SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

AGRICULTURAL ENGINEERING(DEGREE)

PAPER-I

1. ***Soil and Water Conservation:*** Definition and Scope of soil conservation mechanics and types of erosion, their causes, hydrologic cycle, rainfall and runoff-factors affecting them and their measurements, stream gauging-evaluation of runoff from rainfall. Erosion control measures-Biological and Engineering. Basic open channel hydraulics, design of soil conservation, structures-terraces, bonds, outlets and grassed water-ways. Principles of flood control. Flood routing, Design of farm bonds and earth dams. Stream bank erosion and its control. Wind erosion and its control. Principles of watershed management. Investigation and planning in river Valley Projects.

2. ***Irrigation and Drainage-Soil-Water-Plant Relationship:*** Sources and types of irrigation. Planning design of minor irrigation projects. Techniques of measuring soil moisture.

   Duty of water-consumptive use. Water requirements of crops. Measurements and cost of irrigation water. Measuring devices-flow through orifices, weirs and flumes. Leveling and layout of irrigation systems. Design and construction of canals, fields channels, pipelines, head-gates, diversion boxes structures and road crossing. Occurrence of ground water. Hydraulics of wells, types of wells, their construction, drilling methods. Well development testing of wells.

PAPER-II

1. Building Materials-Kinds of building materials-their properties, timber, brickwork and R.C. construction, design of column, beams, roof trusses, joints, Layout of a farmstead. Design of farm houses, animal shelters and storage structures. Rural water supply and sanitation.

2. Farm Power and Machinery-Construction of different types of internal combustion engines. Ignition, fuel lubricating, cooling and governing systems of IC engines. Different types of tractors, chassis transmission and steering. Farm machinery for primary and secondary tillage, seeding machinery, interculture tools and machinery. Plant protection equipment. Harvesting and threshing equipment, machinery for land development. Pumps and pumping machinery.

3. Electricity and Rural Electrification-Power generation and transmission; distribution of electricity for rural electrification; A.C. and D.C. circuit. Uses of electric energy on the farm. Electric motors used in agriculture-types, selection, installation and maintenance.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

AGRICULTURAL SCIENCE

PAPER-I

1. ***Basic Agriculture:***

(a) *History of Agriculture:* Evaluation of present day agriculture as an art and science from primitive methods-development of scientific agriculture in India-Green Revolution.

(b) *Crop Ecology:* Climate and rainfall-Monsoon climate-Southwest and Northeast monsoons-their behaviour and causes, draught and floods- causes and effects; weather forecasting and meteorological services to farmers. Parameters affecting crop plants like temperature, humidity, sunshine hours, coldwaves, storm, wind, hails etc. hydrologic cycle and its importance to plant life. Broad agricultural regions of India on the basis of climate, crops and livestock and vegetation. Efficient cropping zones of India with special reference to Northeast India.

2. ***Agronomy:***

(a) *Agronomy:* Definition-scope of agronomy-classification of crop plants concepts in organic farming and sustainable agriculture.

(b) *Crop-production:* Broad classification of crops with reference to origin, history, distribution, soil and climate requirements, varieties, cultivation practices, seed production and agronomic improvement of the following.

(i) Cereals: Rice, maize, sorghum, wheat, bajra and millets.

(ii) Pulses: Blackgram, Greengram, Bengalgram, Horsegram, Lentil, Peas, Pigeon pea, Cow-pea etc. The importance of legumes in crop rotation.

(iii) Oilseeds: Soyabean, Rape & Mustard, Sunflower, Groundnut, Safflower, Niger, Castor, Linseed etc.

(iv)Commercial & Fiber Crop: Sugarcane, cotton, jute, mesta, tobacco, chilies, onion, garlic etc.

(v) Spices and Condiments: Pepper, mustard, cardamom, ginger, turmeric, cinnamon, glove, coriander etc.

(vi) Medicinal & Aromatic Plants: Difference between aromatic and medicinal plants-cultivation of some important plants in general such as poppy, cinchona, solanum sop, lemon grass, citronella, geranium, rose and tuberose.

(c) *Cropping System/Pattern:* Definition-factors involved in preparation of cropping schemes for different agro-climatic regions in India-types of cropping system-shifting cultivation, merits and demerits-crop rotation-principles of crop rotation-types of crop rotation generally followed in India and the state-factors affecting crop rotation-Role of legumes in crop rotation. Mono-culture vs mixed cropping-merits and demerits with examples. Integrated farming system-why integration of different enterprises is more economical than single enterprises farming co-operative farming and Agro-forestry-irrigated farming vs Rainfall farming-their merits and demerits.

(d) *Dry farming and Water Management:* Definition-soil and climate conditions in dry farming area-soil mulch, water use efficiency (WUE) with various agronomic practices under dry farming conditions. Importance of water

management in crop production-sources of water-methods to have rain water and water from rivers.

Suitability of soils and water quality for irrigation-water requirement for different crops and how to avoid water losses. Importance of drainage in irrigated farms for sustained farming-ill effects to undrained soils. Irrigation-time, depth, methods and systems of irrigation-explain the merits and demerits of these systems. Irrigation practices for important crops. Water lifting devices types and use.

(e) Seed production: Definition of seed qualities of good seed-external conditions required for germination-dormancy in seeds-cause of dormancy-seed treatment methods. Classification of seeds-breeders foundation seed-major causes of storage problem and precautions for domestic, commercial and other advanced techniques to prevent the incidence of storage pest in seed godowns.

(f) *Weeds & Weed Management:* Definition-its beneficial and harmful effect-classification of weed-crop-weed competition and factors effecting weed competition. Methods of weed control integrated weed management-herbicides-classification of herbicides-mode of action selectively of herbicides. Herbicide application equipments-pre post emergent weed control in field crops, vegetable crops and in cropping systems.

3. ***Soil Science, Soil Conservation and Management:***

(a) Soil Science: Definition and concept of soil-composition of soil profile-its affect on crop plants. How the soil holds water and its usage by plants-field capacity-wilting point-premeability. Soil organic matter-humus formation. C-Nratio and its significance to plants. Soil PH and limiting-"Lime makes father rich but the son poor" explain.

(b) Soil conservation: Why do we require to conserve our soil?-Types of soil conservation measures adopted-Role of trees/forest in conservation of water and soil. Soil conservation problem-practices followed in India and the State. Watershed-definition-components of watershed-conservation land treatments adopted-alternate land use system like agro-forestry, agro-horticulture etc. A brief note on conservation farming in India.

(c) Soil Erosion: Concept and factors affecting soil erosion-types of erosion-water erosion, sheet erosion, channel erosion, and wind erosion. Techniques to control soil erosion-vegetative methods of erosion control-mechanical method of erosion control-strip cropping-contour strip cropping-terracing and its classification, terrace systems of the state-Gullies and control measures-Run-off and control measures.

(d) Manures and Fertilizers: manures; composition and conservation of manures-its application. Compost-industrial waste-city waste-disposal and use of other farm waste as manure. Fertilizers-what is a fertilizer? Types of fertilizers-straight-compound-liquid-mixed fertilizer, their use and relative efficiency in relation to crop plants. Factors affecting fertilizer use and placement of fertilizer in crop plants. Liming and other soil amendments-when to apply lime. Essential nutrients-macro-micro nutrient and secondary compound. Importance of Bio-fertilizers in sustainable agriculture. What are green

manures? Its purpose and effects on subsequent crop yields crops used for green manures.

(e) Soil Management: The different management practices that can adopt to improve crop growth and soil condition-types of soil in India and the State-Alkaline-saline-acidic soils and their management and reclamation. Soil fertility and productivity-how to improve the soil fertility. The importance of humus and compost.

4. ***Agricultural Engineering:*** Tillage and its objective-different types of tillage-intertillage and intertillage implements-types of machinery used for landshapping, tillage, seeding, fertilizer applicator, intercultivation, weed control, harvesting and post harvest operations.

5. ***Agricultural Economics:*** Application of basis economic theories to agriculture such as principle of diminishing returns, principle of opportunity costs (equal-marginal return principle), and principles in combining enterprises-independent, competitive, supplementary and complementary enterprises.

(a) Agricultural Marketing and Storage: Definition of Agricultural marketing. Types of agricultural markets. Marketing functionaries (agencies) involved in marketing of agricultural produce. " The nature of some of the agricultural products, e.g. their bulk form and perishability and their seasonal availability further add to the complexity of agricultural marketing"-Elaborate. Regulation of markets. Agricultural produce markets Act,-How this Act came about and how far the Act has helped the producer? The mode of implementing the Act. Importance of standardization and grading of produce for internal trade and export. Consumer production through different measures such as grading under **'AGMARK'** for marketing of quality products. Co-operative marketing-merits and demerits. State level co-operative and National co-operative marketing bodies eg; NAFED (National Agricultural Co-operative Marketing Federation). Other activities of marketing handled by co-operative societies-co-operative export of Agricultural produce, co-operative cold stores. Market extension, marketing intelligence and marketing research and investigation.

(b) Farm Management: Definition, nature and scope of farm management. "Farm management is a branch of economics which deals with agricultural production economics"-Explain. Resources for farm management-land, labour, capital and management. What are the goals of a farm manager? Criteria for selection/buying a farm. Planning and budgeting-farming of farm plan/budget-steps in budgeting with different choices/alternatives (eg. Crop, livestock, building and labour use etc). Farm manager has to face many risks and uncertainties such as price change, yield uncertainty of new methods of production and change of Government policy etc. precautions to be taken adjust to uncertainty in farm management.

(c) Farm Credit/Finance: Decisions to use credit, peculiar features of farm finances-differences between financing agriculture and financing other sectors. Types of loans. Bankers are reluctant to finance the agricultural sector-why? Agencies involved in financing agricultural projects.
Commercialization of Agriculture in India and in the North-eastern region.

(d) Farm Business Analysis: Principles of single and double entry book-keeping, journal, ledger, cashbook, profit and loss recount, balance sheet. Measures of farm efficiency.

6. ***Agricultural Extension Education:*** Difference between formal education and extension education. Objective of extension education. Principles of extension education. Extension teaching methods-classifications. Programme planning in extension education-process (steps) of programme planning, role of extension education in agricultural development. Use of PRA (Participatory Rural Appraisal) in extension education. Importance of Training as a means of extension education in agricultural development.

PAPER-II

1. ***Horticulture Development:***
Definition and Scope of Horticulture*:* Branches of horticulture, importance in the context of the State. Important horticultural crops of the sate-fruit crops: vegetable crops and ornamental crops and package of practices of important horticultural crops including plantation crops, commercial, floriculture, medicinal and aromatic plants.

2. ***Agricultural Botany and Plant Breeding:*** Different branches of plant science-such as genetics, cytology, bacteriology, biometry, taxonomy, plant physiology, plant pathology, micro-biology, ecology and plant breeding-importance of their study and relationship among themselves. The role of plant explores and breeders and botanical gardens in the propagation of economic plants in the old and new world. Vaviliv's center of origin of crop plants-primary and secondary center. Darwin's theory of natural selection. Mendel's law of heredity chromosomes as bearers of heredity. Cell definition-types of cell division-mitosis-meiosis-comparasion of meiosis and mitosis.

Nature and scope of plant breeding, mode of reproduction in relation to breeding methods, what are the different methods of crops improvement? Introduction-selection-hybridization. Difference between self and cross pollinated crops with few examples. Define mutation-different kinds of mutation-its nature-its advantage and disadvantage, application to conventional breeding methods. In vitro techniques in crop improvement and prospects. Tissue culture-protoplast culture etc.

3. ***Improved Seed:*** Definition and prerequisites of an improved variety-its production-multiplication-distribution-maintenance and testing. How is a variety named and released? What do the term 'seed certification' mean? Role of gene bank in preserving the cermplasms.

State the contributions or functions of the following persons/agencies in brief:

(a) i. Darwin (1834-1914)
ii. Gregory Mendel (1822-1884)
iii. Dr. William Roxburgh (The father of Indian Botany)
iv. T.S. Venkataraman (Sugarcane)
v. Dr. K. Ramiah (rice)
vi. Dr. Choudhary Ram Bhan Singh (Wheat)
vii Dr. B.P. Pal (wheat)
viii. Dr. M.S. Swaminathan (Mutation breeder)

ix. Dr. M.S. Randhawa
x. Dr. W. Carey.

(b) i. I.A.R.I (Indian Agricultural Research Institute)
ii. NBPGR (National Bureau of Plant Genetic Resources)
iii. Botanical Survey of India.
iv. Forest Research Institute, Dehradun.

4. ***Plant Physiology:*** Definition-its importance, Role of mineral nutrients in plant metabolism, what are essential elements? Major and minor nutrients-its functions in plant. Nutrient deficiencies-toxicities and remedies in major crop plant.

5. ***Growth and Development:*** Growth regulators-inhalators-definitions and their role-Auxins-Gibberllings Cytokinig-acid-ethylene-its functions and site of synthesis. What is photoperiodism-and its relationship in flowering-mechanism and long day plants-verbalization and flowering-Jane the substances regulation flowering. Development of fruit-growth and ripening-seed and bud dormancy-causes and remedies and its use in technology. Importance of photosynthesis-respiration process in crop improvement programme.

6. ***Plant Protection/Pathology:***

(a) Disease-definition-nature and causes-diagnosis of disease in major crop plants-avenues of penetration-reproduction and dissemination. Types of disease-seed-borne-soil borne-and airborne disease. General account of some important diseases due to fungi, bacteria, viruses, nematodes, angiospermic parasites (eg: striga and loranthus (SPP), and non-paracitic agents affecting cereals, pulses and oilseeds with reference to symptomatology, epidemiology and management practices.

(b) Nematology: Diagnosis-symptoms and pathological effects of nematode injury to important crop plants in general-economic importance of plant parasitic nematodes. Principles of nematodes management with an integrated approach.

(c) Microbiology: Types of micro-organisms-bacteria-fungi-elgae-protozoa and viruses-definitions and their importance in natural plant processes. Procaryotes and Eucaryotes-their functions. Effects of environmental factors on growth and activity of micro-organisms.

(d) Classification of chemicals-fungicides, bacteriacides, nematicides and their methods of application in control of diseases. Systematic and contact chemicals-antibiotics nature and uses.

7. ***Entomology:*** Mode of feeding of insect pest on plants and nature of damage of some important cereals, pulses and oilseeds. Insecticides formulations, solid and liquid formulations. Study of non-insecticides chemicals-chemosterilants, antifeedants, attractants, repellants, chitininhibitors, growth regulators and harmone analogues. Role microbes-pedators, paracites, parasitoids and other natural enemies in biological control. Insect residues-problems of residues in relation to environment and human safety. Pest control measures-physical-mechanical-cultural-biological and concept of integrated pest management (IPM).

Insecticides formulations-classification and mode of action-arsenicals-fluorine compounds, dinitrophenol, chlorinated hydrocarbons chlorinated terpenes, organophosphamates, carbonates, fumigants, insecticides of plant and animal origin and non-insecticides chemical insecticides application equipments-dusters and

sprayers-manual and power operated. Important pest of crops in the state and their control storage posts and their control. Precautions in the use of insecticides.

8. ***Short notes On:***

(a) N.S.C. (National SEED Corporation), F.C.I. (Food corporation of India), N.C.D.C. (Natonal Cooperative Development Corporation), NABARD (National Bank for Agriculture and Rural Development), K.V.K. (Krishi Vigyan Kendra), I.C.A.R. (Indian Coulcil of Agricultural Research), I.R.D.P. (Integrated Rural Development Programme), I.C.R.I.S.A.T. (Integrated Crop Research Institute for Semi-Arid Tropics), T.T.C. (Trainers Training Centre), I.R.R.I. (International Rice Research Institute).

(b) Organic farming, sustainable agriculture, eco-farming, agriculture, I.N.M. (Integrated Nutrient Management), I.P.M. (Integrated Pest Management), Integrated farming system, balanced fertilizers, biotechnology, watershed management, global warming or greenhouse effect, wasteland management, gene bank, T&V system, agriculture, Rhizobial culture, Tissue culture, Genetic Engineering, Rainfed farming.

(c) Important books and authors on agricultural fields/subjects and contribution of some significant workers/scientist, administrators to development of agriculture in India.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

ANIMAL HUSBANDRY & VETERINARY SCIENCE

PAPER-I

1.0. ANIMAL NUTRITION: Energy sources, energy metabolism and requirements for maintenance and production of milk, meat, eggs, wool, evaluation of feeds as sources of energy.

1.1. TRENDS IN PROTEIN NUTRITION: Sources of protein, its metabolism and synthesis, protein quantity and quality in relation to requirements, energy protein in ratios in ration.

1.2. MINERALS IN ANIMAL DIET: sources, functions, requirements and their relationship of basis minerals including trace elements.

1.3. VITAMINS IN RUMINANT NUTRITION: Daily Cattle:
Nutrients and their metabolism with reference to milk production and its composition. Nutrient requirement for calves, Heifers, Dry and Milking cows and Buffaloes, limitations of various feeding systems.

1.5. ADVANCE IN NON-RUMINANT NUTRITION: Poultry nutrients and their metabolism with reference to poultry meat and egg production. Nutrients requirements and food formulation for broilers at different ages.

1.6. ADVANCES IN NON-RUMINANT NUTRITION: Swine nutrients and their metabolism with special reference to growth and quality of meat production, nutrients requirement and feed formulations for creeps, growers and finishers.

1.7. ADVANCES IN APPLIED ANIMAL NUTRITION: A critical review and evaluation of feeding experiments, digestibility and balance studies. Feeding standards and measures of food energy. Nutrient requirements for growth, maintenance and production, balanced rations.

2.0. ANIMAL PHYSIOLOGY:

2.1 GROWTH AND ANIMAL PRODUCTION: Prenatal and postnatal growth, maturation, growth curves, measures of growth, factors affecting growth, body conformation body.

3.3. FEEDING AND MANAGEMENT OF ANIMALS UNDER DROUGHT, FLOODS AND OTHER NATURAL CALAMITIES.

4.0 GENETICS AND ANIMAL BREEDING: Mitosis and meiosis, Mendelian inheritance, deviations to Mendelian genetics. Expression of genes, linkage and crossing over, sex determination, sex influence and sex limited characters, blood groups and polymorphism, chromosomal abbreviations, gene and its structure, DNA as a genetic material, genetic code and protein synthesis, recombinant DNA technology, mutations, types of mutation, methods for detecting mutations and mutations rate.

4.1. POPULATION GENETICS APPLIED TO ANIMAL BREEDING:

Quantitative Vs qualitative traits, Hardy-weinberg law, population vs. individual, gene genotypic frequency, forces changing gene frequency, random drift and small population, theory of path coefficient, inbreeding, method of estimating inbreeding, effective population size, breeding value, estimation of breeding value, dominance and epistatic deviation, partitioning of variation, genotype X environment correlation and genotype X environment interaction, role of multiple measurements, resemblance between relatives.

4.2 BREEDING SYSTEM: Heritability, repeatability and genotypic and phenotypic correlations, their methods of estimation and precision of estimates, Aids to selection and their relative merits, individual, pedigree, family and within family selection.

Pogency testing, methods of selection, construction of selection indices and their uses, comparative evaluation of genetic gains through various selection methods, indirect selection and correlated response, inbreeding, upgrading, cross-breeding and synthesis of breeds, crossing of inbred lines for commercial production, selection for general and specific combining ability, breeding for threes-hold character.

PAPER-II

1. HEALTH AND HYGINE:

1.1. Histology and Histological Techniques: Stains-chemical classification of stains used in biological works. Principles of staining tissue, mordents, progressive and regressive stains. Oiffential tissue of cytoplasmic and corrective tissue elements. Methods of preparation and processing of tissues. Colloidin embedding, freezing micro-to-my microscopy. Bright field microscope and electron microscope, cytology, structure to cell, organelles and inclusions, cell division, cell types. Tissues and their classification. Embrynic and adult tissues. Comparative histology of organs, vascular, nervous, digestive, respiratory, musculo-skeletal and urogenital systems. Endocrine glands, integuments, sense organs.

1.2. Embrology: Embrology of vertebrates with special reference to aves and domestic mammals, gametoganesis, fertilization, germ layers, fetal membrance and placentation. Types of placentin domestic mammals. Technology, twins and twinning, organogenesis, germ layer derivatives, endodermal, mesodermal and ectodermal derivatives.

1.3. Bovine Anatomy-Regional Anatomy: Paranasal sinuses of OX. Surface anatomy of salivary glands. Regional anatomy of infraorbital, maxillary, mandibuloalveolar, mental and corneal nerve block. Regional anatomy of paravertebra nerves, pudental nerve, median, ulnar and radial nerve, tibial, fibular and digital nerves. Granical nerves. Surface anatomy of visceral organs of thoracic, abdominal and pelvic cavities-comparative features of locomotor apparatus and their application in the biomechanics of mammalian body.

1.4. Anatomy of Fowl: Musculo-Skeletal system-functional anatomy in relation to respiration and flying, digestion and egg production.

