
- Managing small enterprises
- Organisational Entrepreneurship
- Planning for growth
- Process of Business Opportunity Identification
- Rehabilitation of Sick Enterprises
- Sickness in Small Enterprises
- Small business

Unit – X

- Corporate governance and ethics
- Ecological consciousness
- Environmental ethics
- Ethical issues and Analysis in Management
- Ethical pressure on individual in organizations
- Ethics and Management System
- Gender issues
- Personal framework for ethical choices
- Social responsibilities of business
- Value based organizations

Unit-XI

- Emerging Opportunities for Global Business
- Export promotion policies
- India's Foreign Trade and Policy
- International financial environment - International Financial Management, Mergers and Acquisitions
- International investment - International capital markets, International Credit Rating Agencies, Implications of the ratings
- International marketing logistics - Organization of shipping services, International logistical structures, Marine cargo insurance, Export Documentation framework, Chartering practices
- International Trade Block
- Multilateral Environmental Agreements (MEAs)
- Policy and performance of Export zones
- Technology monitoring
- Trade agreements with other countries
- WTO and Multilateral trade agreements

COMMERCE

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. Recruitment and Selection, Selecting Human Resources. Induction, Training and Development, Career Planning and Development, Exit policy and Implications. Performance Appraisal and Evaluation. Potential Assessment. Job Evaluation. Wage Determination. Compensation Benefits, Industrial Relations and Trade Unions. Collective Bargaining, Industrial Democracy and Employee Participation, Dispute Resolution and Grievance Management, Labour Welfare and Social Security Measures, Future of Human Resource Management

Unit-IV

Financial Management-Nature and Scope. Valuation Concepts and Valuation of Securities. Capital Budgeting Decisions-Risk Analysis. Capital Structure and Cost of Capital. Understanding Financial Statement and Analysis, Dividend Policy-Theories and Determinants. Long-Term and Short-Term Financing Instruments. Mergers and Acquisitions, Working Capital Management-Determinants and Financing; Cash management; Inventory management; Receivables management, Elements of Derivatives, Corporate Risk Management, Mergers and Acquisitions, International Financial Management: International Capital Market, ForeignExchange Markets, Determination of Exchange Rates, Exchange Risk Measurement, International Investment.

Unit-V

Marketing – Concept, Nature and Scope, Marketing Myopia, Marketing Mix, 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, Relationship Marketing, Sales Function, Consumer Behaviour Theories and Models, Export Marketing-Indian and Global Context, Test Marketing, Distribution Channels.

Unit-VI

Role and Scope of Production Management; Faculty 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; Ansoffs 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, International Trade Block – NAFTA, ASEA, SAARC, Dispute Settlement Mechanism, International Credit Rating Agencies, Emerging Opportunities in Global Business Indian Foreign Trade and Policy: Export Promotion Policies.

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).

Unit-X

Ethics and Management System; Ethical issues and Analysis in Management; Value based organisations; Personal framework for ethical choices Ethical pressure on individual in organisations; Gender issues; Ecological consciousness; Environmental ethics; Social responsibilities of business; Corporate governance and ethics.

FACULTY:- PHARMACY **DISCIPLINE:- PHARMACY**

SYLLABUS FOR PhD ELIGIBILITY TEST (SECTION II/TECHNICAL SECTION):

PHARMACEUTICS

Introduction to Physical pharmacy

- ***Matter, Properties of Matter:***

State of matter, change in the state of matter, latent heats and vapor pressure, sublimation critical point, Eutectic mixtures, gases, aerosols-inhalers, relative humidity, liquid. Complexes, liquid crystals, glassy state, solids- crystalline, amorphous and polymorphism.

- ***Micromeretics and Powder Rheology:***

Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, methods of determining particle size- optical microscopy, sieving, sedimentation; measurements of particle shape, specific surface area; methods for determining surface area; permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

- ***Surface and Interfacial Phenomenon:***

Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and solid-liquid interfaces, complex films, electrical properties of interface.

