Revised Pattern and Syllabus of Entrance Exam for M.Sc. Forensic Science (Academic session 2022-23)

EXISTING PATTERN		PROPOSED PATTERN (2022-23)	
For B.Sc. Medical students		Common for All Students	
SUBJECT	MARKS	SUBJECT	MARKS
Chemistry	34	General Aptitude	15
Botany	33	Basic Forensic Science	15
Zoology	33	General Chemistry	25
For B.Sc. Non-Medical students		Basic Botany	15
Chemistry	34	Basic Zoology	15
Physics	33	Basic Physics	10
Mathematics	33	Basic Mathematics	05
TOTAL MARKS 100		TOTAL MARKS 100	

12/05/2023

(Dr. Raymond Sofi)
Asst. Professor

(Dr. Sapna Sharma)
Asst. Professor

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Asst. Professor

12.5.

(Prof. Minakshi Vashist)
Head of the Deptt. of Forensic Science.

SYLLABUS

General Aptitude	Marks 15

Topics: Latest General knowledge, English grammar, Analogy, Blood Relationships, Aptitude and Reasoning, Numerical reasoning, Average, Percentage, Ratio and Proportion, Time and Distance, Volume and Surface Area for Aptitude Test.

Basic Forensic Science	Marks 15

General Forensic Science, History of Forensic Science, Questioned Document Examination, Forensic Dermatoglyphics, Computer Forensics, Forensic Psychology, Criminalistics, Methods of Analysis in forensic science, Forensic Ballistics, Forensic Chemistry, Forensic Toxicology, Forensic Biology, Forensic Serology including DNA forensics, Forensic Physical Anthropology, Forensic Medicine, Forensic Physics.

General Chemistry (B.Sc. level)	Marks 25

Inorganic Chemistry Atomic Structure, Periodic Properties, Covalent Bond, Ionic Solids, Volumetric Analysis, Hydrogen Bonding & Vander Waals Forces, Metallic Bond and Semiconductors, s-Block Elements, Chemistry of Noble Gases, p-Block Elements, Boron family, Carbon Family, Nitrogen Family, Oxygen Family, Halogen Family, Chemistry of Elements of Ist transition series, Chemistry of Elements of IInd & IIIrd transition series, Coordination Compounds, Non-aqueous Solvents, Chemistry of f – block elements Lanthanides, Chemistry of f – block elements Actinides, Theory of Qualitative and Quantitative Inorganic Analysis, Metal-ligand Bonding in Transition Metal Complexes, Thermodynamic and Kinetic Aspects of Metal Complex, Magnetic Properties of Transition Metal Complex, Electron Spectra of Transition Metal Complexes. Organometallic Chemistry: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, and bonding of alkyls of Li, Al, Hg, and Sn a brief account of metal-ethylenic complexes, mononuclear carbonyls and the nature of bonding in metal carbonyls. Acids and Bases, HSAB Concept, Arrhenius, Bronsted – Lowry, the Lux – Flood, Solvent system and Lewis concepts of acids & bases, relative strength of acids & bases, Concept of Hard and Soft Acids & Bases, Symbiosis, electronegativity and hardness and softness. Bioinorganic Chemistry: Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}. Nitrogen fixation, Silicones and Phosphazenes their preparation, properties and structure.

Physical Chemistry Gaseous States, Critical Phenomenon, Liquid States, Solid State, Kinetics, Rate of reaction, rate equation, factors influencing the rate of a reaction –concentration, temperature, pressure, solvent, light, catalyst, Order of a reaction, Half-life period of a reaction, Arrhenius equation, Theories of reaction rate, Transition state theory of Bimolecular reactions, Electrolytic conduction, molar conductance, equivalent conductance, Arrhenius theory of ionization, Ostwald's Dilution, Law, Debye- Huckel – Onsager's equation for strong electrolytes (elementary treatment only) Transport number, Hittorfs methods, Kohlarausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it, Applications of conductivity measurements, determination of Ka of acids determination of solubility product of sparingly soluble salts, Definition of pH and pKa, Buffer solution, Buffer action, Henderson –Hazel equation, Buffer mechanism of buffer action, Laws of thermodynamic, Temperature dependence of enthalpy, Kirchoffs equation, Bond energies, Chemical Equilibrium, Le-Chatetier's principle, Distribution, Nernst distribution law, Electrolytic and Galvanic cells – reversible & Irreversible cells , conventional representation of electrochemical cells, EMF of cell, Determination of pH using Hydrogen electrode, Quinhydrone electrode and glass electrode by potentiometric methods.