1.5. **PHYSIOLOGY OF BLOOD AND ITS CIRCULATION, RESPIRATION, EXCRETION, ENDOCRINE GLANDS IN HEALTH AND DISEASE.**

1.5.1. Blood Constituents: Properties and functions, blood cell formation Haemoglobin synthesis and chemistry, plasma production, classification and properties, coagulation of blood, Haemorrhagic disorders, antioagulants, blood groups, blood volume, plasma expanders, buffer systems in blood. Biochemical tests and their significance in disease diagnosis.

1.5.2. Circulation: Physiology of heart, cardiac cycle, heart sounds, heart beat, electro cardiograms, work and efficiency of heart-effect of icons on heart function, metabolism of cardiac muscle, nervous and chemical regulation of heart, effect of temperature and stress on heart, blood pressure in hypertension. Osmotic regulation, arterial pulse, vasomotor regulation of circulation, shock. Coronary and pulmonary circulation. Blood-Brain-Barrier- Cerbrosonial fluid-circulation in birds.

1.5.3. Respiration: Mechanism of respiration, transport and exchange of gases, neutral control of respiration, chemoreceptors, hypoexia, respiration in birds.

1.5.4. Excretion: Structure and functions of kidney-formation of urine, methods of studying renal function, renal regulation of acid-base balance, physiological constituents of urine, renal failure, passive venous congestion. Urinary excretion in chicken. Sweat glands and their function. Biochemical tests for urinary disfunction.

1.5.5 Endocrine Glands: Functional disorders, their symptoms and diagnosis, synthesis of hormones, mechanics, and control of excretion, hormonal receptor, classification and function.

1.6. GENERAL KNOWLEDGE OF PHARMACOLOGY AND THERAPEUTICS OF DRUGS.

Cellular level of pharmacodynamics and pharmacokinetics, drugs acting on fluids and electrolyt balance. Drugs acting on Automatic nervous system. Modern concepts of anaesthesia and dissociative anaesthetics. Autocoids –Antimicqobials and principles of chemotheraphy in microbial infections use of harmones in therapeutics-hemotheraphy of parasitic infections. Drugs and accumulation of poison in the edible tissues of animals. Chemotheraphy of Neoelastic disease.

1.7 VERTENIARY HYGINE WITH REFERENCE TO WATER, AIR AND HABITATION.

Assessment of pollution of water, air and soil, importance of climate on animal health. Effect of environment on animal function and performance. Relationship between industrialization and animal agriculture. Animal housing requirements for specific categories of domestic animals viz. pregnant cows and sows, milking cows, broiler birds, stress, strain and productivity in relating to animal habitation.

2. ANIMAL DISEASES:

2.1. Pathogenesis, symptoms, postmortem lesions, diagnosis and control of infectious diseases of cattle, pigs and poultry birds, sheeps and goats.

2.2. Etiology, symptoms, diagnosis and treatment of metabolic and reproductive diseases of cattle, pig, poultry, sheep and goat.

2.3 Deficiency diseases of domestic animals and birds.
2.4 Parasitic diseases of animals and birds.
2.5 Diagnosis and treatment of nonspecific condition like impaction, bloat, diarrhea, indigestion, dehydration, stroke, poisoning.
2.6 Diagnosis and treatment of neurological disorders.
2.7 Principle and methods of immunization of animals against specific diseases, herd immunity , disease free zones, 'Zero' disease concept and chemoprophylaxis.
2.8 Anaesthesia-local, regional and general, preanaesthetia medication, symptoms and surgical interference in fractures and dislocations, hernia, choking, abomassal displacement. Caesarian operation, rumenotomy and castrations.
2.9. Diseases investigation techniques-materials for laboratory investigation. Establishment of Animal Health Centres. Disease free zone.
2.10. Management of wild animals and animals in captivity for treatment. Drugs used for tranquilising the ferocious animals.

3. VERTENIARY PUBLIC HEALTH:

3.1. Zoonoses: Classification, definition, role of animals and n birds in prevalence and transmission of zoonotic diseases, occupational zoonotic diseases.
3.2. Epidemiology: Principles, definition of epidemiological terms, application of epidemiological measures in the study of diseases and diseases control. Epidemiological features of air, water and feed borne infections.
3.3. Veterinary Jurisprudence: Rules and regulations for improvement of animal quality and prevention of animal diseases, state and central rules for prevention of animal and animal product borne-disease. S.P.C.A. veterolegal cases-certificates. Materials and methods of collection of samples for veterolegal investigation.

4. MILK AND MILK PRODUCTS TECHNOLOGY:

4.1. Milk Technology: Organization of rural milk procurement selection and transport of raw milk, quality testing and grading raw milk, quality stores, grades of whole milk, skimmed milk and cream.

Processing, packing, storing, distributing, marketing defects and their control, nutritive properties of the following milk: Pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombine and flavoured milks, preparation of cultures milk, cultures and their management yoghurt, dahi, lassi and srikhand. Preparation of flavoured and sterilized milks. Legal standards. Sanitation requirements for clean and safe milk and for the plant equipments.

4.2. Milk Products Technology: Selection of raw materials, assembling, production, processing, storing, distribution and marketing milk products such as butter, ghee, khoa, channa, cheese, condensed, evaporated, dried milk and baby food, ice cream and kulfi, by-products, whey products, butter milk, lactoses and caseion, tasting, grading, judging milk products-BIS and agmark specifications, legal standards, quality controls, nutritive properties, packaging processing and operations control costs.

5. MEAT HYGINE AND TECHNOLOGY:

5.1. Meat Hygiene:

5.1.1. Ante mortem care and management of food animals, stunning, slaughter and dressing operations, abattoirs requirements and designs. Meat inspection procedures and judgment of carcasses, meat cuts. Grading of carcasses, meat cuts, duties and functions of veterinarians in wholesome meat production.

5.1.2. Hygiene methods of handling and production of meat, spoilage of meat and control measures, post slaughter physiochemical changes in meats and factors that influence them, quality improvement methods. Adulteration of meat and detection, regulatory provisions in meat trade and industry.

5.2. Meat Technology:

5.2.1. Physical and chemical characteristics of meat, meat omulaisons, methods of preservation of meat, curing, canning, irradiation, packaging of meat and meat products. Meat products and formulations.

5.3. Byproducts: Slaughter house byproducts and their utilization, Edible and inedible byproducts. Social and economic implication of proper utilization of slaughter house byproducts. Organ products for food and pharmaceuticals.

5.4. Poultry Products Technology: Chemical composition and nutritive value of poultry meat. Pre-slaughter care and management. Slaughtering techniques, inspection, preservations of poultry meat and products. Legal and BIS standard, structure, composition and nutritive value of eggs, microbial spoilage, preservation and maintenance, marketing of poultry meat, eggs and products.

5.5 Rabbits/Fur Animals Farming: Care and management of rabbit meat production, disposal and utilization of fur and wool and recycling of waste by products. Grading of wool.

6. EXTENSION: Basic philosophy, objectives, concept and principle of extension-different methods adopted to educate farmers under rural conditions. Generation of technology, its transfer and feedback. Problems of constraints in transfer of technology. Animal husbandry programmes for rural development.

7. FORAGE PRODUCTION: Different types of folders, both legumes and non-legumes, cultivation and management of pasture and pasture land, hay making, silage making methods of growing and conservation of fodder for animals.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

ARCHITECTURE (DEGREE)

PAPER-I

I. ***Landscape Design:*** Principles of landscape design, landscape elements, materials, planning design.

II. ***Computer Aided Design:*** Application of computers in architecture and planning, understanding elements of hardware and software, programming languages-Fortran, Basic.

III. ***Environmental and Building Science:*** Elements of environmental science, ecological principles concerning environment, role of micro-climate in design control through design elements, elements of solar architecture, principles of lighting and illumination, basic principles of architectural acoustics, noise pollution and control.

IV. ***Visual and Urban Design:*** Principles of visual composition, proportions, scale, rhythm, symmetry, asymmetry, harmony, balance of form and colour, sense of place and space, division of space, focal point, vista, visual survey.

PAPER-II

I. ***History of Architecture:*** Indian-Indus Valley, Vedic, Buddhist, Indo-Aryan, Dravidian and Mughal periods; European-Egyptian, Greek, Roman, Medieval and Renaissance periods.

II. ***Development of Contemporary Architecture:*** Development and impact on society since Industrial Revolution, influence of modern art on architecture, works of national and international architects, post-modernism in architecture.

III. ***Building Services:*** Civil-water supply, sewerage and drainage systems; sanitary fitting and fixtures; electrical and mechanical-principles of electrification of building; elevators, their standards and uses, air-conditioning systems.

IV. ***Construction Systems and Management:*** Building systems and prefabrication of building-elements, principles of joining, and principles of modular coordination.

V. ***Structural Systems:*** Behavioral characteristics of traditional building materials like mud, timber, bamboo, etc.; principles of strength of materials, design of structural elements in wood, steel and RCC; elastic and limit state design, complex structural systems, and principles of prestresing.

VI. ***Urban Services and Networks:*** Design principles of distribution and supply systems for water supply, sewerage, drainage, solid waste disposal and supply power health and demography related aspects of standards at town, neighborhood and site levels.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

ARCHITECTURE (DIPLOMA)

PAPER I

1.Drawing instruments,equipments and materials;their use,care and maintainence. Introduction to Bureau of Indian Standards (BIS). Code of Practice for general and architectural drawings.

2.Geometrical drawings:- definition, construction of plain geometrical figures. Orthographic projections:- Principles,representation and construction of different types

Scales,graphic scales,recommended scales for drawings with reference to BIS codes.

3.Brick Masonry-bricks and brick tiles,principles of construction,bonds in brick masonry

4.Principles of stone masonry construction,classification,terms used.Types of rubble masonry,ashlar masonry.

5.Different components of building-foundation and footing,walls,doors,windows,roofing.

6.Introduction to RCC structure,materials used in RCC construction.

7.Computer- Introduction and general terms used.Windows command and their uses.Autocad commands and use of different tools in the tool bar.

PAPER II

1.Construction of plain geometrical figures
(lines,angles,triangles,rhombus,quadrilaterals, Polygons,ellipses,hyperbola,etc.)

2.Drawing Plan,elevation of points,lines,surfaces,solids.

3.Orthographic projection of furniture- table,chairs,desk,stool,etc.

4. Reducing and enlarging of drawing objects by graphical method and by instrument method.Measured drawing of any object.

5. Free hand lettering.Sketching of set of objects,landcape,mountains.

6. Applied trade problems-involving multiplication,division,common fraction,addition,subtraction,multiplication and division.Application of fractions and decimals to trade problems.Ratio and proportion.Conversion of different units.

7. Algebra-simple equation,problems involving trade.

8. Problems related to triangles,rectangles,square,circle,regular polygons etc.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

AUTOMOBILE ENGINEERING(DIPLOMA)

PAPER-I

1. AUTOMOBILE ENGINE-I
   Auto Engines, Automotive Fuels, Combustion Process in Diesel Engines, Fuel Injection, Equipments for Diesel Engine.

2. AUTOMOBILE ENGINE-II
   Engine Details lll, Engine Lubrication, Engine Cooling.

3. AUTOMOBILE CHASSIS
   Clutch, Gearbox, Propeller Shaft and Universal Joint, Bearing, Seals and Lubrication, Brakes.

4. VEHICLE MAINTENANCE & GARAGE PRACTICE
   Garage Tools-General & Special, Vehicle Maintenance.

5. TRANSPORT MANAGEMENT & MOTOR VEHICLE ACT
   Motor Vehicle Act 1989, Safety of Motor Vehicles, Control of Traffic.

6. AUTOMOBILE ELECTRICAL & ELECTRONICS
   Battery, Basic Electrical Accessories.

7. DESIGN AND DRAWING OF AUTO COMPONENETS
   Basic Concepts of Design, Design Consideration In Auto Components Design, Design of Frame Structure.

8. AUTOMOBILE MANUFACTURING PROCESSES
   Casting, Initial Operations, Special Operations, Metal Joining Processes.

9. STRENGTH OF MATERIALS
   Introduction of Material Properties, Simple Stress & Strain, Principle Strain & Stress.

10. THEORY OF MACHINES
    Fundamentals, Types of Mechanisms, Common Mechanisms.

PAPER-Il

1. VEHICLE SURVEYING AND ACCIDENTAL REPAIRS
   Vehicle Survey, Repairs Procedures & Techniques.

2. RETROFITTING IN MOTOR VEHICLE
   Retrofitting AC & Ventilation System Fitting.

3. AUTO ENGINE RECONDITIONING

General Considerations for Engine Reconditioning, Complete Overhauling of Auto Engine.

4. TYRE MAINTENANCE & RTREADING
   Introduction, Classification of Tyres, Tyre Defects & Repairs, Tyre Retreading.

5. AUTOMOTIVE AIR CONDITIONING
   Air Conditioning System, Maintenance & Repair of Air Conditioning.

6. AUTO BODY WORK PRACTICES
   Introduction to Auto Body, Body Layout and Chassis Frame for Vehicles.

7. AGRICULTURE AND EARTH MOVING MACHINERY
   Dragline-Rope Operated Excavator, Hydraulics in Tractors and Earth Moving Equipment.

8. THERMAL ENGINEERING
   Introduction, Air Compressor.

9. FLUID MECHANICS AND HYDRAULIC MACHINES
   Properties of Fluid, Pumps, Hydraulic Devices.

10. METROLOGY AND QUALITY CONTROL
    Metrology Concepts & Standards, Limits, Fits & Gauges, Fundamental of Statistical Concepts.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

BDS (DENTAL SURGEON)

PAPER-I

1. Human anatomy, including Embryology, Osteology & Histology.
2. Human Physiology, Biochemistry, Nutrition & Diets.
3. Dental materials.
4. General Pathology.
5. General & Dental Pharmacology.
6. General Medicine.
7. General Surgery.

PAPER-II

8. Oral & Dental Anatomy, Physiology & History.
9. Oral Pathology & Microbiology.
10. Prosthetics, Crown & Bridge.
11. Conservative Dentistry.
12. Orthodontics & Paedodontics.
13. Oral Surgery, Dental Radiology & Anesthesiology.
14. Periodontics:
    (a) Periodontology.
    (b) Community Dentistry.
    (c) Oral Medicine.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

Biochemistry

PAPER-I

UNIT-I:

BIOMOLECULE & HUMAN PHYSIOLOGY

Carbohydrates: Structure of monosaccharides,stereoisomerism and optical isomerism of sugars, reactions of aldehydes and ketone groups,ring structure and anomeric forms,mutarotation,chemical reactions of sugars,important derivatives of monosaccharides,di- and tri-saccharides structure,occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides ,eg. glycogen, starch, cellulose,bloodgroup polysaccharides,inulin,chitin,glycosaminoglycans.

UNIT-II:

Lipids: Definition and classification,Fatty acids: introduction,classification, nomenclature, structure and properties of saturated and unsaturated fatty acids,essential fatty acids,triacylglycerols; nomenclature, physical properties,chemical properties and characterization of fats- hydrolysis, saponification value, acid value, rancidity of fats, Reichert- Meissel number and reaction of glycerol, biological significance of fats, Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphinggomyelins, glycolipids- cerebrosides, gangliosides.

UNIT-III

A) Muscles: Structure of striated muscle fiber, Molecular organization of contractile system, Sliding mechanism of muscle contraction, neuromuscular junction.

B) Digestion, digestion and absorption of carbohydrates, fats, proteins.

(MICROBIOLOGY AND VIROLOGY)

UNIT-I

A) History and Development of microbiology: Controversy over spontaneous generation, Fermentation & Germ theory of diseases, Concept of immunization.

B) Microscopy; Compound Microscopy; parts of compound microscopy, Numerical Aperture & its importance.

Resolving power, importance of oil immersion objective, Ray diagram of compound light microscope, Principles and applications of Dark field, Phase contrast, UV & Fluorescent microscopy. Electron microscopy; Principle and Ray diagram.

UNIT-II

A) Staining: Principles and technique of simple and differential staining (Gram, Acid-fast & Endospore staining).
B)Viruses; General characteristics of viruses. Virus structure. Basis of virus classification, detailed study of lytic cycle & Lysogeny.

UNIT-III

A)Classification of Microorganisms; Prokaryotes and Eukaryotes, Haeckal system, Whittaker system, Bergey's manual.
B) Bacteria; (i) Bacterial morphology & subcellular structures (General morphology of bacteri, shapes & sizes).
(ii) Slime layer & capsule, (iii) Cell wall structure of Gm +ve & Gm –ve cells. (iv) General account of ribosome, Flagella & Fimbriae. (v) Chromatin materials, Plasmids and episomes. (vi) Endospore: Detailed study of endospore structure & its formation, Basis of resistance.

MICROBIOLOGY AND IMMUNOLOGY

UNIT-I
Nutrition: (i) Basic nutritional requirements;(ii) Nutritional classification of bacteria; Phototrophs & chemotrophs, (iii) Pure cultures and method of obtaining pure cultures.

UNIT-II
Microbial control
(i) Terminology (ii) Factors influencing anti microbial activity (iii) Mechanisms of cell injury (iv) Physical control methods (v) chemical control methods (vi) Chemotherapeutic agents;- Sulphonamides and Antibiotics (vii) Standardization of disinfectant: Phenol coefficient.

UNIT-III
Immunology
A) The immune system:- Active and Passive immunity, organs and cells of the immune system & their functions.

B) Immunoglobulins:- Nature and general properties of antibodies, Antibody reactions & antibody binding sites, Antibody specificity, Haptens, Basic structure of IgG, Brief account of other types of antibodies,

UNIT-IV
Immunology
A)Clonal selection theory: Brief idea of Hybridomas and monoclonal antibodies, Preparation and its application.
B)Brief idea of Complement system.
C Brief account of cell mediated (Cellular) immunity & humoral (Noncellular) immunity.

PAPER-II

MACROMOLECULES

UNIT-I
Proteins:- (a) Quick review of amino acids, physico-chemical properties of amino acids (Solubility, Boiling & melting points, Reactions like Edman's,Sanger's, Dansyl chloride, Ninhydrin & Formaldehyde). Unusual amino acids.
(b) Determination of primary structure of proteins
(c) Peptide, peptide mapping, Merrifield-Gutt synthesis.

UNIT-II
Proteins:- (a) Secondary structure of proteins:- The Helix, Pleated sheet structures. (b) Tertiary structure of proteins: Forces that stabilize the structure, concept of domains, protein denaturation (c) Quaternary structure of proteins: Subunit interaction (d) Structure and biological functions of Collagen.

UNIT-III
Nucleic acids:- (a) Chemical structure and base composition of nucleic acids, Chargaff's rules (b) Double helical structures, Watson- Crick Model (B- DNA), Deviations from Watson-Crick model, Other DNA helices (A- & Z- DNA).
(c) Forces stabilizing nucleic acid structures, Denaturation & Renaturation, Sugar phosphate chain conformation, Base pairing, Base stacking, Hydrophobic and ionic interactions.

UNIT-IV
Nucleic acids:-
a) Tm & buoyant density and their relationship with G-C content in DNA, satellite DNA.
b) DNA sequencing; Maxam-Gilbert & Sanger's dideoxynucleotide sequencing.

c) Structure of m-RNA, r-RNA & t-RNA.

ENZYMOLOGY

UNIT-I

a) Classification & Nomenclature of enzymes, Specificity of enzymes action (Lock & Key model & Induced fit model).

b) Enzyme catalysis: Proximity & Orientation effect, covalent catalysis, acid-base catalysis, metal ion catalysis

c) Regulatory enzymes:- Allosteric (ATCase) & covalently modulated (Glycogen Phosphorylase) enzymes.

UNIT-II

a) Mechanism of action of Chymotrypsin and Ribonuclease.

b) Role of vitamins as coenzyme precursors (Riboflavin, Niacin, Pyridoxine, Biotin and Thiamine)

c) Effect of enzyme concentration, upward & downward curvatures with examples.

d) Effect of temperature on enzyme activity & temperature quotient.

UNIT-III

Enzyme Kinetics: Importance of measuring initial velocities, Derivation of Michaelis-Menten equation, Single & double reciprocal plots, Graphical representation of various inhibitors (Competetive, Noncompetetive & Uncompetetive) on Lineweaver-Burke plots, Importance of Kcat / Km. Bisubstrate reactions – brief introduction to sequential and ping-pong mechanisms with examples.

UNIT-IV

a) Effect of pH, General pH profile diagram with exceptions.

b) Concept of enzyme assay & its importance, Enzyme activity units (Katal & Specific activity)

c Enzyme isolation and purification:- Enzyme solubilization, brief idea of various fractionation procedures, criteria for enzyme purity and homogeneity.

BIOPHYSICAL & BIOCHEMICAL TECHNIQUES

UNIT-I

Electrophoresis:-

a Migration of ions in electric field, Factors affecting electrophoretic mobility.

b Paper electrophoresis:- Electrophoretic run, Detection techniques, Cellulose acetate electrophoresis, High voltage electrophoresis, Apllications.

c Gel electrophoresis:- Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & estimation of macromolecules, Applications.