- ***Viscosity and Rheology:***

Newtonian systems, Law of flow, kinematic viscosity, effect of temperature; non-Newtonian systems: pseudoplastic, dilatant, plastic; thixotropy, thixotropy in formulation, negative thixotropy, determination of viscosity, capillary, falling ball, rotational viscometers.

- ***Dispersion Systems:***

Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian motion, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability.

- ***Complexation:***

Classification of complexes, methods of preparation, analysis, & applications.

- *Kinetics and Drug Stability:*

General considerations & concepts, half-life determination, Influence of temperature, light, solvent, catalytic species and other factors, Accelerated stability study, expiration dating.

Dispensing and community pharmacy

- *Prescription:*

Handling of prescription, source of errors in prescription, care required in dispensing procedures including labeling of dispensed products. General dispensing procedures including labeling of dispensed products; Pharmaceutical calculations: Posology, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, alligation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc.

- *Community Pharmacy:*

Organization and structure of retail and whole sale drug store-types of drug store and design, legal requirements for establishment, maintenance and drug store-dispensing of proprietary products, maintenance of records of retail and wholesale, patient counseling, role of pharmacist in community health care and education (First aid, communicable diseases, nutrition, family planning).

- *Drug Information Services:*

Sources' of Information on drugs, disease, treatment schedules, procurement of information, Computerized services (e.g., MEDLINE), Retrieval of information, Medication error- types of medication errors, correction and reporting.

- **Dosages Forms, designing & evaluation**

- *Liquid Dosages Forms:*

Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors and others, manufacturing packaging, labeling, evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia;

- *Semisolid Dosage Forms:*

Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging.

Suppositories:

Ideal requirements, bases, displacement value, manufacturing procedure, packaging and evaluation;

Extraction and Galenical Products:

Principle and method of extraction, preparation of infusion, tinctures, dry and soft liquid extracts;

- *Blood Products and Plasma Substitutes:*

Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam plasma substitutes, -ideal requirements, PVP, dextran Etc. for control of blood pressure as per I.P.;

- *Pharmaceutical Aerosols:*

Definition, propellants, general formulation, manufacturing' and packaging methods, pharmaceutical applications;

- *Ophthalmic Preparations:*

Requirements, formulation, methods of preparation, labeling, containers, evaluation;

- *Cosmeticology and Cosmetic Preparations:*

Fundamentals of cosmetic science, structure and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair, dentifrice and manicure preparations like nail polish, nail polish remover, Lipsticks, eye lashes, baby care products Etc.

- *Capsules:*

Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, formulation, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

- *Micro-encapsulation:*

Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by
phase separation, coacervation, multi-orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

- *Tablets:*

Advantages and disadvantages of tablets, Application of different types of tablets, Formulation of different types of tablets,

granulation, technology on large-scale by various techniques, different types of tablet compression machinery and the equipments employed, evaluation of tablets.

- *Coating of Tablets:*

Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process, evaluation of coated tablets. Stabilityk inetics and quality assurance.

- *Parenteral Products:*

Pre-formulation factors, routes of administration, water for injection, and sterile water for injection, pyrogenicity, non- aqueous vehicles, isotonicity and methods of its adjustment, Formulation details, Containers and closures and selection, labeling; Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products; Aseptic Techniques-source of contamination and methods of prevention, Design of aseptic area, Laminar flow bench services and maintenance. Sterility testing of pharmaceuticals.

- *Packaging of Pharmaceutical Products:*

Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influence choice of containers, legal and official requirements for containers, package testing.

- *Designing of dosage forms:*

Pre-formulation studies, Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant. Solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability. Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products. Study of pro-drugs in solving problems related to stability, bioavailability and elegancy of formulations. Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions. Stabilization and stability testing protocol for various pharmaceutical products. ICH Guidelines for stability testing of formulations.