Quantum Mechanics, Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics, Hamiltonial operator, Physical Properties and Molecular Structure, Optical activity, polarization – (clausius – Mossotti equation), Orientation of dipoles, Magnetic permeability, magnetic properties – paramagnetism, diamagnetism and ferromagnetics, Electromagnetic radiation, statement of Bornoppenheimer approximation, Degrees of freedom, Rotational Spectrum, Diatomic molecules, Energy levels of rigid rotator (semi-classical principles) and (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect, Raman Spectrum: Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra, Electronic Spectrum, Photochemistry, Solutions: Dilute Solutions and Colligative Properties, Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient, Raolut's law, Osmosis law of osmotic pressure and its measurement, Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point, Experimental methods for determining various colligative properties, Abnormal molar mass, degree of dissociation and association of solutes Phase Equillibrium: Statement and meaning of the terms – phase component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system –Example – water and Sulpher systems.

Polyembryony. Structure of Dicot and Monocot seed, Fruit types; Dispersal mechanisms in fruits and seeds. **Plant Physiology:** Plant-water relations, Mineral nutrition, Transport of organic substances, Photosynthesis, Calvin cycle; C4 pathway; CAM plants; photorespiration. Growth and development, seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening; Plant hormones- auxins, gibberellins, cytokinins, abscissic acid and ethylene, history of their discovery, Phytochromes and their discovery, physiological role and mechanism of action.

Ecology: Introduction to Ecology, Environment, Adaptations of plants to water stress and salinity, Population ecology, Community ecology, Biogeochemical cycles: Carbon, nitrogen, phosphorus and hydrological cycle. Phyto-geography: Phyto- geographical regions of India; vegetation types of India (forests). Environmental pollution: Sources, types and control of air and water pollution. Global change: Greenhouse effect and greenhouse gases; impacts of global warming; carbon trading; Ozone layer depletion; Biomagnification

Biochemistry and Plant Biotechnology: Basics of Enzymology, Respiration, Krebs cycle; electron transport mechanism (chemiosmotic theory); redox -potential; oxidative phosphorylation; pentose phosphate pathway. Lipid metabolism, Genetic engineering and Biotechnology.

Economic Botany: Vavilov's centres of origin of crop plants. Origin, distribution, botanical description, brief idea of cultivation and economic uses of the following: Food plants - cereals (rice, wheat and maize), pulses (gram, arhar and pea), vegetables (potato, tomatoand onion). Origin, distribution, botanical description, brief idea of cultivation and economic uses of the following. Fibers- cotton, jute and flax. Oils- groundnut, mustard, sunflower and coconut. Morphological description, brief idea of cultivation and economic uses of Spices- coriander, ferula, ginger, turmeric, cloves. Medicinal plants- *Cinchona, Rauwolfia, Atropa, Opium, Cannabis, Azadirachta, Withania*. Botanical description, processing and uses of; Beverages- tea and coffee; Rubber - *Hevea*; Sugar- sugarcane General account and sources of timber; energy plantations and bio-fuels.

Basic Zoology | Marks 15

Introduction to Phylum- Protozoa (*Plasmodium, Entamoeba, Trypanosoma, Leishmania* and *Giardia*) **Porifera** (*Sycon*), **Coelentrata** (*Obelia*, Corals and coral reefs, Siphonophores), **Helminths** (*Fasciola hepatica, Ancylostoma, Trichinella, Wuchereria* and *Oxyuris*)

Animal Cell Biology: Ultrastructure of different cell organelles of animal cell, Plasma Membrane, Endoplasmic reticulum (ER), Goigi complex, Ribosomes, Lysosomes, Mitochondria, Cytoskeleton, Cilia and Flagella, Nucleus, Euchromatin and heterochromatin, lampbrush chromosomes and polytene chromosomes.

Introduction to Mitosis and Meiosis (Cell reproduction),

Life and Diversity of Annelida to Hemichordata: Phylum – Annelida (*Pheretima*), **Arthropoda** (Insects and *Periplaneta*), **Mollusca** (*Pila*), **Echinodermata** (*Asteries* (Sea Star), **Hemichordata** (*Balanoglossus*)

Genetics: Elements of Heredity and variations, varieties of gene interactions, Linkage and recombination, Sex determination and its mechanism, **Multiple allelism:** Eye colour in Drosophila; A, B, O blood group in man, **Human genetics:** Human karyotype, Chromosomal abnormalities involving autosomes and sex chromosomes, monozygotic and dizygotic twins, Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia), Nature and function of genetic material, Protein synthesis, mutations (deletion, duplication, inversion and translocation); Numerical aberrations (autoploidy, euploidy and polyploidy in animals, Applied genetics, DNA-finger printing, transgenic animals.