UNIT-II

Electrophoresis:-

Disc- Gel electrophoresis:- Procedures & Applications.

a) SDS-PAGE electrophoresis:- Isoelectric focusing, Principle, Establishing pH gradients, Stabilization against convection, Procedures & applications.

b) Immunological techniques:- Immunodiffusion, Immuno electrophoresis, Radioimmunoassay, ELISA and immunofluorescence.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

BIOTECHNOLOGY

Part-I

GENETICS

1) Mendelian Genetics: Laws of heredity and modifications of monohybrid interactions (Incomplete dominance, co- dominance and over dominance).
2) Varieties of gene expression (with atleast one example each), Multiple alleles, lethal genes.
Gene interactions- dominant and recessive epistasis, duplicate genes, complementary genes and dominant and recessive interactions.
3) Linkage and linkage maps: Complete and incomplete linkage, crossing over, three point cross, genetic mapping, Chromosome interference, analysis of ordered and unordered tetrads.
4) Pedigree analysis:- Standard symbols used, penetrance, recessive and dominant inheritance, Probability, sex linked inheritance.
5) Chromosomal aberrations: Variation in chromosome number- types, generation of variation, aneuploidy, dosage compensation and barr bodies (human), Variation in chromosome structure- types, generation of variation, identification of heterozygotes due to chromosomal variations, consequences.
6) Mutations: Classification and types, molecular basis of mutations, mutagens and their actions, hot spot mutations.
7) Bacterial Plasmids: Types, structures, properties and significance.
8) Operon concept: Inducible and repressible operons, positive and negative regulations, lactose, tryptophan and arabinose operons perpaining to their structure and regulatory mechanisms (both positive and negative regulation in detail).
9) DNA transfer mechanism : Conjugation: F factor, mechanisms of conjugation, Hfr strain and its transfer, sexduction.
Bacterial transformation: concept of transforming principle, mechanism of trsnsformation in Streptococcus and Haemophilus in detail .
Transduction: Virulent and temperate Phages, lytic and lysogenic life cycles, Mechanism of generalized andspecialised transduction, abortive transduction, co-transduction.
10) Transposable Elements: Characteristics, transposable elements in prokaryotes (insertion sequences, Transposons) and Eukaryotes (yeast Ty elements, Ac/Ds elements in maize, Copia and P elements in Drosophila, Alu sequence in humans), mechanisms of transposition, excision of transposons.
11) Population genetics: Gene frequencies, allele frequencies, random mating and Hardy- Weinberg principle.

CELL BIOLOGY

1 Overview of plant and animal cell structure, cellular diversity.
2 Mitosis, Meiosis in plants and animals
3 Cell cycle: Phases of cell cycle, checkpoints of cell cycle, regulation of cell cycle.
4 Cell wall: Plant cell wall- Primary and secondary, glycocalyx
Plasma Membrane: Structure, chemistry and receptors; Transport- Simple diffusion facilitaded diffusion active transport, membrane potential and synaptic transmission, exocytosis and endocytosis, pinocytosis and phagocytosis.
5 Structure and function of cell organelles: Endoplasmic reticulum, Mitochondria, Chloroplast, Golgi body, nucleus, lysosomes, vacuoles, peroxysomes and glyoxysomes.
6 Protein targeting
7 Cell junctions and cell matrix interactions
8 Apoptosis, neoplasia and cell death.

Environmental Biology and Biotechnology

1 Understanding Environment and Ecology

1.1 Introduction to Environment Science and ecology
1.2 Environmental components- Introduction, Atmosphere, Ozone layer,hydrosphere, Lithosphere, Biosphere.
1.3 Ecology and its concepts- Biogeography, Ecosystem and community with examples, Ecosystem evolution.
1.4 Energy flow- Second law of thermodynamics, Food chain, Trophic levels, Energy budget. Nutrient cycles (Nitrogen, Phosphorus, and carbon).
1.5 Factors affecting ecosystem- Natural factors, Inter & Intra community factors, Anthropogenic factors.

2 Threats to Ecosystem/ Environment

2.1 Pollution- Air, Water, Soil; Pollutants in ecosystem- Terrestrial, Aquatic ecosystems, Pesticides/ Insecticides, heavy metals, toxins radiations.
2.2 Environmental priorities in India- Environmental Impact Assessment (EIA case study), Red Data book.
TRAFIC
2.3 Microbial biodegradation of plastic, hydrocarbons, Pesticides/ Insecticides ,herbicides and hazardous waste.

3 Biotechnology in Protection and Restoration of Ecosystem

3.1 Protection- Social awareness, Major protection acts in India (Forest conservation act 1980, Wild life Protection Act 1972) and protection efforts in the world (Earth summit, Agenda 21)

3.2 Bioremediation- Importance of bioremediation, use of microorganisms, Phytoremediation, Bioindicators and detector.

3.3 Modern conservation practices- Biotechnology in conservation, Ex situ and In situ conservation practices, In vitro propagation of rare and threatened species, conservation of genetic resources.

3.4 Waste and Disaster Management- Waste water treatment- Biological, Biomedical waste management,Integrated waste management, Hazards in environment, Remote sensing and GIS.

PAPER-II

Molecular Biology

1 DNA as the genetic material:

a. Introduction

b. Different classical experiments leading to evidence of DNA as genetic material.

c. Structure of DNA- Watson and Crick model.

2 Nucleic acids- structure, properties and functions.

a. DNA forms: A,B & Z.

b. RNA: tRNA, rRNA, mRNA and non coding RNA (Mi-, SiRNA)

3. Concept and Organization of Genomes- Viral, bacterial, Organelles, human, types of genome sequences including gene families and gene clusters.

4. Eukaryotic genomes:

a. Chromosomal organization and structure, Euchromatin, heterochromatin, centromere, telomere.

b. Chromatin structure (nucleosomes)- histone, non- histone proteins

5. Definition of genes- introns/ exons, Regulatory sequences, promoters, enhancers and suppressors.

6 Central dogma of Molecular biology and exceptions to central dogma.

7 DNA replication in prokaryotes and eukaryotes.

8 DNA damage and repair
a. Mutations
b. DNA repair mechanism
9 Transcription in prokaryotes and eukaryotes
a. Mechanism of transcription
b. Regulation of transcription

10 Genetic code
a. Major scientific contributions to decipher genetic code
b. Concept of codon, reading frame, frame shift
c. Degeneracy of codon

Plant and Animal Development

Plant Development

1 Plant as a living system, Unique features of plant development, principles of plant development.
2 plant development at- Cellular, organ and whole plant levels, whole plant as an interacting dynamic system.
3 Major phases of plant development
Vegetative development: Zygote to seed embryo to seedling till vegetative maturity, pattern formation in plants- vegetative
4 Reproductive development: Shift from vegetative to reproductive phase ,Induction- perception of inductive stimuli and subsequent changes,Pattern formation in plants- flowering.
5 Microsporogenesis, development of male gametophyte and male gamete,Megasprogenesis, development of female gametophyte and female gamete, Double fertilization and triple fusion, Development of Endosperm.
6 Concept of competence, determination, commitment,differentiation,de-differentiation and re-differentiation (Partial/ terminal) in vivo with one example each.
7 Model system to understand plant development, Fucus, and Arabidopsis.
8 Programmed cell death- ageing and senescence.
9 Molecular regulation of development in Arabidopsis.
10 In vitro response in relation to developmental stages of plants/ organs.

Animal Development:

1 Gametogenesis, oogenesis and Spermatogenesis fertilization.
2 Types and patterns of cleavage, blastulation 2
3 Gastrulation in amphioxus, frog and chick upto formation of three germinal layers.

4 Overview of organogenesis in frog, chick

5 concept of stem cells, Progenitor cells, cell lineages, determination, commitment and differentiation.

6 Concept of differentiation, redifferentia and regulation, feedback inhibitiontion, transdifferentiation and three types of generation with one example of each type.

7 Role of genes in patterning and development of Drosophila.

8 Ageing and Apoptosis.

9 Abnormal development and teratogenesis in animals

Metabolic Pathways

1 Bioenergetics: Bioenergetic, source of free energy for cells, Free energy change during reaction, important types of reaction in metabolism, oxidation- reduction reaction, biological oxidation-reduction reaction, types of electron transfer, redox potential, phosphoryl group transfer and ATP.

2 Enzymes: Definition, advantages over chemical catalyst, classification with examples, how enzymes work, specificity, enzyme activity, specific activity, turnover number; Enzyme kinetics: substrate concentration, Presteady state, Steady state assumption, Michaelis Menten equation, initial velocity ,v max,K. Lineweaver Burke's plot.

Inhibition: Reversible, Irreversible,competitive,non-competitive,Regulation: Allosteric enzymes and regulation, feedback inhibition.

3 Metabolism: Introduction to anabolism and catabolism.

4 Carbohydrate metabolism: Glycolysis, fates of pyruvate: cori cycle fermentation, ED pathway, TCA cycle, Anapleurotic reactions, gluconeogenesis, glycogen breakdown and glycogen synthesis, Glyoxylate pathway, Pentose Phosphate pathway, Regulations of pathways.

5 Electron transport system and photosynthesis, light and dark reactions, C3 and C4 pathways.

6 Overview of lipid metabolism: Action of Lipases, Beta oxidation of Fatty acids (Even No.) Ketone bodies, synthesis of fatty acids, overview of cholesterol synthesis, and phospholipid synthesis.

7 Overview of protein metabolism: Metabolic fates of amino acids, tramsamination, transfers of amino groups by glutamate, urea cycle, Nitrogen fixation by nitrogenase, incorporation of ammonia into biomolecules through glutamate and glutamine, Amino acid Biosynthetic families, Grouped by metabolic Precursors.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

BOTANY
PAPER I

1 Microbiology: Viruses, bacteria, plasmids, structure and reproduction. General account of infection and immunology, Microbes in agriculture, industry & medicine, and air, soil & water, control pollution using microorganisms.

2 Pathology : Important plant disease in India cause by viruses, bacteria mycoplasma, fungi and nemotodes. Modes of infection, dissemination physiology and parasitism, and methods of control, Mechanism of action of biocides Fungal toxins.

3 Cryptogams: Structure and reproduction from evolutionary aspect and ecology and economic importance of algae; fungi, bryophytes and pteridophytes, Principal distribution in India.

4 Phanerogams: Anatomy of wood, secondary growth Anatomy of C2 and C plants, stomatal types Embryology, barriers to sexual incompatibility Seed Structure, Apomixis and polyembryony. Polynology and its applications. Comparision of systems of classification of angiosperms. Modern trends in biosystematics. Taxonomic and economic importance of Cycadacceae, Pinacceae, Gnetales, Magnolianceae, Renunculaceae, Cruciferae, Rosaceae, Leguminosae, Euphorbiaceae, Malvaceae, Dipterocarpaceae, Umbelliferae, Asclepiaceae, Verbaneceae, Solanceae, Rubiaceae, Cucurbitaceae, composite, Gramineae, Palme, Liliaceae, Musaceae and Orchidaceae.

5 Morphogenesis: Polarity, symmetry and totipotency. Differentiation and differentiation of cells and organs. Factors of morphogenesis. Methodology and application of cell, tissues, organ and protoplast cultures from vegetative and reproductive parts. Somatic hybrids.

PAPER II

1. Cell Biology: Scope and perspective General knowledge of modern tools and techniques in the study of cytology. Prokaryotic and eukaryotic cells structural and ultrastructural details. Functions of organelles including membranes. Detailed study of mitosis and meiosis, Numerical and structural variations in chromosome and their significance. Study of polygene and lampbrush chromosomes-structure behaviour and cytological significance.

2. Genetics and Evolutions: Development of genetics and gene concepts. Structure and role of nucleic acids in protein synthesis and

reproduction. Genetic code and regulation of gene expression. Gene amplification. Mutation and evolution, Multiple factors, linkage and crossing over, Methods of gene mapping. Sex chromosomes and sex-linked inheritance. Male-sterility, its significance in plant breeding. Cytoplasmic inheritance. Elements of human genetics. Standards deviation and chi-square analysis. Gene transfer in micro-organisms. Genetic engineering. Organic evolution-evidence mechanism and theories.

3. Physiology and Biochemistry: Detailed study of water relations Mineral nutrition and ion/transport. Mineral deficiencies. Photosynthesis mechanism and importance, photosystem I and II, photorespiration, Respiration and fermentation, Nitrogen fixation and nitrogen metabolism. Protein synthesis. Enzymes. Importance of secondary metabolites. Pigments as photo-receptors, photoperiodism, flowering.

Growth indices, growth movements., senescence.
Growth substances-their chemical nature, role and applications in agriculture.

Agrochemicals, Stress, physiology Vernalization Fruit and seed physiology dormancy, storage and germination of seed. Parthenocarphy, fruit ripening.

4. Ecology: Ecological factors, Concepts and dynamics of community succession. Concept of biospheres. Conservation of ecosystems. Pollution and its control. Forest types of India. Afforestation, deforestation and social forestry, endangered plants.

Economic Botany: Origin of cultivated plants. Study of plants as sources of food, fodder and forage, fatty oils, wood and timber, fiber, paper, rubber, beverages, alcohol, drugs, narcotics, resins and gums, essential oils, dyes, mucilage, insecticides and pesticides, Plant indicators, Ornamental plants, Energy plantation.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

B.Sc /B.Tech IN DAIRY TECHNOLOGY

PAPER-I

I. DIARY TECHNOLOGY:

(a) Market Milk
(b) Cream, Butter & Fat Rich Diary Products
(c) Indigenous Diary Products
(d) Cheese and By-products Technology
(e) Ice Cream & Frozen Products
(f) Condensed Milk
(g) Dried Milk Products
(h) Judging of Diary Products
(i) Packaging of diary Products
(j) Food Processing
(k) Industrial Quality Control

II. DIARY ENGINEERING:

(a) Workshop Practice and Drawing
(b) Thermodynamics, Boiler & Steam Engine
(c) Fluid Mechanics
(d) Machine Design
(e) Heat and Mass Transfer
(f) Electrical Engineering
(g) Refrigeration Engineering
(h) Diary Process Engineering-I
(i) Diary Process Engineering-II
(j) Diary Plant Layout and Waste Disposal
(k) Instrumentation and Plant Maintenance
(l) Solid Mechanics
(m) Engineering Mechanics

III. DIARY CHEMISTRY:

(a) Organic chemistry
(b) Physical chemistry
(c) Biochemistry
(d) Introduction to Diary Chemistry
(e) Chemistry of Fat Rich diary Products
(f) Fermented, Frozen and Indegenous Milk Products
(g) Milk Proteins and Related Products
(h) Chemistry of concentrated and Dried Milk
(i) Milk Nutrition
(j) Chemical Quality control

PAPER-II

I. DIARY MICROBIOLOGY:

(a) General Biology
(b) General Microbiology
(c) Microbiology of Fluid Milk
(d) Microbiology of Starter Culture
(e) Microbiology of Milk Products-I
(f) Microbiology of Milk Products-II
(g) Industrial Fermentation
(h) Microbiology Quality Control

II. DIARY ECO/STATISTICS, MANAGEMENT AND COMPUTER SCIENCE

(a) Applied Mathematics
(b) Economic Analysis
(c) Diary Development in India
(d) Diary Book Keeping and Accountancy
(e) Statistical Methods
(f) Plant Management Economics
(g) Cooperative Management
(h) Project Management
(i) Marketing Management
(j) Introduction to SQC and CR
(k) Computer and its Application in Diary Industry

III. DIARY HUSBANDRY:

(a) Milk Production Management
(b) Lactation and Reproduction
(c) Ruminant Nutrition
(d) Diary Cattle Production

IV. DIARY EXTENSION:

(a) Introduction to Extension Education

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

CHEMISTRY
PAPER I

1. **Atomic structure & chemical bonding:** Quantum theory, Heisenberg's uncertainity principle, Sechrodinger wave equation (time independent). Interpretation of the wave function, particle in a one-dimensional box quantum numbers, hydrogen atom wave functions. Shapes of s, p and d orbitals lonic bondl; Lattice energy, Born-Haber cycle, Fajans rule, dipole moment, characteristics of ionic compounds, electonegativity differences. Covalent bond approach. Concept of resonance and resonance energy. Electronic configuration of H_2 + H_2 N_2 O_2 F_2 NO, CO and HF molecules in terms of molecular orbital approach Sigma and pi bonds. Bond order, bond strength & bond length.

2. **Thermodynamics :** Work heat and energy. First law of thermodynamics. Enthalpy, heat capacity. Relationship between Cp and Cv. Laws of thermochemistry. Kirchoff's equation. Spontaneous and non-spontaneous changes, Second law of thermodynamics. Entropy changes in gases for reversible and irreversible processes. Third law thermodynamics. Free energy, variations of free energy of a gas with temperature, pressure and volume, Gibbs-Helmholtz equation. Chemical potential. Thermodynamic criteria for equilibrium. Free energy change in chemical reaction and equilibrium constant. Effect of temperature & pressure on chemical reaction and equilibrium. Calculation of equilibrium constants from thermodynamic measurements.

3. **Solid State :** Forms of solids, law of constancy of interfacial angles. Crystal systems and crystal classes crystallographic groups) Designation of crystal faces, latics structure and unit cell. Laws of rational indices. Bragg's Law X-ray diffraction by crystals. Defects in crystals. Elementary study of liquid crystals.

4. **Chemical Kinetics:** Order and molecularity of a reaction, Rate equations (differential & integration forms) of zero, first and second order reactions. Half life of a reaction. Effect of temperature. Pressure and catalysts on reaction rates. Collision theory of reaction rates of bimolecular reactions. Absolute reaction rate theory. Kinetics of polymerization and photo-chemical reactions.

5. **Electrochemistry:** Limitations of Arrhenius theory of dissociation Debye-Heckel theory of strong electrolytes and its quantitative treatment.

Electrolytic conductance theory and theory of activity co-efficients. Derivations of limiting laws for various equilibria and transport properties of electrolyte solutions.

6. Concentration cells, liquid junction potential, applications of e.m.f. measurement of fuel cells.

7. **Photochemistry :** Absorption of light Lambert-Beer's Law. Laws of photochemistry. Quantum efficiency. Reasons for high and low quantum yields. Photo-electric cells.

8. **General Chemistry of 'd' block elements:**

   (a) Electronic Configuration : Introduction to theories of bonding in transition metal complexes, Crystal field. Theory and its modification; applications of the theories in the explanation of magnetism and electronic spectra of metal complexes.

   (b) Metal carbonyes; Cyclopentadienyl, Olefin and acetylene complexes.

   (c) Compounds with metal-metal and metal bonds atom clusters.

9. **General Chemistry of 'f' block elements:** Lanthanides and actinides; Seperations, Oxidation states, megenetic and spectral properties.
10. Reactions in non-aqueous solvents (liquid ammonia and sulphur dioxide).

PAPER-II

1. Reaction mechanisms; General methods (both kinetic and non-kinetic) study of mechanisms of organic reactions illustrated by examples.

Formation and stablility of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes and benzyenes).

SN^1 and SN^2 mechanism-H_1, E_2 and E_1 cB eleminationscis and trans addition of carbon to carbon double bonds-mechanism of addition to carbon-oxygen double bonds-Michael addition to conjugated carbon-carbon double bonds-aromatic electrophilic and nucleophilic substituions allylic and benzylic substitutions.

2. Pericyclic reactions: Classification and examplesan elementary study of Wood-Ward-Hoffmann rules of the pericyclic reactions.

3. Chemistry of the following name reactions: Aldol condensation, claisen condensation, Diecmann reaction, Perkin reaction, Reimer-Tiemann reaction, Cannizzaro reaction.

4. Polymeric systems:
(a) Physical Chemistry of polymers: End group analysis, Sedimentation. Light Scattering and Vis-cosity of polymers.
(b) Polyethylene, Polystryene, Plyvinyl Choloride, Ziegler Natta Catalysis, Nylon, Terylene.
(c) Inorganic Polymeric systems: Phosphonitric halide compounds; Silicones; Borazines.

Friedel-Craft reaction, Reformatsky reaction, Pinacolpinacolone, Wagger-Meer-Wein and Beckmann rearrangements, and their mechanisms uses of the following reagents in organic synthesis: O_5 O_4 HIO, NBS, diborane, Na-liquid ammonia, NaBH4 LiA IH_4.

5. Photochemical reactions of organic and inorganic compounds, types reactions and examples and synthetic uses-Methods used in structure determination, principles and application of UV-visible $IRIH_2$ NMH and mass spectra for structure determination of simple organic and inorganic molecules.

6. **Molecular Structural determinations: Principles and Applications to simple organic and in-organic Molecules.**

(i) Rotational spectra of diatomic molecules (Infrared and Raman), isotopic substitutions and rotational constants.
(ii) Vibrational spectra of diatomic linear symmetric, linear asymmetric and bent triatomic molecules (Infrared and Raman).
(iii) Specificity of the functional groups (Infrared and Raman).
(iv) Electronic Spectra-Singlet and triplet states, conjugated double bonds L B unsaturated carbonye compounds.
(v) Nuclear magnetic Resonance Chemical shifts, spins-spin coupling.