- *Performance evaluation methods:*

In-vitro dissolution studies for solid dosage forms methods, interpretation of dissolution data. Bioavailability studies and bioavailability testing protocol and procedures. In vivo methods of evaluation and statistical treatment. GMP and quality assurance, Quality audit. Design, development, production and evaluation of controlled/sustained/extended release formulations.

Biopharmaceutics & Pharmacokinetics

- *Introduction to biopharmaceutics:*

Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion, ion-pair formation and pinocytosis); Factors influencing absorption- biological, physico-chemical, physiological and pharmaceutical; Drug distribution in the body, plasma protein binding.

- *Pharmacokinetics:*

Significance of plasma drug concentration measurement. Compartment model- Definition and Scope. Pharmacokinetics of drug absorption - Zero order and first order absorption rate constant using Wagner-Nelson and residual methods. Volume of distribution and distribution coefficient. Compartment kinetics- One compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route. Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance. Extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration.

- *Clinical Pharmacokinetics:*

Definition and scope: Dosage adjustment in patients with and without renal and hepatic failure; Design of single dose bio-equivalence study and relevant statistics; Pharmacokinetic drug interactions and their significance in combination therapy.

- *Bioavailability and bioequivalence:*

Measures of bioavailability, Cmax, tmax, Keli and Area Under the Curve (AUC); Design of single dose bioequivalence study and relevant statistics; Review of regulatory requirements for conducting bioequivalent studies. Biopharmaceutical Classification System (BCS) of drugs.

PHARMACEUTICAL CHEMISTRY

Physical Chemistry and its importance in pharmacy

- *Importance of basic fundamentals of physical chemistry in pharmacy:* of Gases, Kinetic theory of gases, deviation from ideal behavior and explanation.
- *The Liquid State:* Physical properties (surface tension, parachor, viscosity, refractive index, dipole moment);
- *Solutions:* Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory;
- *Thermodynamics:* First, Second and Third laws, Zeroth law, Concept of free energy, enthalpy and entropy, absolute temperature scale;
- *Thermochemical equations; Phase rule; Adsorption:* Freudlich and Gibbs adsorption, isotherms, Langmuir's theory of adsorption.
- *Photochemistry:* Consequences of light absorption, Jabolenski diagram, Quantum efficiency; Chemical
- *Kinetics:* Zero, First and Second order reactions, complex reactions, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis;
- *Quantum Mechanics:* Postulates of quantum mechanics, operators in quantum mechanics, the Schrodinger wave equation.

Organic Chemistry and its importance in pharmacy

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 configurational isomerism, optical activity, specification of configuration, Reactions involving stereoisomers, chirality, conformations;

Stereoselective and stereospecific reactions; Structure, Nomenclature, Preparation and Reactions of:

Alkanes, Alkenes, Alkynes, Cyclic analogs, Dienes, Benzene, Polynuclear aromatic compounds, Arenes, Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones, Carboxylic acids, Functional derivatives of' carboxylic acids, a,ß-Unsaturated carbonyl compounds, Reactive intermediates- carbocations, carbanions, carbenes and nitrenes;

- *Nucleophilic and Electrophilic Aromatic Substitution Reactions:*

Reactivity and orientation; Electrophilic and Nucleophilic Addition Reactions; Rearrangements (Beckman, Hoffman, Benzilic acid, pinacole-pinacolone and Bayer-Villager).

- *Elimination reactions; Conservation of Orbital Symmetry and Rules:* Electrocyclic, Cycloaddition and Sigmatropic reactions;

Neighboring group effects; Catalysis by transition metal complexes; Heterocyclic Compounds:

Nomenclature, preparation, properties and reactions of 3, 4, 5, 6 & 7-membered heterocycles with one or two heteroatoms like 0, N, S. Chemistry of lipids, Carbohydrates and Proteins.

Biochemistry

- *Enzymes:* Nomenclature, enzyme kinetics and their mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
- *Co-enzymes:* Vitamins as co-enzymes and their significance. Metals as cofactors and their significance.

Medicinal Chemistry

- *Basic Principles:*

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.