Principles of classification; Origin and Evolutionary tree **of Chordates, Protochordates, Cyclostomes, Pisces:** Scales & Fins, Parental care in fishes, fish migration

Mammalian Physiology: Introduction, Classification, Structure, function and general properties of carbohydrates and lipids, enzyme action, Transport through biomembranes (Active and Passive), buffers.

Nutrition: Nutritional components, Carbohydrates, fats, lipids, Vitamins and Minerals.

Muscles: Types of muscles, ultra-structure of skeletal muscle, Bio-chemical and physical events during muscle contraction; single muscle twitch, tetanus, muscle fatigue muscle, tone, oxygen debt.

Bones: Structure and types, classification, bone growth and resorption, effect of ageing on skeletal system and bone disorders.

Life And Diversity Of Chordates: Amphibia (*Rana tigrina*), **Reptilia** (Hemidactylus, Poisonous and non-poisonous snakes), **Aves** (*Columba livia*), **Mammals:** Classification, type study of Rat; Adaptive radiations of mammals and dentition.

Mammalian Physiology: Circulation: Origin, conduction and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, fluid pressure and flow pressure in closed and open circulatory system; Composition and functions of blood & lymph; Mechanism of coagulation of blood, coagulation factors; anticoagulants, haempoiesis

Respiration: Exchange of respiratory gases, transport of gases, lung air volumes, oxygen dissociation curve of hemoglobin, Bohr's effect, Haburger's phenomenon (Chloride shift), control / regulation of respiration.

Excretion: Patterns of excretory products viz. Amonotelic, ureotlic uricotelic, ornithine cycle (Kreb's– Henseleit cycle) for urea formation in liver. Urine formation, counter-current mechanism of urine concentration, osmoregulation, micturition.

Organic Chemistry: Structure and Bonding, Stereochemistry of Organic Compounds, Mechanism of Organic Reactions, Alkanes and Cycloalkanes and their IUPAC nomenclature, Alkenes, Arenes and Aromaticity, Dienes and Alkynes, Alkyl and Aryl Halides, Alcohols, Epoxides, Phenols, Ultraviolet (UV) absorption spectroscopy, Absorption laws (Beer-Lambert law), molar absorptivity, chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones,Woodward- Fieser rules, calculation of max of simple conjugated dienes, unsaturated ketones., Carboxylic Acids & Acid Derivatives, Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Structure, nomenclature and preparation of acid chlorides, esters, amides and acid anhydrides. Physical properties, interconvers ion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterifica tion and hydrolysis (acidic and basic). Infrared (IR) absorption spectroscopy. Amines, Diazonium Salts, Nitro Compounds, Aldehydes and Ketones, NMR Spectroscopy: Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting,splitting of signals and coupling constants, magnetic equivalence of protons. Carbohydrates: Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose in to mannose. Formation of glycos ides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and Deoxyribose. Disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. Organometallic Compounds, Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions. Heterocyclic Compounds, Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Heterocyclic Compounds: Introduction to condensed five and six- membered heterocycles. Prepration and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline. Organosulphur Compounds, Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates. Organic Synthesis via Enolates, Synthetic Polymers, Ziegler-Natta polymerization and vinyl polymers. Amino Acids, Peptides& Proteins, Classification and electrophoresis. Preparation of -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid– phase peptide synthesis, Structures of peptides and proteins: Primary & Secondary structure.