Electron spin Resonance: Study of inorganic complexes and free radicals.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

CIVIL ENGINEERING (DEGREE)

PAPER-I

1. BUILDING MATERIALS:

Timber: Different types and species of structural timber, density-moisture relationship, strength in different directions, defects, influence of defects on permissible stress, preservation, dry and wet rots, codal provisions for design plywood.

Bricks: Types, Indian standard classification, absorption, saturation factor, strength in masonry, influence of mortar strength on mansory strength.

Cement: Compound of different types, setting times, strength.

Cement Mortar: Ingredients, proportions, water demand, mortars for plastering and masonry.

Concrete: Importance of W/C Ratio, strength, ingredients including admixtures, workability, testing for strength, elasticity, nondestructive testing, mix design methods.

2. SOLID MECHANICS: Elastic constans, stress, plane stress, Mohr's circle of stress, strains, plane strain, Mohr's circle of strain, combined stress; elastic theories of failure; simple bending, shear; Torsion of circular and rectangular sections and simple members.

3. STRUCTURAL ANALYSIS: Analysis of indeterminate skeletal frames-moment distribution, slope-deflection, stiffness and force methods, energy methods, Muller-Bresiau principle and application. Plastic analysis of indeterminate beams and simple-shape factors.

4. DESIGN OF STEEL STRUCTURES: Principles of working stress method.

Design of connections, simple members, Bilt-up sections and frames. Design of Industrial roofs, principle of cultimate load design. Design of simple member and frames.

5. DESIGN OF CONCRETE AND MASONRY STRUCTURES: Limit state design for bending, shear, axial compression and combined forces. Codel provisions foe slabs, beams, walls and footings. Working stress method of design of R.C. members. Principles of prestresses concrete design, materials, method of prestressing, losses. Design of simple members and determinate structures. Introductions to prestressing of indeterminate structures.

Design of brick mansory as per I.S. Codes.

6. CONSTRUCTION PRACTICE, PLANNING AND MANAGEMENT:

Concreting Equipment: Weight, batcher, mixer, vibrator, batching plant, concrete pump, granes, hoists, lifting equipment.

Earthwork Equipment: Power shovel, hoe, dozer, dumper, trailers and tractor, rollers, sheep foot rollers, pumps.

Construction, Planning and Management: Bar chart, link bar chart, work-break down structures, activity on-arrow diagrams. Critical path, probabilistic activity durations; Event-based networks. PERT network; time-cost study, crashing; Resources allocation

PAPER-II

1. ***(a) FLUID MECHANICS, OPEN CHANNEL FLOW, PIPE FLOW:***
Fluid properties, pressure, thrust, buoyancy; flow Kinematics; integration of flow equations; flow measurement; relative motion; moment of momentum; viscosity, boundary layer and control, drag, lift; dimentional analysis, modelling, cavitation; flow oscillations; momentum and energy principles in open channel flow, flow controls, hydraulic jump, flow sections and properties; normal flow, gradually varies flow, surges; flow development and losses in pipe flows; measurements; siphons; surges and water hammer; delivery of power; pipe network.

(b) HYDRAULIC MACHINES AND HYDROPOWER: Centrifugal pumps, types, performance parameters, scaling, pumps in paraller, reciprocating pumps, air vessels, performance parameters; hydraulic ram; hydraulic turbines, types, performance parameters, controls, choice; power houses, classification and payout, storage, pondage, control of supply.

2. ***(a) HYDROLOGY:*** Hydrological cycle, precipitation and related data analysis, PMP, unit and synthetic hydrographs; evaporation and transpiration; floods and their management, PMF: streams and their gauging; river morphology; routing of floods; capacity of reservoirs.

(b) WATER RESOURCES ENGINEERING: Water resources of the glone; multipurpose uses of water; soil-plant-water relationship, irrigation systems, water demand assessment; storages and their yields, ground water yields and well hydraulics; waterlogging, drainage design; irrigation revenue; design of rigid boundary canals; Lacey's and Tractive force concepts in canal design' lining of canals; sediment transport in canals; non-overflow and overflow sections of gravity dams and their design, energy dissipaters and tail water rating; design of headworks, distribution works, falls, cross-drainage works, outlets; river training.

3. ENVIROMENTAL ENGINEERING:
(a) Water Supply Engineering: Sources of supply, yields, design of intakes and conductors; estimation of demand; water quality standards; control of waterborne diseases; primary and secondary treatment, detailing and maintenance of treatment units, conveyance and distribution systems of treated water, leakage and control rural water supply; institutional and industrial water supply.

(b) Waste Water Engineering: Urban rain water disposal; systems of sewage collection and disposal; design of sewage systems, pumping; characteristics of sewage and its treatment, disposal of products of sewage treatment, stream flow rejuvenation; institutional and industrial sewage management; plumbing systems; rural and semi urban sanitation.

(c) SOLID WASTER MANAGEMNT: Sources, classification, collection and disposal; design and management of landfills.

(d) AIR AND NOISE POLLUTION AND EXOLOGY: sources and effects of air pollution, monitoring of air pollution; noise pollution and standards; ecological chain and balance, environmental assessment.

4. ***(a) SOIL MECHANICS:*** Properties of soils, classification and interrelationship; compaction behavior, methods of compaction and their choice; permeability and seepage, flow nets. Inverted filters, compressibility and consolidation; shearing resistance, stresses and failure, soil testing in laboratory and in-situ; stress path and applications; earth pressure theories, stress distribution in soil, soil exploration, samplers. Load tests, penetration tests.

(b) FOUNDATION ENGINEERING: Types of foundations, selection criteria, bearing capacity, settlement, laboratory and field tests; types of piles and their design and layout, foundations on expansive solid, swelling and its prevention, foundation on swelling soils.

5. ***(a) SURVEYING:*** Classification of surveys, scales, accuracy; measurement of distances-direct and indirect methods; optical and electronic devices; measurement of directions, primatic compass, local attraction; theodolites-types; measurement of elevations-spirit and trigonometric leveling; relief representation; contours; digital elevation modeling concept; establishment of control by triangulations and traversing-measurements and adjustment of observations, computation of coordinates; field astronomy, concept of global positioning system; map preparation by plane tabling and by photogrammetry; remote sensing concepts, map substitutes.

(b) TRANSPORTATION ENGINEERING: Planning of highway system, alignment and geometric design, horizontal and vertical curves, grade separation; materials and construction methods for different surfaces and maintenance; principles of pavement design; drainage.

Traffic surveys; intersections, signaling; mass transit system. Accessibility, net working. Tunneling, alignment, methods of construction, disposal of muck, drainage, lighting and ventilation, traffic control, emergency management.

Planning of railway systems, terminology and designs, relating to gauge, track, controls, transits, rolling stock, tractive power and track modernization; maintenance; appurtenant works; containerization.

Harbours-layout, shipping lanes, anchoring, location identification; littoral transport with erosion and deposition; sounding methods; dry and wet docks, components and operations; tidal data and analysis.

Airport-layout and orientation; runway and taxiway design and drainage management; zoning laws; visual aids and air traffic control; helipads, hangers, service equipment.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

CIVIL ENGINEERING (DIPLOMA)

PAPER-I

1. BUILDING MATERIALS:

(i) Brick: Composition, Classification, manufacturing process and uses.
(ii) Concrete: Composition & promotion of ingredients, mixing and placing, water cement ration.
(iii) Timber: Classification & structure, defects, disease & decay, seasoning & use.
(iv) Paint, Varnished & Distemper: Purpose of painting, ingredients of paint & varnished, purpose of applying distemper & process of distempering.

2. BUILDING CONSTRUCTION:

(i) Bearing Capacity of Soil: Determination of bearing capacity of soil, method improving bearing capacity of soil.
(ii) Foundation: Definition, load on building, types of building foundation.
(iii) Stair Case: Location, types of stair case & importance of stair case with reference to building construction.
(iv) Roof.
(v) Details of Doors & Windows.

3. SURVEYING:

(i) Chain Survey: Definition, principles of chain survey, error due to incorrect ranging, error in length. Numerical problems.
(ii) Compass Survey: Definition, basis difference between chain & compass survey, bearing of lines, types of meridians, whole circles & quadrantal bearing. Numerical problems.
(iii) Leveling: Definition of different terms in leveling methods of finding out reduced level, fields book recording, effects of curvetion & refraction. Numerical problems.
(iv) Contouring: Definition, uses and characteristics of contour, methods of contouring.
(v) Plane Table Surveying: General description, accessories of place table, setting up of place table, orientation, two point & three point problem.

4. P.W.D. ACCOUNTS:

(i) Organization of Engineering Department: Regular and work charges establishment, duties and responsibilities of Sub-Engineer.
(ii) Work: Classification of work, Original, major, minor, repair work, annual repair, special repair. Method of execution of work: through contract or departmentally, contact agreement, work order, item rate contact, lump-sum contract, schedule rate contract & cost plus percentage contract. Measurement book, master roll, quittance roll, method of labour payment and use of forms and necessity of submission.

5. ROAD ENGINEERING:

(i) Introduction: Requirements of good, history of road development in India.
(ii) Road Project: road survey, preparation of map, land acquisition, road alignment, longitudinal section, cross section & formation.

(iii) Classification of Road: Classification of road as per I.R.C. & cross-section of different classes of roads.

(iv) Design, Construction & Maintenance of roads: Earth & gravel roads, W.B.M. roads, bituminous road, difference between flexible and rigid pavement.

(v) Road Drainage: Drainage of urban roads and hill roads.

(vi) Traffic Engineering & Traffic Control: road junction, grade separation, traffic island, pedestrian crossing, road sign and object of road arboriculture.

(vii) Design and construction of bridges and culverts.

6. HYDRAULICS:

(i) Hydrostatics: Density, specific gravity, surface tension viscosity & their units, definition of pressure, intensity of pressure, atmospheric pressure, gauge pressure, total pressure, centre of pressure, buoyancy, centre of buoyancy, metacentre & metacentric height. Numerical problems.

(ii) Hydrodynamics: Basic equation of fluid flow & application, equation of continuity of liquid flow, Bernoulli's theorem & its application, venturimetre, orifice meter, pitot tube. Numerical problems.

Definition of various hydraulic co-efficients and their relationship. Numerical problems.

Difference between notches and weirs deduction of discharge formula for different types of notches. Numerical problems.

Flow of water through pipes, various losses in flow through pipes, derivation of formula. Numerical problems.

(iii) Hydraulics Machines: turbine-general classification & principles. Types of pump-centrifugal pump & reciprocating pump.

PAPER-II

1. THEORY OF STRUCTURE:

(i) Bending Moment and Shear Forces: B.M. & S.F. of beans simply supported and cantilever with point loas and U.D.I. Numerical problems.

(ii) Bending stress in Beam: Bending stress in steel & timber beam, fletched beam. Numerical problems.

(iii) Stability of Retaining Wall and Dam: Calculation of forces acting on retaining wall and dam, Rankin's formula for earth pressure, stresses at base criteria for safety and stability calculation. Numerical problems.

(iv) Complex Stress and Strain: Definition of principle stress, stresses in inclined plane, Mohr's circle for calculation of stresses graphically. Numerical problems.

2. IRRIGATION AND HYDRAULIC STRUCTURES:

(i) Introduction: Definition necessity for irrigation, types of irrigation in India.

(ii) Rainfall and Run off: Measurement of rain, rain gauge, run off, factors effecting run off, characteristics of catchment area, factors effecting run off.

(iii) Water Requirement of Crops: River, lake, well, tube well, yield from these sources, river head work.

(iv) Storage Dam: concrete dam and earth dam, materials used for construction, advantages and disadvantages, construction of dams.

(v) Lift Irrigation: Wells, dupe wells and tube wells.

3. DESIGNING, DRAWING AND DETALLING:

(i) Introduction: Details of R.C.C. beam, slab, column, lintel, footing and stair case.
(ii) Design of R.C.C. Member: beam, slab, column, column footing, numerical problems.
(iii) Design of simple Steel Structure: types of joints, permissible stresses in rivets, design of joints, framed connection & seat connection. Numerical problems.

4. ESTIMATING:

(i) Introduction: General idea of estimating, use of standard estimating forms, use of schedule of rates.
(ii) Earthwork: Unit of measurement, different methods of calculating quantity of earth. Numerical problems.
(iii) Road Work: Unit of measurement, method of estimating various items of works.
(iv) Masonry Work: Units of measurement, method of estimating brick maronry & reinforces brick masonry.
(v) Concrete Work: Unit of measurement, method of estimating mass-concrete and reinforced concrete work and shuttering.
(vi) Rate Analysis: analysis of rates of brick, plain cement concrete work, R.C.C. work, door, window, plastering, R.C.C. floor, white washing, shuttering, D.P.C. & carriage of materials.
(vii) Types of Estimate: Plinth area estimate, cubic rate estimate, detailed estimate, revised estimate, supplementary estimate, annual repair estimate, contingency and work charged establishment, departmental charge, bill of quantities & costing. Numerical problems.

5. SOIL MECHANICS:

(i) Introduction: Definition, particle size, classification, particle arrangement in course-grained, clays and composite soils.
(ii) Soil Engineering Tests: Water cement ration, specific gravity, particle size distribution, liquid limit determination and plastic limit determination application of consistency limit. Numerical problems.
(iii) Permeability: Head, gradient, Dory's law, laboratory determination and filed determination of permeability, concept of seepage, discharge through flow nets, flow net sketches.

6. RAILWAY:

(i) Introduction: History of railway development in India, importance of railway.
(ii) Railway Project: Traffic survey, engineering survey, track alignment, land with, selection of site for station yard.
(iii) Permanent Way: Definition, requirement of permanent way, gauges of railway track, function of rails, requirement of rails, types of rail sections.
(iv) Railway Joints & Sleeper: Requirement of ideal joints, types of railway joints, function of sleepers, type of sleepers & comparison between different types of sleepers.
(v) Signaling: Definition & objective classification of signaling system, methods of control for movement of trains.

7. PUBLIC HEALTH:

(A) WATER SUPPLY

(i) Introduction: necessity of public water supply, population forecast, estimating of quantity of water, design period of water supply project.

(ii) Sources and Collection Work: Sources of water, ground water, aquifer, velocity, porosity, permeability, shallow and deep well, infiltration gallery, collection of samples for various tests, various impurities, hardness and P.N. value determination.

(iii) Clarification of Water: Process of screening, softening, settling and sedimentation, coagulation, flocculation and settling tank.

(iv) Filtration: Theory of filtration, design of slow sand and rapid gravity filter with construction details.

(v) Chlorination & Softening: Necessity of disinfection methods and types of chlorination, removal of free residual chlorine, water softening.

(vi) Distribution System: Service reservoir function & design, simple network design of distribution, leakage, prevention of waste, maintenance of minimum and maximum pressure in pipe, prevention of corrosion in pipe.

(B) SANITATION

(i) Introduction: Purpose & principles of sanitation, requirement of rural and urban sanitation.

(ii) Underground Drainage & Sewerage: Quantity of sewage, types of sewer, maximum and minimum flow, self cleansing velocity, size of sewers, gradients, design, domestic and industrial flow of sewage, ventilation of sewers, inspection chamber, sewer materials, construction, laying, jointing, manhole, drop manhole. Lamphole, flushing tank, necessity of pumping sewage, classification of pumps, components of pumps.

(iii) Disposal of Night Soil: Septic tank and soak pit-function and design.

(iv) Sewage Disposal: Primary treatment, grit chamber, clarifier, flow diagram of treatment plant, trickling filter, activated sludge process design.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

COMMERCE (DEGREE)

PAPER-I

I. FINANCIAL & COST ACCOUNTING

Financial Accounting : Meaning and Scope of Accounting; Accounting Principles and Postulates; Accounting Concepts and Convention; Construction of Trading, manufacturing, Profit and loss Account and Balance sheet of Companies; Financial Statement Analysis; Depreciation, Inventory Valuation, Cash and Fund Flow Statements' Issue Forfeiture and reissue of forfeited shares; Issue of preference shares, Debentures and their redemption.

Cost Accounting : Cost Concept' Cost Sheet and reconciliation of Cost and Financial Accounting' Overhead-Apportionment of overhead; Process costing; Budget and Budgetary control – Cash Budget, Production Budget, Sales budget, Labour Budget' Standard Costing – Variance Analysis.

Auditing : Objectives of Auditing; Audit process- Considerations at the commencement of audit; Valuation and verification of assets-fixed, wasting and current assets-liabilities; Audit of limited companies-appointment, powers, duties and responsibilities; Recent Trends in auditing-cost audit, Management audit and Tax audit.

Income Tax : Basic concepts-Income; Agricultural Income, casual income, assessment year, previous year, gross income, total income, exemptions and deductions, Tax planning and Tax evasion; Computation of total income and tax liability of an individual.

PAPER-I

I. FINACIAL MANAGEMENT AND INDIAN FINANCIAL SYSTEMS:

Financial Management: Meaning – objectives; Financial goals; profit vs. wealth maximization; Investment evaluation criteria, sources of capital and cost of capital associated with different sources leverage – operating and financial leverage, effects in drawing alternate financial plans' optimum capital structure; management of working capital-Nature of working capital, significance of working capital, operating cycle and factors determining working capital cash receivables, internal financing; dividend policies.

II. INDIAN FINANCIAL SYSTEM: Components of Indian Financial System; Indian banking structure; Reserve Bank of India, Commercial Banks, Rural Banks, Co-operative Banks- Role and functions; Monetary Policy, Salient provisions of the banking regulation Act 1949: Bank Ombudsman- role and functions; Non-Banking Financial Institutions- functions and workings; Money Market; Instruments of Money market, recent trends; Constituents of Indian Capital Market; Functions and role of stock exchanges-listing, public issue; Functionaries of Stock exchanges, Regulatory agencies – SEBI; Financial service Companies – merchant banking services, credit rating-functions and roles; Multilateral Funding Agencies.

III. ORGANIZATION THEORY AND INDUSTRIAL RELATIONS

Origination Theory : Meaning and types of organization, organizational goals and theories of organization; Organizational values, Attitudes, personality; Motivation – theories of motivation; Leadership – theories and styles; conflict management; Organizational change, adaptation and growth; Organizational control and effectiveness; Transactional analysis; Organization and culture sensitivity- studies by Hofstede and others.

Industrial Relations: Nature and scope of Industrial relations; Trade Union movement in India-growth structure, Collective bargaining- approaches, conditions, limitations and effectiveness in Indian context; Discipline and Grievance management, Counseling-principles and methods; Prevention and settlement of Industrial disputes- preventive measures and settlement machinery; Participative management and co-ownership problems and prospects; Wage policy in India; Labour laws in relation to Absenteeism, Misconduct, Termination, Workmen compensation, provident fund; Laws relating to bonus, working conditions and gender sensitivity.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

COMPUTER SCIENCE

PAPER-I

I. ***Basics and Programming:*** Basic units of computer systems, algorithms, flowcharts; Programming in C/C++: Data types, declarations and expressions, functions, pointers, arrays.

II. ***Data Structure:*** Primitive data types, array, stack, queue, link list, trees, sorting and searching techniques, symbol tables, hashing etc.

III. ***Logic Design:*** Number system, Binary arithmetic, Boolean algebra and logic functions, Minimization, Flip-flops, design of combinational and Sequential circuits, Registers, Counters, decoders, Encoders, Adders circuits and Code converters.

IV. ***Computer Organization:*** Instruction formats and Addressing Modes, Control Units organization, hardwired and micro programmed control, arithmetical and logical unit organization, Memory types and Hierarchy, Cache memory.

V. ***Application Software:*** Dbase IV, LOTUS 123 and Visual basic 6.

VI. ***Computer Peripherals:*** concept of I/O channels, operation of Keyboard, Monitors, Printers, Scanners and graphic input & display devices; Operation of Secondary memories: hard disk, floppy, CD's magnetic tapes etc.

VII. ***System Software's:*** Assemblers, macros, loaders, linkers and editors.

VIII. ***Installation and Maintenance of Computers:*** Auxiliary components required for installation of computers, power system, maintenance of different components of computers and accessories.

PAPER-II

I. ***Operating Systems:*** fundamentals, process states, process management, CPU scheduling context switching, memory management, virtual memory, File systems, Directory systems, shell and kernel of UNIX, the UNIX file system, system calls, UNIX system administration.

II. ***Computer Architecture:*** Data flow architecture, SISD, SIMD, MIMD; RISC and CISC machines, pipelining, parallel processing; examples of different modern processors like: Intel Pentium III, HP Risc, SUN Ultra Spare etc.

III. ***Software Engineering:*** concept of systems, Software development process modules, software project planning and management; cost estimation methods, scheduling requirement analysis, software testing strategies, Quality Assurance.

IV ***Data Processing and Files Systems:*** Concept of information and data, organized data, Data processing using COBOL, File handling using COBOL.

I. Data Based Management System: Date Abstraction, Data models, Data independence, DDL, Attributes, Keys, Query processing, Structure of relational Databases, Example of SQL; Distributed Databases, Security and integrity, Network Model.