Synthetic Procedures, Mode of Action, Uses, Structure Activity Relationships including Physicochemical Properties of the Following Classes of Drugs:

Drugs acting at synaptic and neuro-effector junction sites: Cholinergics, anti-cholinergics and cholinesterase inhibitors, Adrenergic drugs, Antispasmodic and anti-ulcer drugs, Local Anesthetics, Neuromuscular blocking agents.

- *Autacoids:* Antihistamines, Eicosanoids, Analgesic-antipyretics, Anti-inflammatory (non-steroidal) agents.

- *Steroidal Drugs:* Steroidal nomenclature (IUPAC) and stereochemistry, Androgens and anabolic agents, Estrogens and Progestational agents,

  Oral contraceptives, Adrenocorticoids;

- *Drugs acting on the central nervous system:*

General Anesthetics, Hypnotics and Sedatives, Anticonvulsants, Anti-Parkinsonian drugs, Psychopharmacological agents (Neuroleptics, Anti-depressants, Anxiolytics), Opioid analgesics, Anti-tussives, CNS stimulants.

- *Diuretics; Cardiovascular drugs:*

Anti-hypertensives, Anti-arrythmic agents, anti-anginal agents, Cardiotonics, Anti-hyperlipedemic agents, Anticoagulants and Anti-platelet drugs.

- *Thyroid and Anti thyroid drugs; Insulin and oral hypoglycemic agents:*

Chemotherapeutic Agents used in bacterial, fungal, viral, protozoal, parasitic and other infections, Antibiotics: ß-Lactam, macrolides, tetracyclines, aminoglycosides, polypeptide antibiotics, fluoroquinolones, Anti-metabolites (including sulfonamides); Anti-neoplastic agents; Anti-viral agents (including anti–HIV); Immunosuppressives and immunostimulants; Diagnostic agents; Pharmaceutical Aids.

- *Microbial Transformations:*

Introduction, types of reactions mediated by micro-organisms, design of biotransformation processes, selection of organisms, biotransformation process and its improvements with special reference to steroids.

- *Enzyme Immobilization:*

Techniques of immobilization, factors affecting enzyme kinetics, Study of enzymes such as hyaluronidase, penicillinase, streptokinase, amylases and proteases, Immobilization of bacteria and plant cells.

Pharmaceutical Analysis

Different techniques of pharmaceutical analysis, Preliminaries and definitions:

Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision and accuracy.

- *Fundamentals of volumetric analysis:* Methods of expressing concentration, primary and secondary standards.

- *Acid Base Titrations:*

Acid base concepts, Role of solvents, Relative strengths of acids and bases, Ionization, Law of mass action, Common ion effect, Ionic product of water, pH, Hydrolysis of salts, HendersonHasselbach equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyprotic systems, Polyamine and amino acid systems, Amino acid titrations.

- *Oxidation Reduction Titrations:*

Concepts of oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of redox titrations, Redox indicators, Cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving cerric ammonium sulphate, potassium iodate, potassium bromate, potassium

permanganate; titanous chloride, stannous chloride and Sodium 2,6-dichlorophenolindophenol.

- *Precipitation Titrations:*

Precipitation reactions, Solubility product, Effect of acids, temperature and solvent upon the solubility of a precipitate, Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, indicators, Methods of end point determination (GayLussac method, Mohr's method, Volhard's method and Fajan's method).

- *Non-aqueous titrations:*

Acidic and basic drugs, Solvents used, Indicators.

- *Complexometric titrations:*

Complexing agents used as titrants, Indicators, Masking and demasking;

- *Miscellaneous Methods of Analysis:*

Diazotization titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer aquametry, Oxygen flask combustion method, Gasometry.

- *Chromatography:*

Theory of chromatography, plate theory, Factors affecting resolution, van Deemter equation. The following chromatographic techniques (including instrumentation) with relevant examples of Pharmacopoeial products: TLC, HPLC, GLC, HPTLC, Paper Chromatography and Column Chromatography.