Basic Botany	Marks 15

Diversity Of Microbes: General characters, classification and life history of Bacteria, Algae, Viruses, Fungi.
Cell Biology: The Cell Envelopes, Ultra-structure and function, Chromosome, Cell Cycle, Cell Division, Chromosomal aberrations.
Diversity Of Archegoniates: Bryophyta and Pteridophyta.
Genetics: Introduction to Genetic Material (DNA), Genetic Inheritance, Extra-nuclear Inheritance, Genetic Variations, Gene Expression.
Biology and Diversity of Seed Plants: General characters, origin and evolution of Gymnosperms, Geological Time Table: Evolution of Seed Habit, Pilger and Melchior's (1954) system of classification of Gymnosperms.
Palaeobotany- Fossils and Fossilization. Morphology and anatomy of root, stem, leaf/leaflet and reproductive parts including mode of reproduction, life-cycle and economic importance of following plants: *Cycas, Pinus, Ephedra*
Taxonomy and Systematics; fundamental components of taxonomy (identification, classification, description, nomenclature and phylogeny), Botanical Nomenclature, principles and rules, principle of priority. Keys to identification of plants. Type concept, taxonomic ranks, Salient features of the systems of classification of angiosperms proposed by Bentham & Hooker and Engler & Prantl. Floral Terms and Types of Inflorescence.
Diversity of Flowering Plants: Diagnostic features and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Euphorbiaceae, Rutaceae, Fabaceae, Cucurbitaceae Diversity of **Flowering Plants**: Diagnostic features and economic importance of the families: Apiaceae, Asclepiadaceae, Lamiaceae, Solanaceae, Asteraceae, Liliaceae and Poaceae
Plant Anatomy: Introduction to Tissues, Tissue systems, The Shoot system, Cambium, Secondary growth in dicot stem, characteristics of growth rings: sap wood and heart wood, periderm; Anomalous secondary growth (*Dracaena, Boerhaavia* and *Achyranthes*). **Leaf**: Types of leaves (simple and compound); phyllotaxy. Epidermisuniseriate and ultiseriate, epidermal appendages and their morphological types. Anatomy of typical Monocot and Dicot leaf and cell inclusions in leaves, leaf abscission, Stomatal apparatus and their morphological types. **Root system**: Structural modifications in roots Storage (*Beta*), Respiratory (*Rhizophora*), Epiphytic (*Vanda*). **Plant Embryology:** Flower-a modified shoot, Microsporangium, Microsporogenesis, pollen grains and its structure (pollen wall) and germination (microgametogenesis). Endosperm types and its biological importance. Embryogenesis in Dicot and Monocot.

Neural Integration: Nature, origin and propagation of nerve impulse along with medullated & non-medullated nerve fibre, conduction of nerve impulse across synapse.
Chemical integration of Endocrinology: Structure and mechanism of hormone action: physiology of hypothalamus, pituitary, thyroid, parathyroid, adrenal, pancreas and gonads.
Reproduction: Spermatogenesis, Capacitation of spermatozoa, ovulation, formation of corpus luteum, oestrous-anoestrous cycle, Menstrual cycle in human: fertilization, implantation and gestation.
Fish and Fisheries: Introduction to world fisheries, Fresh Water fishes of India, Fin fishes, Crustaceans, Molluses and their culture.
Nutrition: Sources of food (Natural, Artificial) and feed composition (Calorie and Chemical ingredients). **Field Culture, Culture technology**
Ecology & Evolution: Basic concepts of animal ecology, Factors affecting environment, Ecosystem, Biogeochemical cycles, Population, Origin of life, Concept and evidences of organic evolution and species, Evolution of man.
Developmental Biology: Historical perspectives, aims and scope of developmental biology. Generalized structure of mammalian ovum & sperm. Spermatogenesis and Oogenesis. Fertilization, parthenogenesis, different types of eggs and patterns of cleavage in invertebrates and vertebrates; Process of blastulation in invertebrates and vertebrates, Fate-map construction in frog and chick. Gastrulation in invertebrates and vertebrates, Extra embryonic membranes: structure & significance in birds and mammals. Concepts of competence, determination and differentiation. Concept of regeneration.

Basic Physics	Marks 10

Physical World, Units and Measurements, Kinematics, Motion in a Straight Line, Motion in a Plane, Laws of Motion, Work, Energy and Power, Motion of System of Particles and Rigid Body and Rotational Motion, Gravitation, Properties of Bulk Matter, Mechanical Properties of Solids, Mechanical Properties of Fluids, Thermal Properties of Matter, Thermodynamics, Behaviour of Perfect Gases and Kinetic Theory of Gases, Kinetic Theory, Oscillations and Waves, Electrostatics: Electric Charges and Fields, Electrostatic Potential and Capacitance, Current Electricity, Current Electricity, Magnetic Effects of Current and Magnetism, Moving Charges and Magnetism, Magnetism and Matter, Electromagnetic Induction and Alternating Currents, Electromagnetic Induction and Alternating currents, Electromagnetic Waves, Optics, Ray Optics and Optical Instruments, Wave Optics, Dual Nature of Radiation and Matter, Dual Nature of Radiation and Matter, Atoms and Nuclei, Electronic Devices, Semiconductor -Electronics: Materials, Devices and Simple Circuits

Basic Mathematics	Marks 05

Basic understanding of Rational Numbers, Linear Equations in One Variable, Quadrilaterals, Practical Geometry, Data Handling, Squares and Square Roots, Cubes and Cube Roots, Exponents and Powers, Factorisation, Graphs, Number Systems, Mensuration, Sets and Functions, Algebra, Coordinate Trigonometry Geometry, Calculus, Statistics and Probability, Relations and Functions, Linear Programming