II. ***Design and Analysis of Algorithms:*** Analyzing Algorithms, the big-Oh notation, divide and conquer & greedy method, Dynamic programming, Scarch and traversal techniques, NP completeness.

III. ***Compilers:*** Lexical analysis, Syntax analysis-different parsing techniques, semantic analysis, Error detection, Optimization and code generation.

IV. ***Computer Communication and Internet:*** Role of Computers in communication, seven layer ISO OSI model, LAN MAN and WAN network topologies, Internet and its standards, Knowledge of TCP/IP, Knowledge of Internet, Internet routing, IP address.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

DAIRY/ FOOD TECHNOLOGY (DEGREE)

1 **ELEMENTARY BIOLOGY**: Life, Living and Non-living; origin of life, Oparin's abiotic theory, evolution; unicellular multicellularity complex tissue system, branches of biology; cell; introduction botany; history of botany; brief introduction of branches of botany; morphology; anatomy; taxonomy; physiology; palaeo botany; introduction zoology; classification of animal kingdom; adaptation of animals; external morphology of frogs; internal anatomy of frogs, internal organs; different internal systems; introduction to lower botany; algae, fungi, bacteria, virus; bryophyte; pteridophyte; scope/ application of biology.

2 **INTRODUCTORY MICROBIOLOGY**: Systematic study of major groups of micro- organism of importance in food industry; principles and methods of food preservation; food spoilage and its causes, food in relation to diseases; sources and types of micro organisms of milk; starter culture; role of micro organisms in the manufacture of milk and milk products. Microbial spoilage and dairy products and their control; isolation and identification of micro organisms involved in food spoilage; enumeration and diagnosis of food poisoning organisms; isolation of micro organisms from milk products and their identification; microbiological grading of milk and milk products.

3 **PRINCIPLE OF ECONOMICS:** Basic terms and concepts of economics, meaning and nature of micro and macro economics, nature and scope of agricultural economics, its role and importance, characteristics of factors of production, measures to improve land productivity, Government policies labour-division of labour, problems of unemployment under employment and disguised unemployment, capital formation in agriculture, forms of business organization, demand-law of determination under different market situations- government policy, characteristic features of developed and under developed economies. International trade in agricultural-exim policy- role of WTO, International trade in agriculture. Financial institutions and their role; RBI, IDBI, IMF, NABARD

4 **FUNDAMENTALS OF FOOD TECHNOLOGY:** Scope of food processing in India; Introduction of food processing, food preservation, food packaging, food drying and dehydration, fruit and vegetable processing, processing of meat and meat products, processing of milk and

milk products, processing of marine products. Important food industries in India; role of food technology in national economy.

5 **PRINCIPLES OF FOOD ENGINEERING:** Units and dimensions, mass and energy balance, flow of fluids, heat transfer, modes of heat transfer, heat exchanger, Kinetics of chemical reaction in foods, evaporation, dehydration, drying, refrigeration, physical separation process and extraction.

6 **FOOD CHEMISTRY:** Physico- chemical properties of foods. Physical properties- solutions, osmotic pressure, acids, bases, pH, buffers, boiling points, freezing point, colloids, viscosity, surface tension emulsions. Water moisture content of food, bound water. Carbohydrates- structure, cooking properties & functions of starches dextrin's cellulose, fibers, hemicelluloses, pectins, gums in different foods, functions of sugar in food browning. Lipids classification, physical characteristics, structure and functions and effect on cooking properties of lipids in foods, rancidity, hydration. Protien-types of food proteins, physical characteristics, structures, functions and effects on cooking properties of various animal & plant proteins, denaturation properties, protein gels, pigments and color. Role and effects of cooking on chlorophyll's, myco-globin, hemoglobin, authocyamins, flavoroids, tannins, carotenoids, quinines, xyanthones, pectins and their contribution to acceptability of food. Use of synthetic colours in food. Flavour-sensation of taste, smell, visual appearance, flavor texture of food. Flavour compounds-terpeniods, flavoroids, sulphur compounds and others volatile flavor compounds and their role in sensory evaluations. Enzymes-enzymes in food processing, enzymic browning.

7 **PRINCIPLES OF FOOD PROCESSING AND PRESERVATION** : Introduction and historical developments in food processing and preservation; General Principles in food processing; methods of food processing; principles of food processing; preservation by high temperature; preservation by low temperature; Sun drying, dehydratrion, freeze drying, dehydrofreezing; preservation by chemicals; preservation by fermentation and irradiation; canning, can manufacture.

8 **FOOD BIOTECHNOLOGY:** Prospectus of Biotechnology. Molecular genetics i.e fundamentals of molecular biology with social reference of chemistry and biology and DNA (primary secondary and tertiary) structures. Bioloogical role of DNA in cell metabolism. General recombination mechanisms and technique used for improvement in microbial strains. Applications of genetical control mechanism in

industrial fermentation process, (Induction, manipulation and recombination). Recombinant –DNA technology(plasmids and cloning): Cell and tissue culture. Continuous culture. Secondary metabolites synthesis. Expression of foreign genes. Promoter(enzymes). Biomass production by using various micro organisms. Application of Biotechnology in food(food industries), pharmaceuticals and agriculture. Bio-gas plant.

9 **PRINCIPLES OF FOOD QUALITY AND SAFETY:** Objective, function, and importance of quality control, methods of quality assessment of food material; theoretical and practical consideration of quality assurance: Grades and standards, Description of different quality control system(codex, TQM,USFDA, BIS, HACCP, ISO 9000 series); Cleaning and sanitation, local and international approaches for safe foods; statistical quality control techniques; permitted food additives; food adulteration and food safety.

10 **REFRIGERATION & AIR CONDITIONING :** Thermodynamic cycles, mechanical vapour compression refrigeration, thermodynamic cycle, calculations of single stage saturation and actual cycles, two stage cycles and cascade refrigeration system, heat pump; compressors, expansion valves, evaporators and condensers, absorption system of refrigeration, ice manufacture, air conditioning, principles of psychometry, pshchometric processes, comfort chart and effective temperature and respiration heat, cooling, load calculations and design of cold storage's conveying and distribution of processed air, air conditioning controls.

11 **ENVIRONMENTAL STUDIES :** Definition, scope and importance Ecosystem, concept of an ecosystem, structure and function of an ecosystem, producer, consumer and decomposes, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids, introduction, types, characteristics features, structures and functions of the following ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem; social issues and the environment: from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problem and concerns, case studies, environmental ethics, climatic change, wasteland reclamation, consumerism and waste products. Environmental protection Act, Air(Prevention and control of pollution) Act. Issues involved in enforcement of environmental legislation. Public awareness.

12 **FOOD HANDLING AND STORAGE ENGINEERING:** Overview of material handling system and devices in food processing plants. Design of screw, bucket, belt, oscillation & vibrating conveyor. Refrigerated transportation of food materials. Principles and practices of storage: Physiochemical changes in stored products during storage, air tight, non-air tight, under ground conventional and modern storage structures for fruits, vegetables, meat and marine structures, economies of storage structures.

13 **QUANTITATIVE TECHNIQUES IN FOOD PROCESSING :** Definition : Principles components of decision problems; scope in agriculture and food engineering application of linear and dynamic programming in food processing; transportation and assignment models in food processing ; queing theory; application of PERT-CPM in food processing ; optimization and simulation techniques in food processing.

14 **PRINCIPLES OF THERMAL AND NON-THERMAL FOOD PROCESSING:** Principles of thermal and non-thermal food processing, definition and scope of thermal food processing; concept of retart technology; thermal processing and food quality analysis and control; radio frequency heating, microwave processing, infra red heating, instant and high heat infusion, ohmic heating, combined high pressure and thermal treatment of food; high hydrostatic pressure food processing, oscilating magnetic field food processing, application of light, pulses in the sterilization of food and packaging material, food irradiation and hurdle technology.

PAPER-II

1 BOILER TECHNOLOGY :

Fuels; types of fuels and their properties, chemical properties, combustion, stoichiometric air requirement, burners, storing of fuels, properties of steam, mollier chart and steam tables, classification of boilers, fire tube and water tube boiler, mounting and accessories, feed water treatment; draught, natural and force height of chimney, plant layout, economy in heat energy, boiler maintenance and safety, use of boilers in food industries, boiler codes, Indian Boiler Regulation Acy.

2 **PRINCIPLES OF FOOD AND DIARY MICROBIOLOGY :**

Introductory concepts; role of intrinsic parameter and extrinsic that affect microbial growth of foods. Classification of new organism, control of microbial population. Food spoilage, microbiology of foods fermentation or respiration; mechanism of energy production oxidation and substrate level phosphorylation, fermenters type, functions design and control, fermentation-mechanism, conditions and factors affecting fermentation.

3 **ENVIRONMENTAL STUDIES-II :**

Natural Resources : Forest resources, water resources, mineral resources, food resources, energy resources, land resources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life style.

Biodiversity and its conservation: Introduction, definition, genetic, species and ecosystem diversity bio geographical classification of India, value of diversity, consumptive use, productive use, social, ethical aesthete and option values. Biodiversity at global, national and local levels. India as mega-diversity nation. Hot-spot of biodiversity. Threat to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity, in-situ conservation of biodiversity.

Environmental Pollution: Definition, causes effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards. Solid waste management: causes effect and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquake, cyclone and landslide.

4 **CEREALS, PULSES & OIL SEEDS TECHNOLOGY:**

Composition, structure and processing characteristics of cereals grains, legumes and oilseeds, post harvest, post processing practices for their safe storage, parboiling and milling of paddy, quality characteristics, curing and aging of rice, processed rice products, wheat and its quality characteristics of milling into flour and semolina, flour milling, turbo grinding and air classification, flour grades and their suitability for baking purpose, assessment of flour quality and characteristics, milling of Durum wheat, macaroni products; Ingredients, technology and quality parameters for baked products; bread, biscuits and cakes; breakfast cereals, dry and wet milling of corn, starches and its conversion products, malting of barley, pearling of millets, milling of legume-pulses by traditional and improved processes; processing of oilseeds for direct use and consumption, oil and protein products, processing of extracted oil refining, hydrogenation, interstrification, processing of deoiled cake into protein concentrates and isolates; textured protein, functional protein preparations, peanut butter, Mararine and Spread.

5 **TECHNOLOGY OF DIARY PRODUCTS:**

Fluid Milk: Composition of milk and factors affecting it; Phsico-chemical characteristics of milk and milk constituents, production and collection, cooling and transportation of milk. Packaging storage and distribution of pasteurized milk: whole, standardized, toned, double toned and skim milk. Test for milk quality and adulteration; UHT processed milk, flavoured, sterilized milk Cleaning and sanitation of diary equipments; Cream: definition, classification and physic-chemical properties of cream; Butter: definition, classification, composition and methods of manufacture; Icecream: definition, classification, composition, constituents of their role. Preparation of mixes and freesing of icecream, over run, judging, grading and defects of icecream; evaporated and condensed milk: method of manufacture, packaging and storage Roller and spray drying of milk solids, Instantization, flow ability dustiness, reconstituability, dispersability, wet ability, sink ability and appearance of milk powders, manufacture of casein, whey protein, lactose from milk or use in formulated foods.

6 **PROCESSING OF MARINE PRODUCTS:**

Importance of fisheries, classification of aquatic animals; composition and nutritional quality of fish; transportation and storage of fish; unit operations in fish processing, preservation by curing, chilling and freezing of fish, drying, fish products, canning of fish products, modified atmosphere packaging of fish and fish products; HACCP and quality assurance of sea food.

7 **FOOD PACKAGING TECHNOLOGY:**

Chemical and physical properties of package materials, interaction between package and food, selection and evaluation of packaging materials and systems, package design criteria, printing, computers application in packaging, modified atmospheres, corrosion, scale-up, waste engineering, CIP systems.

8 **TRANING – 1**

9 **TECHNOLOGY OF BEVERAGES:**

Introduction, classification, beverages industry in India, traditional beverages; manufacturing technology of mineral water and carbonated drinks; water quality, treatment and fortification process, bottling, packaging, storage and transportation, fruit beverages; squash, cordial, nectar, crush, alcoholic beverages; milk beverages, selection and economies of different beverages packaging materials, selection, operation and maintenance of beverage machines/equipments, automation in beverage industries, quality control and safety in beverage industries, waste management in beverage industries, marketing of beverages.

10 **TECHNOLOGY OF MEAT & POULTRY PRODUCTS:**

Meat and poultry industries in India-kinds of meat animals and poultry birds-pre-slaughter care-methods of stunning-slaughtering-dressing of meat and poultry-post slaughter care and post mortem inspection-classification and quality of meat-aging, curing smoking, canning and irradiation preservation of meat, freezing and dehydration of meat and meat products, curing agents and additives-meat products- formed and sectioned meat-sausage products, hygiene and sanitary conditions in a meat processing plant; formation, structure, chemical composition and nutritive value of eggs-collection, handling, grading and quality parameters of eggs-methods of preservation of egg and their products-spoilage of egg and their products-hygiene and sanitation, regulations; recent development in meat poultry processing, quality and safety control measures, planning, layout design consideration in meat and poultry processing unit, export regulation of meat and poultry products.

11 **FRUIT AND VEGETABLE PROCESSING:**

Unit operations; receiving, washing, grading, peeling, size reduction, blanching, sulphiting/sulphuring, syruping/brining, exhausting, processing and packaging; processing technology of the manufacture of the new products from fruits and vegetables; beverages, preserved, sauces, pickles, soups and others; preservation technologies; packaging requirements; spoilage of process fruits; vegetables and their control;

nutritional evaluation of processed fruits; plant layout and hygiene; fruit and vegetable plant layout, design, personal hygiene, plant sanitation and waste disposal; quality control in fruits and vegetable processing industry.

12 **FOOD ADDITIVES:**

Scope, permitted food additives, general principles for the use of food additives. GRAS and international regulatory status(FAO, WHO, WTO) of food additives, functions, types, modes of action, consequences of use, risks and benefits of food additives. Nutritional additives, preservatives, anti-microbial agents, antioxidants, emulsifiers, enzymes and acidulates, flavoring agents and flavor enhancers. Sweeteners, natural and synthetic, coloring agents; methods used for safety evaluation, food additives and hypersensitivity.

13 **BAKING & CONFECTIONERY TECHNOLOGY:**

Technology of baking; dough rheology; equipments; baking of bread; sponge goods; biscuits and cookies; flaky pastry; pie; Danish pastry; bakery decorations; confectionery; cocoa and chocolate manufacture; role of ingredients and additives, stages of sugar cookery; machinery; confectionery products; packaging.

14 **DRYING AND DEHYDRATION OF FOOD:**

Water activity its relation with shelf-life of food materials, equilibrium moisture content and latent heat of vaporization, equipments for movement and heating of air, resistance to air flow in granular bed, drying characteristics of cereals, pulses, oilseeds, spices and other food materials, heat requirement and thermal efficiency of drying systems, operation of different types of dryers, dehydration of food by microwave, dielectric and irradiation.

15 **QUALITY CONTROL IN FOOD INDUSTRY:**

Hygiene regulation, central of airborne contamination HACCP implementation, Indian experience, assessing an operation, microbiological central methods, instrumental measurements of sensory attribute of foods; appearance, color, volume, density and specific gravity, Rheological and textural characteristics, textural profile analysis. To relation between instrumental and sensory analysis of food quality attributes.

16 **MARKETING OF FOOD PRODUCTS:**

Nature of products. Cost concepts, cost curves and short run and long equilibrium. Returns to scale and economies of scale. Project preparation and feasibility analysis. Financial management. Demand, markets,

marketing, market structure, marketing management and pricing strategies of firms. Marketing environment and consumer buying behaviour. Market segmentation, market measurement, market plan, marketing promotion, management of distribution and market research. Market information system, export and government regulations, GATT and WTO.

17 **PROCESSING OF SPICE AND PLANTATION CROPS:**

Production and processing scenario of spice, flavor and plantation crops and its scope. Major spices: 1)Post harvest technology composition, processed products of following spices. 2)Ginger 3)Chill 4)Turmeric 5)Onion and garlic 6)Pepper 7)Cardamon 8)Aercanut, cashew nut, coconut. Minor spices, herbs and leafy vegetables: tea, rubber and oil palm, Spartans, processing and utilization all spice, annie seed, sweet basil. Caraway seed, cassia, cinnamon, clove, coriander, cumin, dill seed. Fern seed nutmeg, malt, mint marjoram, rose merry, saffron, sage, savory, thyme, ajowan, asartida, curry leaves. Tea-types, processing, quality control, coffee & cocoa: Processing vanilla and annatto processing. Flavours of minor spices. Flavour of major spices. Spice oil and oleoresins. Flavours of soft drinks baking and confectionery Standards specification of spices. Functional packaging of spices and spice products.

18 **FOOD PLANT SANITATION & WASTE MANAGEMENT:**

Sanitary design of food process equipment, selection of sanitizing agents for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation. By-products obtained from dairy plant, egg & poultry processing industry and meat industry. Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water, pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated bio-filtration, biological fluidized bed reactor, dried bacteria culture process tertiary treatments or advanced waste water treatment system(AWT); polishing ponds, DAF techniques, micro trainers treatment and disposal of sludge, sand filters, removal of nitrogen, phosphorous, sulphur, physical chemical treatment process.

19 **FOOD LAWS AND LEGISLATION**

Concept and significance of food legislation, food laws and legislation, Prevention of Food Adulteration(PFA), Bureau of Indian Standards(BIS), Agmark, Agricultural and Processed Food Products Export Development Authority(APEDA), International Standardization and Organisation(ISO),

Codex Alimentrius Commission(CAC), Food Laws & Legislation in EU, Middle East, SAARC and ASEAN.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

DRAUGHTSMAN (DIPLOMA)

PAPER-I

1. Bricks- Characteristics of a good brick,manufacture of bricks,Tiles,Terra-Cotta characteristics of cement and lime.

2. Sequence of construction of buildings.Names of different parts of building.

3. Bricks masonry- Principles of construction of bonds.Tools and equipments used ,scaffolding.

4. Stone masonry- Terms used, Principles of construction,classification,composite masonry and strength of walls.

5. Timber-structure-Indian timber uses.

6. Foundation-Purpose. Causes of failure of foundations,bearing capacity of soils,Dead & Live loads,Examination of ground, types of foundation.Setting out of building on ground excavation.

7. Dampness in building and damp proof course.Method of prevention of dampness in building.Mortar-types,proportion & mixing,Plastering and Pointing,white washing & Distempering.

8. Types of ground floor and methods of construction granolithic,Mosaic,brick-tiles etc,floors.

9. Arches-Technical terms,different types,brick and stone centering lintel.Market forms and sizes.

10. Carpentry Joints-terms,classification of joints.

11. Doors-parts of door,location,sizes and types.

12. Windows & ventilators including steel window and ventilators-fixtures and fastening used in doors,windows and ventilators.

13. Roof-Pitched roof types,components parts of roof, King post & Queen post trusses

14. Stairs- Terms,forms,material,planning and designing of stairs.

15. Residential building- Principles of planning,Orientation-Local building by law.Types of residential building.Method and find out quantities for a single storied residential building.

16.(a) Unit of force,laws of motion,equation of motion.
(b) Heat and Temperature, Unit of heat.
(c) Light-Laws of reflection and refraction.
(d) Magnetism- Properties, magnetic angle.
(e) Loads-various types,bending moment,shearing force,cantilever,simpy supported beam and over hanging beams.
(f) Electricity- Ohm's Law.

PAPER-II

1. Plumbing- Common hand tools- their description and use. Descripton of plumbing operation.

2. Carpentry- Carpenter's hand tools, their names,description and use. Common joints Grinding and sharpening of tools. Properties and uses of different timbers used in construction work

3. Electrical- Safety precautions and Elementary first aid. Artificial respiration and treatment of Electric shock. Elementary Electricity. General idea of supply system. Wireman's tool kits.
Wiring materials,Electrical fittings. System of wiring. Wiring installation for domestic lighting.

4. Surveying- Chain surveying principles- Instrument employed,use,care, and maintainence, Field book plotting. Introduction to plain table survey. Prismatic compass. Instruments and accessories their use and description level book. Differential levelling

5. Road- Introduction to Roads, general principles of Allignment, classification and construction of different types of roads.

6. Railways- Indian Railways their Ganges, construction of permanent ways, Different Rail sections, use and type of slipper

7. Bridges- Introduction of bridges, common parts of a bridge,classification of culverts, Bridges types. Location of a bridge.

8. Irrigation- Definition of terms used in irrigation. Duty, Delta, Intensity of Irrigation, Types of
Dam, Reservoir types; Canals- classification and distribution system canal structures, types of
cross drainage works.

9. Public Health Engineering- Introduction- terms used in Public Health Engineering, system of
sanitation- house plumbing, sanitary fitting.

10. R.C.C.- Introduction to R.C.C.uses, materials proportions aand form work including bending of bars and construction reference to BIS code, Reinforced brick work. Materials used for RCC construction, selection of materials course aggregate, fine aggregate cement-

water reinforcement, characteristics. Method of mixing concrete hand andd machine, slump test.