- *The Theoretical Aspects, Basic Instrumentation, Elements of Interpretation of Spectra, and Applications (quantitative and qualitative) of the Following Analytical Techniques:*

Ultraviolet and visible spectrophotometry, Fluorimetry, Infrared spectrophotometry, Nuclear Magnetic Resonance spectroscopy [proton technique only], Mass Spectrometry (EI & CI only), Flame Photometry, Atomic Absorption Spectroscopy, X-ray Diffraction Analysis, Radioimmunoassay.

- *Quality assurance:*

GLP, ISO 9000, TQM, Quality Review and Quality documentation, Regulatory control, regulatory drug analysis, interpretation of analytical data, Validation, quality audit: quality of equipment, validation of equipment, validation of analytical procedures.

PHARMACOLOGY

- *Fundamentals of general pharmacology:*

Dosage forms and routes of administration, mechanism of action, combined effect of drugs, factors modifying drug action, tolerance and dependence; Pharmacogenetics; Principles of Basic and Clinical pharmacokinetics, absorption, Distribution, Metabolism and Excretion of drugs, Adverse Drug Reactions; Bioassay of Drugs and Biological Standardization; Discovery and development of new drugs, Bioavailability and bioequivalence studies;

- *Pharmacology of Peripheral Nervous System:*

Neurohumoral transmission (autonomic and somatic), Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic receptor and neuron blocking agents, Ganglion stimulants and blocking agents, Neuromuscular blocking Agents, Local anesthetic Agents.

- *Pharmacology of Central Nervous System:*

Neurohumoral transmission in the C.N.S., General Anesthetics, Alcohols and disulfiram, Sedatives, Hypnotics, Anti-anxiety agents and Centrally acting muscle relaxants, Psychopharmacological agents (anti-psychotics), anti-maniacs, and hallucinogens, Antidepressants, Anti-epileptics drugs, Anti-Parkinsonian drugs, Analgesics, Antipyretics, Narcotic analgesics and antagonists, C.N.S. stimulants, Drug Addiction and Drug Abuse.

- *Pharmacology of Cardiovascular System:*

Drugs used in the management of congestive cardiac failure, Antihypertensive drugs, Anti-anginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists, Anti-arrhythmic drugs, Anti-hyperlipedemic drugs, Drugs used in the therapy of shock.

 Drugs Acting on the Hemopoietic System:

Hematinics, Anticoagulants, Vitamin K and hemostatic agents, Fibrinolytic and anti-platelet drugs, Blood and plasma volume expanders.

 Drugs acting on urinary system:

Fluid and electrolyte balance, Diuretics.

 Basic Concepts of Pharmacotherapy:

Clinical Pharmacokinetics and individualization of Drug therapy, Drug delivery systems and their Biopharmaceutic s & Therapeutic considerations, Drugs used during infancy and in the elderly persons (Pediatrics & Geriatrics), Drugs used during pregnancy, Drug induced diseases, The basics of drug interactions, General principles of clinical toxicology, Common clinical laboratory tests and their interpretation.

 Important Disorders of Organs, Systems and their Management: Cardio-vascular disorders- Hypertension, Congestive heart failure, Angina,
Acute myocardial infarction, Cardiac arrhythmias.

 CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression.

 Respiratory disease- Asthma.

 Gastrointestinal Disorders- Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis.

 Endocrine Disorders- Diabetes mellitus and Thyroid disorders.

 Infectious Diseases- Tuberculosis, Urinary tract infections, Enteric infections, Upper respiratory infections. Hematopoietic Disorders- Anemias,

 Joint and Connective tissue disorders- Rheumatic diseases, Gout and Hyperuricemia.

 Neoplastic Diseases- Acute Leukaemias, Hodgkin's disease. Therapeutic Drug Monitoring, Concept of Essential Drugs and Rational Drug use.