Forms of Rivets, proportions. Types of Riveted joints. Design of Riveted connection, Failure of Riveted joints.

11. Estimating- Types of estimate, standard method of taking out Quantity, Labour and Material detailed and abstract estimate. Analysis of rates for simple items of work Schedule of Rates, Specification.

12. Computer- General terms used in computer, Elementary DOS command: word processor command and their uses: Window command and their uses: Auto CAD commands and use of different Icons of Auto CAD: Knowledge about different Co-ordinate system: Knowledge about geometrical drawings and 2D drafting: Knowledge about different edit Commands:

Knowledge about different codes of system: Knowledge about 3D drafting: Basic knowledge about layout and printing of drawings.

13. Knowledge about Architectural Desk top and creating modeling.

14. Arithmetical calculation:-

(i) Application of fractions and decimals.
(ii) Ratio and proportion.
(iii) Conversion of different system
(iv) Simple equation, Quadratic equation.
(v) Areas of triangles, rectangles, square,circle.
(vi) Logarithms
(vii) Trigonometrical Ratios, functions, applied problems height and distances.
(viii) Problems related to stress, strain, yang's modules, lever's Heat & Temperature.
(ix) Problems on simply supported beam, Over hanging beam.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

ECONOMICS (DEGREE)

PAPER-I

1. The Framework of an Economy: National Income and Accounting.
2. Consumer Demand and Price: Law of demand; Utility analysis and Indifference curve techniques; Consumer equilibrium.
3. Production and Cost; Law of Variable proportion and Return to factor: Production function; Least cost combination of inputs; Return to Scale; Economies of scale; Concept of costs.
4. Market structures and Pricing: Equilibrium of a firm under different market structures; Price discrimination; Pricing of factors of production.
5. Income and Employment: Investment decisions and determination of income and employment; Macro economic models of income and distribution.
6. Economic Development and Growth: Development and underdevelopment; Measuring development and development gap-HDI and other indices of development and quality of life; Economic Growth-factors affecting growth; Growth models-Harrod and Domar; Neo-classical growth models-Solow and Joan Robinson's growth Models.
7. Money and Banking: Commercial and Central banks; credit creation and credit control; Supply of money – components and determination; Inflation.
8. Taxation: Types of taxes and their impact on the economy: Objectives and instruments of budgetary and fiscal policy in a planned developing economy.

PAPER-II

1. International Trade: Comparative costs; Ricardian and Hecksher Ohlin theory; Balance of payments and adjustment mechanism.
2. International Monetary system and Banking Institutions.
3. Indian Economic Policy: Guiding principles of Indian economic policy-planned growth and distributive justice, eradication of poverty; Extent and incidence of poverty in India.
4. Agricultural Production in India: Agricultural production; agricultural policy; land reforms; technological changes; relationship with the industrial sector.
5. Industrial Production in India: Industrial production; Industrial policy; public and private sectors; liberalization and its economic implications; roles and problems of small scale and cottage industries.
6. Budgetary trends and fiscal policy in India.
7. India's Foreign Trade: Composition and direction; balance of payment – problems and policies; role of foreign capital in economic development; import liberalization export promotion and their implications.
8. Indian planning: Objectives, strategy, experiences and problems.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

EDUCATION

(PAPER -I)

FOUNDATION OF EDUCATION

Unit 1
Philosophical Foundation of Education(Course Structure)

1.1 **Philosophy:**
- Meaning , nature and functions.
- Relationship between Philosophy and education
- Contributions of Philosophy to education

1.2 **Educational Aims:**
- Meaning nature, need and importance
- Aims of education in relation to Philosophy of life.
- Immediate and ultimate aims of education.

1.3 **Freedom and Authority in Education**

1.4 **Educational thoughts and practices**-Ancient India, Greece and Rome

1.5 **Educational thoughts and contributions**-Mahatma Gandhi, Rabindranath Tagore, John Dewey and Russel.

Unit 2 Psychological Foundation of Education(Course Structure)

2.1 **Human development:**
- Concept of growth, development and maturation
- Genetic and environmental influence on human development

2.2 **Cognitive Development:**
- Development of perceptual abilities
- Concept formation
- Language development

2.3 **Intelligence and creativity:**
- Meaning and nature of intelligence
- Theories of intelligence-Spearman and Thurstone
- Creativity-nature and development
  - Techniques of developing
  - Creativity-Brainstorming and Gordon's synetics techniques.

2.4 **Development of Personality**:
- Types and traits approaches-Sigmund Freud and Carl Rogersd

- Role of Education in developing personality.

2.5 **Emotional correlates of Behaivour:**

- Emotions-Nature , development and control
- Interest-Meaning ,development and change
- Attitudes-Meaning, development and change

2.6 **Learning**

- Meaning and nature
- Factors affecting learning
- Types of learning(Gagne's classification)
- Transfer of learning

Unit 3 Sociological Foundation of Education(Course Structure)

3.1 **Sociology of Education**

- Meaning, nature and scope of sociology of education
- Social factors affecting education

3.2 **Education and Culture**

- Concept of culture
- Education and cultural change
- Diversity of Indian culture

3.3 **Education and Social Groups**

- Primary and secondary groups, their interactions and educational implications
- Group dynamics
- Social process and education

3.4 **Education and Social Stratification**

- Social structure
- Social strtaification; caste, ribe, class, gender, rural and urban
- Education and social mobility
- Equality in educational opportunities.

3.5 **Education and Social Transformation**

- Concept and process of social change
- Tradition and modernity
- Education as an agent of social change
- Eduaction ans social control.

(PAPER -II)

DIMENSIONS OF EDUCATION

Unit 1 Education system in India(Course Structure)

1.1 **Constitutional Provisions:**

- Legal and constitutional foundations of the present system
- Constitutional provisions
- Role of Local bodies

1.2 **Recommendations of Commissions:** Recommendations of

- University Education Commission(1948-49)
- Secondary Education Commissdion(1952), Kothari Education Commission(1964-66) and the National Policy of Education(1986) in relation to: (i) Objectives and curriculum (ii) Teacher's role
  (iii) Institutional organizational set up (iv) Financing and resource mobilization

1.3 **Education in North-East India with special reference to Tribal Communities**

- Traditionl Institutional and practices
- Cultural and organizational features of tribal communities in relation to education
- Progress on education, problems and issues.

Unit 2 Human Abilities and Dynamics of Human Behaivour(Course Structure)

2.1 **Human abilities:**

- Nature and types of Human abilities
- Concept of measurement & evaluation of human abilities and problems related to it.

2.2 **Dynamics of Human Behaivour**

- Attitudes and beliefs as determinants of behaivour
- Psychology of religious experience-fanaticism and fundamentalism
- Prejudice and bias in perception- communal and sectarian behaviour
- Development of secular ethics
- Sources of pressure on behaivour and self concept:

(i) Family (ii) Peer group (iii) Religion (iv) Other organisations (v) Order & discipline

(vi) Drugs, narcotics and alcoholism and their influence on behaivour

(vii) Maladjustment and deviant behaivour (viii) Mechanism of adjustment

(ix) Methods of studying individual & group behaivour-case study and sociometry

Unit 3 Educational Technology

3.1 Concept and scope of educational technology
3.2 Systems approach to Education
3.3 Communication approach
3.4 Programmed learning

Unit 4 Educational Management(Course Structure) Educational Planning

4.1 Process of educational planning

4.2 Developments at centre & State level

4.3 Personnel Management

4.4 Financial Management:

(i)Soure of income (ii) Pattern of Expenditure (iii) Budgeting (iv) Accounting (v) Auditing

4.5 Work ethics & code of behaivour in educational organisation.

Unit 5 Guidance & Counselling(Course Structure)

5.1 Educational guidance- Importance, scope and principles

5.2 Vocational guidance-meaning and need

5.3 Organised programme of vocational guidance

5.4 Counselling-Principles and techniques

5.5 Organisation of guidance services-Role of principals, teachers, parents, counselor and career masters.

Unit 6 Adult and Continuing Education(Course Structure)

6.1 Meaning, importance & scope of adult and non-formal education

6.2 Development of adult and non-formal education-NAEI and NLM

6.3 Voluntary agencies for adult education.

Unit 7 Environmental Education

7.1 The concept and types of environment

7.2 Aims and objectives of environmental education

7.3 Constitutional provision and environment

7.4 International conferences on environment & development-Non Alignment Summit(Sept. 1989)

-United Nations Conference on environment and development – Rio Brazil(1992)-Agenda-21

7.5 Man and environment

Unit 8 Value Education

8.1 Meaning and types of values

8.2 Socio-cultural traditions and values

8.3 Value development

8.4 Traditional Vs modern values in tribal society

8.5 Role of value in National and International Integration

8.6 Human rights with special reference to International declaration on Human Rights.

EN***D***

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

ELECTRICAL ENGINEERING (DEGREE)

PAPER-I

1. EM THEORY:

Electrical and magnetic fields. Gauss's Law and Amperes Law. Fields in dielectrics, conductors and magnetic materials. Maxwell's equations. Time varying fields. Plane-wave propagation in dielectric and conducting media. Transmission lines.

2. ELECTRICAL MATERIALS:

Band theory, conductors, semi-conductors and insulators. Super-conductivity. Insulators for electrical and electronic applications. Magnetic materials. Ferro and Ferri magnetism. Ceramics, properties and applications. Hall effects and its applications. Special semiconductors.

3. ELECTRICAL CIRCUITS:

Circuits elements. Kirchoff's Laws. Mesh and Nodel analysis. Network Theorems and applications. Natural response and forced response. Transient response and steady state response for arbitrary inputs. Properties of networks in terms of poles and zeros. Transfer function. Resonant circuits. Three phase circuits. Two-port networks. Elements of two-element network synthesis.

4. MEASUREMENTS AND INSTRUMENTATION:

Units and standards. Error analysis. Measurement of current. Voltage, Power, Power-factor and energy. Indicating instruments. Measurement of resistance, inductance, capacitance and frequency. Bridge measurements. Electronic measuring instruments. Digital Voltmeter and frequency counter Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc. Data acquisition systems. A/D and D/A converters.

5. CONTROL SYSTEMS:

Mathematical modeling of physical systems. Block diagrams and signal flow graphs and their reduction. Time domain and frequency domain analysis of linear dynamical system. Errors for different type of inputs and stability criteria for feedback systems. Stability analysis using Routh-Hurwitz array. Nyquist plot and Bode plot. Toot Locus and Nicols chart and the estimation of gain and phase margin. Basis concepts of compensator design. State variable matrix and its use in system modeling and design. Sampled data system and performance of such a system with the samples in the error channel. Stability of sampled data system. Elements of nonlinear control analysis. Control system components, electromechanical, hydraulic pneumatic components.

PAPER-II

1. ELECTRICAL MACHINES AND POWER TRANSFORMERS:

Magnetic circuits-analysis and design of power transformers. Construction and testing. Equivalent circuits losses and efficiency. Regulation auto-transformer. 3 phase to former. Parallel operation. Basic concepts in rotating machines. EMF, torque, basic machine types construction and operation, leakage, losses and efficiency.

B.C. Machines construction, excitation method, circuit models, Armature reaction and comutation, characteristics and performance analysis. Generators and motors.

Starting and speed control. Testing losses and efficiency.

Synchronous machines. Construction. Circuit model. Operating characteristics and performance analysis. Synchronous reactance. Efficiency. Voltage regulation, Salient-pole machine. Parallel operation. Hunting short circuit transients.

Induction machines. Construction. Principle of operation. Rotating fields. Characteristics and performance. Analysis. Determination of circuit model. Circle diagram. Starting and speed control. Fractional KW motors. Single phase synchronous and induction motors.

2. POWER SYSTEM: Types of Power Stations, Hydro Thermal and Nuclear Stations. Pumped storage plant. Economics and operating factors.

Power transmission lines, Modeling and performance characteristics. Voltage control. Load flow studies. Optimal power system operation. Load frequency control. Symmetrical short circuit analysis. Zbus formulation. Symmetrical components. Per Unit representation. Fault analysis. Transient and steady-state stability of power systems. Equal area criterion.

Power System Transients. Power systems protection circuit breakers. Relays HVDC transmission.

3. ANALOG AND DIGITAL ELECTRONICS AND CIRCUITS:

Semiconductor device physics, PN junctions and transistors, circuit models and parameters, FET, Zener, Tunnel, Schottky, photo diodes and their applications, rectifier circuits, voltage regulators and multiplier switching behavior of diodes and transistor.

Small signal amplifiers, biasing circuits, frequency response and improvement, multistage amplifiers and feedback amplifiers, D.C. amplifiers, oscillators, large signal amplifiers, coupling amplifier, push pull amplifier, operational amplifier, weve shaping circuits, multivibrators and flip-flops and their applications. Digital logic gate families, universal gates combinational circuits for arithmetic and logic operation, sequential logic circuits. Counters, registers RAM and ROMS.

4. MICRO PROCESSORS: Microprocessors architecture-instruction set and simple assembly language programming. Interfacing for memory and I/Q. applications of micro processors in power system.

5. COMMUNICATION SYSTEMS: Types of modulation. AM, FM and PM. Demodulation. Noise and bandwidth considerations. Digital communication systems. Pulse code modulation and demodulations. Elements of sound and vision broadcasting. Barrier communication. Frequency division and time division multiplexing, telemetry system in power engineering.

6. POWER ELECTRONICS: Power semiconductor devices. Thyristor. Power transistor, GTOs and MOS-FETs. Characteristics and operation. AC to DC converters: 1 phase and 3 phase DC to DC converters.

AC regulators. Thyristor controlled reactors, switched capacitor networks. Inverters: Single-phase and 3 phase. Pulse with modulation. Sinusoidal modulation with uniform sampling switched mode power supplies.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

ELECTRICAL ENGINEERING (DIPLOMA)

PAPER-I

1. PRINCIPLE OF ELECTRICAL ENGINEERING

(i) Conductor: Conducting materials and their properties, used of conducting materials in different fields.

(ii) Insulators: Insulating materials and their properties, used of insulting materials in different fields.

(iii) Work Power and Energy: Definitions and units, relation between electrical, mechanical and heat units simple problems.

(iv) Direct Current Circuits: Series, parallel and series-parallel circuits of resistance division of current in parallel circuits with problems, Kirchoff's laws-point law and Mesh law with simple problems.

(v) Magnetism and Electromagnetism: Definition of magnetic flux, flux density, magnetic induction, permeability, magnetizing force, magnetomotive force, reluctance, electromagnet, parody's laws of electromagnetic induction, Lenz's, self and mutual induced e.m.f. right hand rule.

(vi) Capacitors: Definition of capacitance, capacitance of parallel plate condenser and their uses.

(vii) A.C. Fundamentals: Definition of cycle, time period, frequency, amplitude, phase, phase difference, R.M.S. value, average values, form factor, crest factor, phasar representation of alternating quantities, simple problems.

(viii) Single Phase A.C. Circuit: A.C. circuit with resistance-induction, resistance-capacitance, resistance-inductance-capacitance connected in series and parallel by means of phasar diagram, power factor, power with simple problems.

(ix) 3 Phase Circuits: Line and phase quantities and their relationship in star delta connected circuit, 3 phase power, related problems.

2. D.C. MACHINES AND BATTERY

(i) D.C. Machines: Construction and function of different parts of D.C. machine. Functional difference between generator and motor. Principles of operation of motor. Back e.m.f. Types of generator and motor, starting of D.C. motors. Different and efficiency of motor and generator.

(ii) Battery: Construction of load amid cell and working principle, charging and discharging with chemical reaction, induction of fully charged battery.

3. ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENT

(i) Moving iron and Moving Coil Instrument: Construction working principle of ammeter and voltmeter with application.

(ii) Energy Meter: Single phase and 3 phase energy meter-induction type-construction, working principle and application, testing of energy meter.

(iii) Watt Meter: Dynamometer and induction type-construction, working principle, measurement of 3 phase power using two watt meter and three wattmeter. Three phase wattmeter basic principle.

(iv) Instrument Transformer: Definition of instrument transformer current transformer and potential transformer-construction, application.
(v) Power Factor Meter: Single phase and three phase-construction and working principle.
(vi) Synchroscope and its uses:
(vii) Localization of cable fault: Common fault in cable, Murray loop test.
(viii) Cathode Ray Oscilloscope: Construction, working principle and uses.

4. BASIC ELECTRONICS AND COMPUTER

(i) Electron Emission: Different methods of electron emission.
(ii) Semiconductor Devices: P.N. junction diode, Zener didde characteristics and application PNP and NPN transistors, rating, characteristic in different configuration.
(iii) Power Supplies: Halt wave and full wave rectifier (centre tape-and bridge). Filters and types of filter circuit, Ripple factor.
(iv) Amplifier: Transistor as an amplifier-CB, CE and CC configuration, voltage, current and power gains, RC coupled, transformer coupled amplifier, push pull amplifier.
(v) Oscillator: Types of oscillators-Hartley's, Copitts oscillators. Condition for oscillation and frequency of oscillation.
(vi) Modulation: Principle of modulation, types of modulation-amplitude modulation and frequency modulation.
(vii) Basic Concept of Computer: Types of computer, analogue, Digital, general purpose, mini and micro computer, and their application, concept of operating system-function and characteristics. Definition of interpreter, compiler, source code, object code, elementary idea of device and file management.
(viii) Input/Output Device: Classification, keyboard, display units, their resolution, printers, different types of printers, plotters, mouse, digitizer and character reader.
(ix) Storage Devices: Disks, magnetic tape, different types of floppy disc.
(x) Programming Language Concept: Flowing charting, pseudocode, programme development, structure programming.
(xi) System Installation Concepts: Hardware and software specifications, different types of requirements system layout, testrun, training protection and removal of dust free condition.

5. ELECTRICAL DRAWING AND ESTIMATING

(i) Drawing and stimation of aterials required for service connection to domestic and industrial consumer (both overhead and underground).
(ii) Design and drawing of installation layout of building with C.T.S., P.V.C. and conduit wiring with estimation of material required.
(iii) Design, drawing and estimation of materials for wiring of industrial installation i.e. workshop etc.
(iv) Drawing of different earthing (pipe earthing and plate earthing) and estimation of materials required for earthing.
(v) Estimation and drawing of 44o.230 volts distribution lines with details.
(vi) Design, drawing and estimation of materials required for single and double pole mounted transformer substation for a given load.

PAPER-II

1. A.C. MACHINES

(i) Transformer: Basic definition, constructional features of different types (caretype and shelltype), principle of operation, e.m.f. equation, transformation ratio, open circuit and short circuit test, losses and efficiency, condition for maximum efficiency, three phase transformer-different types of connections-delta, delta, star/delta star with simple problems, Autotransformer-construction, principle of working and uses.

(ii) Three Phase Induction Motor: Principle of operation, construction, types of rotar synchronour sped, rotor speed slip, rotar current and frequency, star-delta starter and autotransformer starter for squirrel cage and slip ring motor.

(iii) Alternator: Constructional features of different types of alter (Hydro and turbo generator), effect of change of excitation synochorinizing of single and three phase alternator.

(iv) Synchronous Motor: Construction and working principle, method of starting, operation at constant and variable excitation with problems motor on load, vector diagram, application with special reference to p.f. improvement.

(v) Synchronous Converter: Description and operational principle starting from A.C. side from D.C. side.

(vi) Mercury Are Rectifier: Description and operation for single phase and three mercury rectifier.

2. ELECTRICAL POWER

(i) D.C. and A.C. Distribution System: Different types of distributor, use of interconnectors in distribution system with simple problems comparison of A.C. and D.C. system.

(ii) Overhead Distribution Lines: Different types of poles bracket, insultators, stays, guard wires. Materials used for insulators, different types of insulators with diagram and uses.

(iii) Underground Cable: Different types, comparison with overhead system, laying of underground cables.

(iv) Power Factor Improvement: Causes of law power factor and its effect. Methods of improving power factor with simple problem.

(v) Power Station: Sources of electric power, general layout and selection of site for thermal power station, hydro electric and nuclear power station.

(vi) Over Head Transmission: Short lines and medium lines, low medium and high voltage, I.E. rules for voltage drops, simple problems. Elementary idea of skin effect and corona effect, sag and tension.

(vii) Economic Considerations: Economic of generating, load factor, demand factor, capacity factor, lead curve, load-duration curve, methods of tariff, simple problems.

(viii) Switch Gear and Protection: Oil circuit breaker and air blast circuit breaker, construction and operational principle with simple diagram for over current relay. Over voltage reply, buchholz relay lightning arrestar-discription with diagram for horn gap and thyrito type arrester construction and uses of isolator, H.R.C. Fuse and current limiting reactor.

(ix) Substation: Different types of substation names of different types of equipments, measuring instruments and recording instrument, earthing substation.

3. ELECTRICAL INSTALLATION

(i) Internal Wiring: Different types of internal wiring with their field of application, advantage and disadvantage, material required for each system. I.E. rules for placing of switches mains, cut-outs and sockets. Testing of wiring before commissioning as per I.E. rules, meggar and its uses.

(ii) Illumination: Definition of lumen, lux, illumination level laws of illuminations, co-efficient of illumination, maintaining factors, spaceheigh ratio. Different bypes of lamps, connection of fluorescent lamps and gas discharge lamps.

(iii) Machine Installation: Different methods of foundation alignment and leveling. Necessity of earthing, selection earthing points as per I.E. rules, size of earth conductor.

4. PLANT MAINTAINANCE

(i) Symptom, fault and remedies A.C. and D.C. motors, transformer.
(ii) Schedule maintenance of transformer motors.
(iii) Preventive maintenance of transformer, maintenance of cooling oil.
(iv) Maintenance of lead acid cell.
(v) Preventive maintenance of alternator.
(vi) Details of a hydraulic and thermal power project-equipment and machineries used (preliminary idea about line plans in various activities of the project).

5. ELECTRICAL MACHINE DESIGN

(i) Design of single phase Transformer: Design of care, primary winding, secondary winding, yoke, over all size, tank.
(ii) Design of 3 phase induction meter-design of start, rotor.
(iii) Design of a choke.
(iv) Design of main dimension of alternator, stator, rotor.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

ELECTRONICS & COMMUNICATION

PAPER-I

1. ***Materials and Components:*** Structure and properties of Electrical Engineering materials; Conductors, Semiconductors and Insulations, Magnetic, Ferroelectric, Piezoelectric, Ceramic, Optical and Super-conducting materials. Passive components and characteristics Resistors, Capacitors and Inductors; Ferrities, Quartz crystal Ceramic resonators, Electromagnetic an Electromechanical components.

2. ***Physical Electronics, Electron Devices and ICs:*** Electrons and holes in semiconductors, Carrier Statistics, mechanism of current flow in a semiconductor, Hall effect; Junction theory; Different types of diodes and their characteristics; Bi-polar Junction transistor; Field effect transistors; Power switching devices like SCRs, GTOs, Power MOSFETS; Basics of ICs-bipolar, MOS and CMOS types; basic of Opto Electronics.

3. ***Signals and Systems:*** Classification of signals and systems; system modeling in terms of differential and difference equations; State variable representation; Fourier series; Fourier representation, Fourier Series, Fourier transforms and their application to system analysis; Laplace transforms and their system analysis; Convolution and superposition integrals and their applications; Z transformers and their application to the analysis and characterization of discrete time systems; Random signals and probability, Correlation functions; Spectral density; Response of linear system to random inputs.

4. ***Network Theory:*** Network analysis techniques; Network theorems, transient response, steady state sinusoidal response; Network graphs and their applications in network analysis; Tellegen's theorem. Two port networks; Z, Y, h and transmission parameters. Combination of two ports, analysis of common two ports. Network functions: Parts of network functions, obtaining a network function from a given part. Transmission criteria: delay and rise time, Elmore's and other definitions effect of cascading. Elements of network synthesis.

5. ***Electromagnetic Theory:*** Analysis of electrostatic and magnetostatic fields; Laplace's and Piossons's equations; Boundary value problems and their solutions; Maxwell's equations; application to wave propagation in bounded and unbounded media; Transmission lines: basic theory, standing waves, matching applications, misconstrue lines; Basics of wave guides and resonators; Elements of antenna theory.

6. ***Electronic Measurements and Instrumentation:*** Basic concepts, standards and error analysis; Measurements of basic electrical quantities and parameters; Electronic measuring instruments and their principles of working: Analog and digital comparison, characteristics, application. Transducers; Electronic measurements of non electrical quantities like temperature, pressure, humidity etc; basics of telemetry for industrial use.

PAPER-II

1. ***Analog Electronic Circuits:*** Transistor biasing and stabilization , Small signal analysis; Power amplifiers. Frequency response. Wide banding techniques. Feedback amplifiers. Tuned amplifiers. Oscillators. Rectifiers and power supplies. Op Amp, PLL, other linear integrated circuits and applications. Pulse shaping circuits and waveform generators.

2. ***Digital Electronic Circuits:*** Transistor as a switching element; Boolean algebra, simplification of Boolean functions, Karnaguh map and applicators; IC logic gates and their characteristic IC logic families: DTL, TTL, ECL, NMOS, PMOS and CMOS gates and their comparison; Combinational logic Circuits; Half adder, Full adder; Digital comparator; Multiplexer, Demulti-plexer; ROM and their applications. Flip flops. R-S, J-K, D and T flip-flops; Different types of counters and registers Waveform generators. A/D and D/A converters. Semiconductor memories.

3. ***Control Systems:*** Transient and steady state response of control systems' Effect of feedback on stability and sensibility; Root locus techniques; Frequency response analysis. Concepts of gain and phase margins: Constant-M and Constant-N Nichol,s Chart; Approximation of transient response from Constant-N Nichol,s Chart; Approximation of transient response from closed loop frequency response; Design of Control Systems, Compensators; Industrial controllers.

4. ***Communication Systems:*** Basic information theory; Modulation and detection in analogue and digital systems; Sampling and data reconstruction; Quantization; and coding; time division and frequency division, multiplexing; Equalization; Optical communication: in free space & fiber optic; Propagation of signals oat HF. VHF, UHF and microwave frequency; Satellite Communication.

5. ***Microwave Engineering:*** Microwave Tubes and solid state devices, Microwave generation and amplifiers, Waveguides and other Microwave Components and Circuits, Misconstrue circuits, Microwave Antennas, Microwave Measurements, Masers, lasers, Microwave propagation. Microwave Communication Systems terrestrial and Satellite based.

6. ***Computer Engineering:*** Number Systems. Data representation; Programming; Elements of a high level programming language PASCAL/C; Use of basic data structures; Fundamentals of computer architecture; Processor design; Control unit design; Memory organization, I/o System Organization. Microprocessors: Architecture and instruction set of Microprocessors 8085 and 8086, Assembly Language Programming. Microprocessor based system design: typical examples. Personal computers and their typical uses.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

FISHERY

PAPER – I

Section 'A' 1. Fishery Biology.

Section 'B' 2. Fishery Pathology.

Section 'A' 3. Aquaculture.

Section 'B' 4. Aquaculture

PAPER – II

Section 'A' 1. Fish Processing Technology.

Section 'B' 2. Fishery Engineering.

Section 'A' 3. Fishery Economics, Statistics, Marketing, Administration & Finance.

Section 'B' 4. Fishery Extension, Development & Conservation.

OR

Section 'A'5. Fishery Oceanography.

Section 'B'6. Limnology.

PAPER-I SECTION 'A'

I. FISHERY BIOLOGY:

1. Taxanomy of Fin fishes and Shell Fishes:

General principles of Taxanomy binomial nomenclature, and techniques of classification. Classification and external morphology of crustaceans, mollusces and fin fishes with special emphasis on commercially important groups.

2. Biology of Fin Fishes and Shell Fishes:

Study of internal organization of fin fishes, crustareans, mollusces digestive, circulatory, respiratory, nervous, excretory, reproductive and skeletal system, study of the food and feeding habits, growth, age, length-weight relationship, maturation, fecundity estimation, ova diameter, studies, spawing embryonic and larval development and juvenile stages of commercially important fishes, crustaceans and molluses, migration and other behavioral aspects of commercially important fishes, crustaceans and molluses.

3. Physiology of Fishes:

Principles of physiology-cellular and organiamal respiration-gas exchange-metabolism, circulation, digestion, excretion, nervous system, hormones, reproductive physiology in fishes, ecological influence on maturation and spawning, endocrine and neural mechanism process of maturation secondary sexual characters, breeding behavior, fertilization and development.

4. Capture Fisheries Marine and Inland:

Survey of the marine fisheries of the world. Maine fishes and fishery resources of India, fisheries banded on habitual neretic, oceanic, pelagic, and demersal fisheries-fisheries of sardines and Mackerels, tune, Bheel fishes, Bombay duck, ribbon fishes, white bait, seen fishes, flying fishes, pomfrets, sharks, rays, skates, sciaenids, polynemds, flat fishes, cat fishes, mullets, milk fish, hilsa, prawns, lobsters, crabs, cephalopods, pearl oysters, mussels and chanks. Ancillary fisheries including turtles, corals, sponges, ecnhinoderms and whales hunting fisheries and other recourses of the exclusive economic zones.

Survey of the freshwater capture fisheries of the world, freshwater and estuarine fishes and fisheries of India. Craft and gear use in inland water, reveriner estuarine, lacustrine, tank and pond fisheries, brackish water fisheries, capture fisheries of major medium and minor carps, exotic carps, cat fishes, air breathing fishes, feather backs, hilsa and other migratory fishes, hill stream fisheries.

5. Population dynamics and Management of Fisheries:

Principal of population dynamics, importance of the study of populations. Bearing of fish biology on population studies. Unit stocks, problems of age, rates of growth, recruitment and mortality rates catch, stock, effort, simple analytical approaches to population management and problems of overfishing. Forecasting and conservation of fishery resource. Introduction of simple mathematical models suitable for tropical fisheries. Exploitation, conservation and management of important fishery recources.

6. Fishery Biotechnology:

Chemistry of nucleic acids Genetic code. Recombinant DNA concept. Restriction enzymes and ligases, steroids as anabolic agents. General application of molecular, biological techniques to fisheries. Application of enzymes in fishery products vaccine development programme for various fish diseases. Hytridoma technology application to fisheries. Cryopreservation, preservation of male female gametes and embryo preservation.

Chromosonal Engineering: Production of monosex population. Gynogenesis triploid and tetraploid, sterile fish production, scope of transgenic fish production gene cloning. Marine bioactive compounds, their extraction and properties and environmental biotechnology-its application.

PAPER-I SECTION 'B'

II. FISHERY PATHOLOGY:

1. Determining Health Condition of Fish Lots:

The Escape Reflex, defensive, tail reflex, ocular reflex, evaluation of specific change and signs, sampling and sending of sick fish for laboratory investigation, determination of the freshness of dead fish, sampling and sending of water for toxicological investigation.

2. Laboratory diagnosis of fish Diseases:

Handling of fish in the laboratory, determination of the nutritional state, age and sex of fish. Systematic examination of skin, gills, body cavity, brain, etc. Preservation of parasite & bacteriological sample. Crusta-ceans parasites on fish.

3. Isolation and Identification of Fish Pathogen:

Isolation of different pathogen from different parts of fish body and from intermediate host. Characters and key for the determination and classes and orders of Protozoa. Flagellates, Coecidia, Myxosporidias, etc. Review of Crustacean parasites on culture fish.

4. Fish Parasitology:

Taxgonomy, classification, method in identification of Monogenetic, and Digenetic. Flukes, Nematode, Acanthocephalan and Hirudinea, growth, nutrition, chemistry and metabolism of helminthes.

5. Fish Bacteriology:

Bacterial anatomy: Staining-reactions mortality, bacterial-resistance, preservation of cultures, sterilization, antiseptics and disinfectants. Taxonomy-classification. Method used in identification of bacteria. Staphylocaccus, streptococcus, Pseudomonas and vibrio.

6. Fish Mycology:

Structure, identification, classification and physiology of yeasts and fungi, dispersal mycological and host aspects pathogenicity. Actinopmyees, Mycobacterium and CAN bacteria in relation with UDS.

7. Fish Viruses and Remedial Measures of Diseases:

Laboratory diagnosis of viral infection of fish, environmentally induced abnormalities, principles involved in vaccine development. Prophylactic measures in aqua farms, pathogen free water, pathogen free food. Hygiene vector and pest control. Diseases resistant species.

PAPER-I SECTION 'A'

III. AQUACULTURE:

1. Principles of Aquaculture:

History and definition of aquaculture, scope and importance of aquaculture in the world. Indian and west Bengal, present status of aquaculture, species for culture, species of fin fishes and shell fishes cultivated in India, seed resources, collection and transportation with special emphasis to West Bengal

Extensive, semi-intensive culture. Mono species and Monosex culture, polyculture, pre-stocking management desilting, eradication of predatory and weedfishes, control of aquatic weeds, principles of limining and fertilization, stocking- species combination dens , ratios,pond- stocking management- nutrition, supplementary feeds and feeding, suitable water and soil quality management, algal blooms and control, survival, harvesting, and yield, culture of fish food organisms.

2. Water and Soil Chemistry:

Types of water, physico chemical parameters of fresh, brackish water and marine waters. Soils and their distribution . Techniques of analysis of water quality parameters. Soils-their formation, structure, classification, chemistry and conservation, Techniques of Soil analysis. Types of water and soils and their condition for optimum fish production. Pesticides reduces in water, soil and fishes, soil analysis in relation to pisciculture.

3. Fresh Water Aquaculture Systems:

Fresh water fish culture systems-monoculture and composite Fish culture system, culture of India major carps. Culture of exotic carps, air-breading fish culture, tilapia culture, culture achatma etc. Fresh water fish farm management.

4. Fish Nutrition: Introduction to nutrition, nutritive needs of fish and prawns, energy, Carbohydrates, fat (lipids), protein, minerals, vitamin, vitamin deficiency symptoms, water-non-nutritive factors feed formulation for fish and prawn pallated feeds-micro encapsulated diets, extended feeds, feed handling and storage, rations for fish and prawn feeding, cold water fish feeding, warm water fish feeding systems, other feed and management aspects, nutritional toxicants of fish. Drugs and antibiotics fish as a bioassay.

5. Aquarium Fish Culture & Management:

Ornamental fish culture as a hobby and commercial enterprise. Setting up of freshwater aquaria, marine aquaria use of filters. Design of small indoor aquaries, and maintenance of large aquaria, display of aquatic organisms, aeration methods, taxonomy of species suited-live bearing fishes, egg laying fishes, biology of the ornamental fishes, physio-chemical proportion of water used in aquaria plants. Plants and other structure for beauty and utility. Common fish diseases and their control. Breeding of commercial important aquarium fishes. Mass culture of live food organisms, preparation of supplementary feeds and mass production of ornamental fishes.

6. Fish Genetics and Breeding:

Mendelian genetics-principles of saggregation, independent assortment, dominance, recessivenesss, sex determination and sex linkage. DNA as genetic material DNA structure, mutation-spontaneous, induced practical application of mutation chromosomal types general and in fish variation chromosomal number Techniques for genetic

improvement-application genetic in fisheries, genetic improvement techniques Hybridization-Bio technology application in fishes.

Theory of fish breeding, structure of pituitary gland, neurohormonal an pituitary harmone on maturity, fecundity and breeding. Gemetogenesis, preservation of gamatas, influence of environmental factors on fish breeding. Induced breeding techniques, hypophysation, induced breeding techniques of India major carps, exotic carps, Air breathing fishes, milk fishes and mullets, controlled breeding of shell fishes eyestalks ablation induced maturation and spawing of cultivated prawns. Natural fish and prawn seed sources. Collection techniques and transportation. Gena frequence chromosome aberration. Gexotype frequency. Use of gendotropin releasing induce in induced fish breeding.

PAPER-I Section (B)

IV. AQUACULTURE:

1. Mariculture:

History of mariculture, mariculture in India, scope and feasibility of mariculture in India. Important species cultivated. Site selection, selection of materials for enclosures, support and structures, surface fleating units, anchorages etc. Technique of culture of mussels, clams, edible oysters, pearl oyster, chank culture, culture of crabs, sea weeds and other organism, Harvesting and transport. Cage and pen culture of marine organism.

2. Brackish Water Aquaculture System with Special Emphasis on Shrimp Farming:

Types of brackish water areas in India and their suitability for aquaculture. Cultivable brackishwater fishes and prawns. Brackishwater fish & prawn culture system. Pond preparation, fertilization, stocking rates, supplementary feeding, growth, harvesting and yield.

Status of shrimp farming in India and world. Site selection for shrimp culture. Design and construction of shrimp pond/farm, cultivable panacid shrimps. Presparation of a shrimp pond. Culture techniques. Extensive, semi-intensive and intensive farming practice, water quality management, shrimp nutrition, routine farm disease management in shrimp farm. Indicator problems and their remedy. Shrimp seed resources in India.

3. Integrated Farming and Special Culture Systems:

Scope and importance of integrated system in developing rural economy. Integrated aquaculture/agriculture/horticulture/animal husbandry. Concept of quick organic recycling, economic viality of the systems. Pen culture, cage culture running water fish culture, crab, pearl, Achaia culture, use of recirculating system.

4. Hatchery System(Fish and Prawn) and Nursery Management:

Hatcheries for fish, shrimp and mollusces-layout, water supply, quality of water, larval - food production etc. hatchery systems for major carps, exotic carps, hatching of eggs, collection of hatchings. -4-Nursery layout for fish, shrimp/praw and mollusces, rearing them in nursery ponds, water quality for breeding hatching and rearing systems. Management of Chinese hatchery.

Shrimp hatchery, mechanism and management of shrimp hatchery systems, water quality in shrimp hatchery, larval food development in prawn and Molluscan hatchery systems, management and disease management, Packaging and Transport of fish seed, prawn post larvas etc.

5. Beel and Reservoir Fisheries: Definition of beel and reservoir types of beels, reservoirs Morphomatry Modelling physcio-chemical condition-stratification-Plankton distribution-Plankton biomass-production-relationship between abiotic and Biotic factors-craft and gear of beel and reservoir-aquatic plans energy flow in beels and reservoir-beels and reservoir potential and exportation-pollution and eutrophication of beels and reservoir.

PAPER-II SECTION 'A'

V. FISH PROCESSING TECHNOLOGY:

1. GENERAL BIOCHEMISTRY:

Bio-chemistry, its scope and importance in biomedical sciences P^H concepts, Dissociation of $^H{}_2$ O, weak acids and bases Buffers and their uses.

Isotopes and their application in biological experiments. Chemistry structure and properties of monosacharides, disaccharides and polysaccharides.

Classification of lipid and fatty acids, physical and chemical properties of fatty acids and triacylgycarols. Chemistry and functions of phospholipids, glycolipide, sterol and waxes.

Classification of proteins and amino acids structures and finction and properties of amino acids. Structure and conformation of proteins.

Chemistry of nulcotides. Structure and function of DNA & RNA.
Enzymes-classification and kinetics chemistry and function of fate soluble vitamins. Coenzyme role of B comples vitamins. Biological oxidation reduction electron transport chai-in ermiadiary metabolism of carbohydrates. Digestion and absorption. Pathways of carbohydrates metabolism viz. glycogenolysis, glyengenesis, gycolysis glycogenesis, Krabs cycle and HMP pathway. Endocrine regulation of carbohydrate metabolism. Digestion and absorption of lipids. Betaoxidatin of fatty-cids-ketone body formation. Protein digestin and absorption. Oxidative deamination, transmination, nitrogen extretion and urea cycle. Flasma proteins and their function.

2. Principles of Fish Processing: Role of preservation and processing technology in fisheries. Mechanisms of fish spoilage-autolysis. Racidity and bacterial action. Tigor Motis, its significance, handling of fresh fish/prawn on board and on shore. Freshness of fish/prawn and its quality. Use of ice and refrigerated brine. Use of antibiotics and chemicals, salt curing as method of preservation, drying smoking boiled fish, other methods of mechanicals refrigeration. Production of ice, different types of ice-calculation of quantity of ice.

3. Freezing Technology: History of food refrigeration, basic principles of freezing and melting, latent heat, specific heat and other thermal properties of food. Physico-chemical

changes in fish during freezing-freezing techniques, sharp freezing, contact plate air blast freezing, immersioned freezing cryogenic freezing, and its relation to method of freezing. Thawing process and Thawing curve, Spoilage of frozen fish-denaturation and oxidation, its prevention.

Freezing of shrimp, head-less raw, pealed and deveined, cooked & frozen. Unit operations involved in freezing. Fish slices production, frolegs and other products, cold storages of frozen products changes during cold storage of frozen foods and precautions. Study of packing materials, packing and transportation.

4. HUMAN NUTRITION:

I. Food Production:

a) Food production and consumption pattern in different parts of India-food requirement and per capita availability.
b) Importance of Animal Foods in solving nutritional problems measures for increasing their availability. Food distribution system in the country and in the family.

II. Principles of Human Nutrition:

(a) Protein, Carbohydrates and Fats requirements for different age groups, sources, functions and deficiency signe.
(b) Vitamins and minerals-requirements, sources functions and deficiency signa.
(c) Energy needs of the body for different age groups and activities.
(d) Water its importance in human nutrition.

5. Fishery Microbiology:

Fish microbiology a general account of micro organisms bacteriology of fish. Source of fish and microbial load, microbial spoilage of fish, microflora of various types of semi-processes and processed fishery products processes by freezing, radiation, drying, canning and with chemical preservation treatment. Influence of environmental factors on spoilage. Microbiological quality control aspects of food, canned and other fishery products, Plant sanitation and its importance in food processing and in reducing microbial spoilage of processes food. Chemical and physical preservatives in food processing and the effect on spoilage organisms. Use of anti-biotics in foods preservation.