PHARMACOGNOSY

 Sources of Drugs: Biological, marine, mineral and plant tissue cultures as sources of drugs;

 Classification of Drugs: Morphological, taxonomical, chemical and pharmacological classification of drugs;

 Quality Control of Crude Drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.

 Introduction to Active Constituents of Drugs: Their isolation, classification and properties.

Systematic Pharmacognostic study of the followings:

 Carbohydrates and derived products: agar, guar gum acacia, Honey, Isabagol, pectin, Starch, sterculia and Tragacanth.

 Lipids: Bees wax, Castor oil, Cocoa butter, Codliver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice Bran oil, Shark liver oil and
Wool fat.

 Resins: Study of Drugs Containing Resins and Resin Combinations like Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of Tolu, balsam of Peru, benzoin, turmeric, ginger.

 Tannins: Study of tannins and tannin containing drugs like Gambier, black catechu, gall and myrobalan.

 Volatile Oils: General methods of obtaining volatile oils from plants, Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium,

Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood;

- *Phytochemical Screening:* Preparation of extracts, Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts.

Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs.

GLYCOSIDE CONTAINING DRUGS:

- *Saponins :* Liquorice, ginseng, dioscorea, sarsaparilla, and senega.
- *Cardioactive glycosides:* Digitalis, squill, strophanthus and thevetia,
- *Anthraquinone cathartics:* Aloe, senna, rhubarb and cascara,
- *Others:* Psoralea, gentian, saffron, chirata, quassia.

ALKALOID CONTAINING DRUGS:

- *Pyridine-piperidine:* Tobacco, areca and lobelia.
- *Tropane:* Belladonna, hyoscyamus, datura, duboisia, coca and withania.
- *Quinoline and Isoquinoline:* Cinchona, ipecac, opium.
- *Indole:* Ergot, rauwolfia, catharanthus, nux-vomica and physostigma.
- *Imidazole:* Pilocarpus.
- *Steroidal:* Veratrum and kurchi.
- *Alkaloidal Amine:* Ephedra and colchicum.
- *Glycoalkaloid:* Solanum.
- *Purines:*

Coffee, tea and cola. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.

General Techniques of Biosynthetic Studies and Basic Metabolic Pathways/Biogenesis:

Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.

- *Terpenes: M*onoterpenes, sesquiterpenes, diterpenes, and triterpenoids.
- *Carotenoids:* a-carotenoids, ß-carotenes, vitamin A, Xanthophylls of medicinal importance.
- *Glycosides:* Digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.
- *Alkaloids:* Atropine and related compounds, Quinine, Reserpine, Morphine, Papaverine, Ephedrine, Ergot and Vinca alkaloids.

Lignans, quassanoids and flavonoids.

- *Plant Tissue Culture:*

Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.

PhD ADMISSION SYLLABUS FOR PET

FACULY : ARCHITECTURE & PLANNING **DISCIPLINE : ARCHITECTURE & PLANNING**

SYLLABUS FOR PhD ELIGIBILITY TEST (SECTION II/TECHNICAL SECTION):

Section 1: Architecture and Design

Visual composition in 2D and 3D; Principles of Art and Architecture; Organization of space; Architectural Graphics; Computer Graphics– concepts of CAD, BIM, 3D modeling and Architectural rendition; Programming languages and automation. Anthropometrics; Planning and design considerations for different building types; Site planning; Circulation- horizontal and vertical; Barrier free design; Space Standards; Building Codes; National Building Code.

Elements, construction, architectural styles and examples of different periods of Indian and Western History of Architecture; Oriental, Vernacular and Traditional architecture; Architectural developments since Industrial Revolution; Influence of modern art on architecture; Art nouveau, Eclecticism, International styles, Post Modernism, Deconstruction in architecture; Recent trends in Contemporary Architecture; Works of renowned national and international architects.

Section 2: Building Materials, Construction and Management

Behavioral characteristics and applications of different building materials viz. mud, timber, bamboo, brick, concrete, steel, glass, FRP, AAC, different polymers, composites.

Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Estimation, specification, valuation, professional practice; Construction planning and equipments; Project management techniques e.g. PERT, CPM etc.

Section 3: Building and Structures

Principles of strength of materials; Design of structural elements in wood, steel and RCC; Elastic and Limit State design; Structural systems in RCC and Steel; Form and Structure; Principles of Pre-stressing; High Rise and Long Span structures, gravity and lateral load resisting systems; Principles and design of disaster resistant structures.

Section 4: Environmental Planning and Design

Ecosystem- natural and man-made ecosystem; Ecological principles; Concepts of Environmental Impact Analysis; Environmental considerations in planning and design; Thermal comfort, ventilation and air movement; Principles of lighting and illumination; Climate responsive design; Solar architecture; Principles of architectural acoustics; Green Building- Concepts and Rating; ECBC; Building Performance Simulation and Evaluation; Environmental pollution- types, causes, controls and abatement strategies.

Section 5: Urban Design

Concepts and theories of urban design; Public Perception; Townscape; Public Realm; Urban design interventions for sustainable development and transportation; Historical and modern examples of urban design; Public spaces, character, spatial qualities and Sense of Place; Elements of urban built environment – urban form, spaces, structure, pattern, fabric, texture, grain etc; Principles, tools and techniques of urban design; Urban renewal and conservation; Site planning; Landscape design; Development controls – FAR, densities and building byelaws.

Section 6: Urban Planning and Housing

Planning process; Types of plans - Master Plan, City Development Plan, Structure Plan, Zonal Plan, Action Area Plan, Town Planning Scheme, Regional Plan; Salient concepts, theories and principles of urban planning; Sustainable urban development; Emerging concepts of cities - Eco-City, Smart City, Transit Oriented Development (TOD), SEZ, SRZ etc.

Housing; Concepts, principles and examples of neighbourhood; Housing typologies; Slums; Affordable Housing; Housing for special areas and needs; Residential densities; Standards for housing and community facilities; National Housing Policies, Programs and Schemes.

Section 7: Planning Techniques and Management

Tools and techniques of Surveys – Physical, Topographical, Landuse and Socio- economic Surveys; Methods of non-spatial and spatial data analysis; Graphic presentation of spatial data; Application of G.I.S and Remote Sensing techniques in urban and regional planning; Decision support system and Land Information System.

Urban Economics; Law of demand and supply of land and its use in planning; Social, Economical and

environmental cost benefit analysis; Techniques of financial appraisal; Management of Infrastructure Projects; Development guidelines such as URDPFI; Planning Legislation and implementation – Land Acquisition Act, PPP etc.; Local self-governance.

Section 8: Services, Infrastructure and Transportation

Building Services: Water supply; Sewerage and drainage systems; Sanitary fittings and fixtures; Plumbing systems; Principles of internal and external drainage system; Principles of electrification of buildings; Intelligent Buildings; Elevators and Escalators - standards and uses; Air-Conditioning systems; Fire fighting Systems; Building Safety and Security systems.

Urban Infrastructure – Transportation, Water Supply, Sewerage, Drainage, Solid Waste Management, Electricity and Communications.

Process and Principles of Transportation Planning and Traffic Engineering; Road capacity; Traffic survey methods; Traffic flow characteristics; Traffic analyses and design considerations; Travel demand forecasting; Land-use – transportation - urban form inter-relationships; Design of roads, intersections, grade separators and parking areas; Hierarchy of roads and level of service; Traffic and transport management and control in urban areas,; Mass transportation planning; Para- transits and other modes of transportation, Pedestrian and slow moving traffic planning; Intelligent Transportation Systems.

Principles of water supply and sanitation systems; water treatment; Water supply and distribution system; Water harvesting systems; Principles, Planning and Design of storm water drainage system; Sewage disposal methods; Methods of solid waste management - collection, transportation and disposal; Recycling and Reuse of solid waste; Power Supply and Communication Systems, network, design and guidelines.