6. Quality Control of Fishery Products:

Quality assessment of processed fish products, microbiological, chemical, physico-chemical and organeplapti tests, sonsery evaluation and SOC technique factors affecting the quality of products, condition of raw materials, handling transport and holding, preparation, processing and storage, water for processing chlorination, softening and quality, influence of water quality on the quality of fish product.

7. FISH BY PRODUCTS:

Introduction, importance of byproducts, Fish manure, fish meal, fish protein concentrate, fish ensilage meat, fish body oil, fish lever oil, squalane, shark fin rays, isinglass, shark skins, chitin, beeha-de-mer, pearl essence fish hydrehysates, peptone, seaweeds, agar, alginie acid agleinate, mannitol, insulin, and fish glue.

8. CANNING TECHNOLOGY:

History and development of canning methods in India and abroad. Canning as a methods of food preservation and its relationship to other methods like icing, freezing,

drying, salting and curing. Main materials used in canning, subsidiary materials like salt, oil, spices, sugar and other additives.

The general canning procedure, preparation of raw materials, packing and filling, conclosing, sterilization, labeling, casing and storage, principles involved in themal processing of foods, microbiological aspects, heat penetration aspects-spoilage of caned-foods, causes of spoilage and prevention.

Fish and shell fish as raw matrials for canning. Special characters of these in relation to canning. Influence of raw materials on the quality of canned foods, canning of fishes mackerel, sardine, seer, pomfretes, tuna nad tuna-like fishes, canning of shell fishes-prawns, lobsters, clams, mussee, oysters-canning of meat, fruits and vegetables, problems related to canning of fish and shell fishes and their prevention, quality control, ISI standards.

9. HAMS & SAUSAGE TEHNOLOGY:

History and development of hams and sausage in India and abroad. Hams sausage as a methos of fish food preservation.

The general procedure of hams and sausage preparation, preparation of raw materials, packing and filling, microbial aspects, causes of spoilage and prevention. Influence on raw materials on the quality of hams and sausage. Problems related to hams and sausage preparation and their prevention, quality control.

10. FISHERY PRODUCT DEVELOPMENT:

Definition of product, product type. Convenience food. Component of a product, product life cycle various methods of developing a new product. Factor to be considered in developing a product, protecting new products developed, functional properties of foods. Factors that effect functionality. Additives, classification, important additives, fabricated foods, some important products fish waters, fish soup, powder fish chowder, fish cakes, fish ball, fish salads, fish ham, sausage and surimi.

PAPER-II SECTION 'B'

II. FISHERY ENGINEERING:

1. Fish Farm Engineering: Fish Farms, objectives and significance. Freshwater. Brackishwater and marine farms, types of ponds, nursery, location, design and construction. Soil and water condition, tidal influence, Gravitational farms, pump-fed farms, contours slope, depth, embankments constructor pumps and sluice gates.

Mensuration area of plane surfaces of regular and irregular shapes as applied to measurement of land. Calculation of earth work in the construction of channels, embankments and ponds. Acraters system like aerators (paddle type, airosygen type, diffusern etc.) feeding devices like automatic feeders, demand feeders etc.

2. Gear Engineering: Classification of fishing gear with particular reference to India. General Principle of gear fabrication. Factors determining selection of fishing gear. Materials

used and their preparation, yearn, construction of twings and ropes. Gear accessories floats, sinkers, buoys and anchors. Types of fishes caught in different kinds of gear sport fishing, care and maintenance of fishing gear. Modernization of fishing gears by using electricity and electronics.

Types of fishing gear operated in relation to types of fish and fishing area. Fishing accessories. Trawling techniques-trawling, side trawing, stern trawling, outrigger trawling, bull trawling, methods of continuous fishing, gill netting-drift and set gillness, shallow and deep water long lines, tune longline, pole and line trawling, bait fishing, purse seining, shore seining, pearl fishing, fish detection. Light and electrical fishing, dip nets, scoop nets, swin nets, cast nets and cover nets, fish traps, stuperfying methods, poisoning, dynamiting electronics equipment uses in fishing. Fish on a test animal for biossay of insecticides and drugs. Plant products as fish poisions.

3. Craft Engineering: Fishing craft in general-factors determining selection of fishing craft, Indian boat types-sailing motorized boats, factory ships etc. Detailed description of selected types such as trawlers, drifters, seiners, longliners, combination vessels, carrier boats, beach landing craft. Fishig boat mechanization in India.

Boat design and specification-principal dimensions of boats, description of hull, tonnage of vessels, principles of boat designing, considerations of law of resistance, high propulsive efficiency and static and dynamic stability. Fishing boat layout based on fishing method. Fish storage, accommodation, fishing equipment and handling arrangements.

Boat materials-selection, seasoning, storage and use of timber in boat building. Indian timbers used in boat building. Treatment of timbers, Boat fastenings and fittings-Ferrous and non-ferrous, modern materials used in boat buildings.

Boat building inspection and maintenance-Drawing practice, design exercise, construction details, mold lifting, preparation of mold and templates. Engine installation, operation, overhauling and assembling of marine engines. Fishing practice. Studying the design and operation of different typesof craft.

4. Principles of Navigation, Seamanship and Harbour Management:

Principles of navigation and seamanship, chart reading and fixing position. Regulation for fishing vessels: to be adopted in India, life saving device. Deck appliances, navigational equipment and usage.

Safety at sea-adaption of rules pertaining to safety of life in the sea, SOS, accident, damage control, usage of signals in safety, adoption of interaction law for safety in the vessel.

Types of harbour-major ports, minor ports, jetties and other shutters, their function, selection of sites interrelation to fishing activities, types and sizes of vessels tupes and quantities of fish landings proximation to the markets, export, repair and maintenance facilities required and available. Infrastructure for handling fish landings, storage for fish, ice and related items. Infrastructure for operation of vessels. Rules, regulations and acts relating to the management and use of harbour and jetties, management bodies.

5. Equipment Engineering and Plant Maintenance:

Deek gear, mechanical and hydraulic equipments, electronic equipments for fish finding and navigation. Mechanism operation and maintenance of various processing equipment and machineries used in freezing canning, by products etc.

6. Remote Sensing: Basic principles of remote sensing. Study, mapping and inventoring of natural resources as water with particular reference to fish population. Application of remotely sensed data of satellite for locating the fish groups.

PAPER-II SECTION 'A'

III. FISHERY ECONOMICS, STATISTICS, MARKETING, ADMINISTRTION & FINANCE:

1. Bio-Statistics: Definition and scope of statistics, collection, classification and tabulation of data, measures of central tendency, measures of dispersion, concepts, null hypothesis levels of significance, degrees of freedom, statistical population, samples, tests of significance, standard normal deviate test for one sample and two samples, t-test, paired t-test, X2-tst in contingency tables, t-test, simple correlation and regression.

2. Computer Applications: Use of computer-Introduction to computers, units of computers, Input-output units, type of computer, programming on computers, definition of 'program', computer languages (only). Software and machine language, principles of programming, flow-charging with examples, programming with BASIC; use of command statements, programming with loops land nested loppings-illustrations with basic statistical measures.

3. Fishery Economics: Fisheries Economics, definition and scope. Production function in capture fisheries. Definition of catch and effort, methodological issues in the estimation of production costs. Definition and classification of production costs. Definition and the methods of computation of depreciation. Economic analysis of capture fisheries. Practical problems in the estimation of costs and returns. Scope and objectives of fisheries management. Sustainable yield curve. Overfishing and underfishing. Maximum sustainable yield and maximum economic yield. Chargers in cost of fishing, price of fish and catch per unit-effort, objectives, type and enforcement of fishery regulations. Socio-economic aspects of fishermen households. Classification of assets and liabilities. Financial statement analysis for solvency and liquidity. Income aspects, definition of gross, net, percapita, and disposable income; income distribution. Lorenz curve, consumption, consumption function for a fisherman family. Engel 's law of family budget. Estimation of consumption expenditure of a fishing family.

Fisheries co-operation, principles of co-operation, objectives, organizational set-up and administration of fisheries co-operatives, present status of fisheries co-operatives in India.

Co-operative education programmes, suggestions for the improvement of their performance.

Output and price as determined by supply and demand. Elasticity of demand and supply. Supply and demand analysis. Theory of demand and utility of law of diminishing marginal utility. The indifference curve. Business organizations. Balance-sheet. Income statement. Analysis of cost. Forms of organization of product markets. Law of diminishing marginal products. Forms of organization of factors markets.

4. Fishery Administration and Finance: Indian fisheries history, development trends, production and utilization in different states, central and states responsibility for fisheries development, conservation and exploitation-ownership of resources.

Fishery Legislation-need for legislation, central legislation, protective legislation, legislation for factional exploitation. Craft and gear, regulation: Restriction on destructive practices. Sanctuaries, closed seasons, regulations on industrial affluent and pollution. Legislation concerning fishing vessels: their operations and processing plants. Foods laws relating to fish and other aquatic products. Indian fisheries Act and rules, convention and proclaimations.

International laws-Treaties and organization, law of the sea relating to fisheries. International conventions on fisheries, international organization for promotion and development of fisheries. International Commissions and Expeditions.

Planning in Fisheries: basic requirements for planning, Estimation of resources and potentialities, project preparation, fixation of targets, means for attaining targets, administratives and technical man power research and training. Economic consideration in decision on development plants: International co-operation programmes.

Personnel management: Managerial principles-office management managerial aspects of reservoir, fish-farms, seed collection production centres, fishing operation, Fishing boats, workshops, cold storage, processing plants, whole-sale and markets.

Fisheries finance, credit for fisheries development, source and types of credit, R's of credit, credit requirement and credit availability, credit oriented problems, reasons for overdues. Factors affecting economics of aquaculture. Principles of production economics applied to aquaculture. Principles of farm management. Management of production process. Selection of site, design and construction. Cost, concepts, capital cost, operating cost, Economics of scale in aquaculture. Income statement analysis, gross returns, net returns and financial ratios, farm planning and budgeting, linear programming, investment analysis, records keeping, farm financial management, labour management, risk and uncertainty, policies for aquaculture development.

5. Marketing and Co-operation:

Concept of marketing-Importance of fish marketing in Indian economy-structure and conducts, and performance in fish marketing-different types of markets and price formation-marketing strategies in fish and fish products-products price-place and promotion, cooperation marketing and its scope in India, role of cold storage plants in fish marketing.

Principles of cooperation-history of co-operaticve movement in India-organization of fish production and marketing co-operatives.

Finance for fish production-cooperative credit and bank finance for fisheries development. Estimation of credit needs for organizing fish farms. Role of fish farming industry.

PAPER-II SECTION 'B'

IV. FISHERIES EXTENSION AND DEVELOPMENT AND CONSERVATION:

1. Fisheries Extension and Teaching Methods: Introduction, extension education, fisheries extension, meaning, differences, scope, concept, objective and principles. Distinguishing features of extension education and formal education, types of informal education-meaning, features of extension education and formal education. Types of informal education-meaning, features. Adult education- meaning, types features. Adult literacy and functions of functional literacy and its importance in fisheries extension. Fisheries extension methods-communication process-meaning, elements, characteristics, teaching methods-meaning, classification. Individual contact method-Farm and Home visits, office calls, personal letters-meaning, objectives, step, advantages and limitations. Group contact methods-Group discussion, method and result demonstrations. Steps in conducing demonstrations, advantages and limitations. Mass contact, methods-campaigns, exhibitions, information corners, village meeting-meeting, objectives, steps, advantages and limitations. Factors influencing the selection and use of extension teaching methods. Adoption and diffusion of innovations, adoption process, diffusion process-meaning, stages in adoption process and influence of information sources at each stage. Adopter categories and barriers in diffuSsion of fisheries innovation.

2. Fisheries Development Programmes: Programmes planning-meaning, scope and principles, steps in programme, planning process and importance of programme planning in fisheries extension. Objectives-meaning of objectives and goals, levels of objectives and criteria for judging the objectives. Evaluation-meaning degrees in evaluation and importance of evaluations in fisheries extension.

Rural Development- Extension Education and community development-similarities and dissimilarities, Evaluation of community development and rural development programme in India. Achievements and shortcomings. Transfer of technology. Programmes of ICAR-Salient feturesof ORP, NDS, lab to land programme, farming system research, development programmes for weaker sections-salient features of IRDP, ITDP, FFDA (fish farmer development agency), BFDA,SFDC,WBFDC, Benfed, CICFRI(BKP), CIFA(Khardah), CIBA (Kakdwip), CIFE (Salt lake), NCDC, MPEDA,EIA, Marketing Agencies, Private Processing plants Owners etc.

Training-meaning, training vs. education and teaching. Teaching of extension workers-types and features-training of farmers, farm women and youth – salient features of FTC , KVK and TRYSEM.

3. Conservation of Endangered Fish Species Sea and River Rancing and Subtainable Fisheries:

Principle of conservation. Impact of conservation on ecology of water bodies and its effect on human ecology. Study of endangered fish species in the country and in the world and the biology of these species available in India. Different methodologies for their conservation; river & sea rancing, sustainable fisheries, capture fisheries considering due importance on its ecological balance.

OR
PAPER-II SECTION 'A'

V. FISHERY OCEANOGRAPHY:

1. Physical and Chemical Oceanography: Physical and chemical properties of sea water, surface currents, thermocline circulation. Upwelling and down welling waves. Ocean tisdes, tidal cycles, TPS, Diagram, continental shelf, slope, rise, open floor abyssal plains, sea mountes submarine ridges, banyans and trenches, chemical composition of sea water, cycle of nitrogen phosphorus and carbon, nitrate, their utility in the identification of limiting nutrients, distribution of dissolve silicon chemical speciation in nominorganic complexes, bio and hydrogenic fractions of oceanic sediments.

2. Hydrography in Relation to Fisheries: Hydrographical parameters -temperature, salinity, oxygen, P^H distribution importance and influence of these factors on fisheries,. Water masses an their relation to fishery resources. Ice land fisheries, temperature water fisheries, tropical water fisheries, tropical water fisheries and sub-tropical water fisheries.

3. Biological Oceanography: Divisions of marine environment, beaches, estuaries, intertidal and interstiletel environments, fijords, mangroves, lagoons, mud Kanks and coral reefs. Fauna and flora and their distribution and adaptation. Fouling and boring organisms and their adaptations. Methods of collection of plankton and preservation, mesoplankton and sooplanton interrelationships, phytoplankton blooms, red tide phenomenon. Bipolarity. Deep scattering layer, bio iminescent plankton, vertical migration of plankton, planktonic indicators, method of estimation of plankton, standing crop, primary production, factors effecting primary production and methods of its estimation. Plankton and fisheries. Food pyramids; food chains and food webs. Energy flow in marine ecosystems.

4. Aquatic Pollution: Definition and kinds of aquatic pollution. Sources of pollution in natural aquatic systems. Aerobic and anaerobic decomposition of organic matter systems. Aerobic and anaerobic decomposition of organic matter systems and their impacts on nutrients regeneration. Eutrophication due to sewage pollution and salient case studies. BOD and COD as tools to assess organic load of a systems Oxygen depletion and demands in loti and lentic systems. Kinds of chemical species of sewage nutrients of pollution in natural waters, Infection agents commonly encounters in polluted aquatic system. Dumping of wastes in marine environment and its impact on marine biota. Physical and chemical properties of industrial wastes bodies. Pesticide present in waste waters and their adverse effect on aquatic plants ands animals. Oil pollution and radio activity in aquatic ecosystem. Thermal pollution.

PAPER II-SECTION 'B'

VI. LIMNOLOGY:

1. Limnology: Introduction to limnology. Inland water types and identity of each, fundamentals of dynamic lotic and lentic environment to fish lakes their origin and diversity. Biological, chemical and physical factors affecting aquatic life. Interaction of waters and soil, factors influencing organic production, methods of studying organic production. Energy flow in freshwater systems. Biological communities and their interrelationship in lakes, ponds, reservoirs and rivers. Adaptation of flora and fauna to biotic and abiotic environment. Larval

ecology, interactions between population community. Eco-systems, producers and consumers-food pyramid, food chain, food web-entry transformations.

2. Meteorology: Introduction, weather and climate, composition and structure of atmosphere, insulation, air temperature variations and measurements, atmospheric pressure and winds, cyclones, depressions and anticyclones measurement of waves and tides, atmospheric moisture, relative humidity, evaporation, condensation, precipitation, monsoon distribution of rainfall in India, clouds and their classification, different meteorological instruments, weather forecasting and interpretation of synoptic charts. Remote sensing application of Techniques.

3. Coastal Ecology: Classification of marine habitats pelagic benthic, neretic oceanic, littoral and abyssal zonations-rocky shore, sandy shore and banks, physical and chemical factors on marine environment. Nitrogen and phosphorus cycle. Sea as a biological environment effect of environmental factors on marine life. Organic production in the sea. Factors regulating production, plankton, factors effecting their distribution and abundance. Bioluminescence, seaweeds, pollution, problems in freshwater bodies estuaries and coastal waters. Effects of pollution on water quality bits and fisheries.

4. Coastal Aquaculture: Status of coastal aquaculture in India, selection for suitable site of coastal systems for aquaculture. Design and construction on brackishwater and marine farms. Suitable species for coastal Aquaculture. Breeding ans culture of brackishwater fin fishes (mullet, milkfish, pearl spot etc.).

Breeding and culture of marine cultivable fishes (eels, lethrinds, seabass, etc.). Cage and pen culture of marine species like yellow tall salmon etc. Seed production and culture of mussels, scam, scallops, cookles and gastropods, edible oysters, pearloysters, seaweeds, lobsters, crabs, sea cucumbers etc. management practices of different coastal aquaculture systems. Brackish and marine live food organisms and their culture. Nutrition and feed formulation for different brackish and marine cultures organisms. Diseases and weater quality management in different brackishwater and marine culture systems

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

FORESTRY

FORESTRY PAPER I:

1. Silviculture - (Weightage – 30% of the total mark)
2. Forest Resource Assessment/Mensuration - (Weightage – 20% of the total mark)
3. Forest Utilization - (Weightage – 20% of the total mark)
4. Forest Management - (Weightage – 20% of the total mark)
5. Adverse Influence on Forest - (Weightage - 5% of the total mark)
6. Social and Farm Forestry - (Weightage - 5% of the total mark)

FORESTRY PAPER II:

1. Forest Policy and Law - (Weightage – 10% of the total mark)
2. Natural Resource Management - (Weightage – 30% of the total mark)
3. Biodiversity Conservation and management - (Weightage – 30% of the total mark)
4. Application of modern tools & technology - (Weightage – 10% of the total mark)
5. Forest survey and engineering - (Weightage – 10% of the total mark)
6. Ecology and Environment - (Weightage – 10% of the total mark)

PAPER I :

1. **SILVICULTURE:** (Weightage to be given – 30% of total marks)

Part A (General Silviculture)	**Part B (Silviculture Practices)**	**Part C Silviculture Systems**	**Part D Silviculture of trees**
Fundamentals of silviculture Definition, Scope, Role of Forests **Locality Factors** Climate, Physiographic, Edaphic and biotic factors, interaction of site factors **Crop morphology** Crop age, even age, Uneven age crop, crop composition, etc **Growth & development of trees:** Forms and life of trees and crops, Growth pattern of trees and crops, hardiness and tolerance of trees. **Classification of Forests types and their distribution:** Types of Forest and their distribution in India and Nagaland, Champion and Seth classification, etc	**Regeneration:** Natural regeneration through seeds and vegetative parts, Artificial regeneration, Nursery and planting techniques, seed orchards. **Cultural and tending operation:** Soil working, weeding, cleaning, thinning, pruning, Maintenance of plantation, etc **Plantation techniques:** Afforestation of difficult areas, plantation journals, estimation, **Genetics and tree improvement:** Mendalian law, plant breeding, biotechnology and tissue culture, seed supply.	**Introduction:** Definition, Scope and classification, formulation and objectives. **Clear Felling System and its modifications.** **Shelter wood system:** Uniform system, group system, Irregular system, canopy lifting system **Selection system:** Characteristics, rotation, feeling cycle, etc **Conversion:** Reason, and types of conversion **Concept of Dauerwald and Method du controlle**	General value, growth characteristics, natural distribution, phenology, silvicultural characters autecology, synecology, community, environment, regeneration, nursery and planting techniques, tending and maintenance of common tree species such as Chukrassia tabularis, tectona grandis, Terminallia spp., Mesua ferrea, Phoebe spp., Pinus spp., Michelia Champaca, Shorea spp., Dipterocarpus spp., Gmelina arborea, etc.

2. **FOREST RESOURCE ASSESSMENT/MENSURATION**: (Weightage to be given – 20% of total marks)
   a. **Diameter and girth measurement:** Objectives, methods, instruments, basal area, formulae
   b. **Height measurement:** Objectives, definition of various height- bole height, crown height, etc., methods, instruments used
   c. **Crown Measurement:** Objectives, method and types of measurement – crown width, crown height, volume, density, etc.
   d. **Volume Measurements:** Standing and felled trees, Use of various formulae, different methods of measurement, specific gravity measurement, concept and measurement of various types of volume- standard volume, small timber, etc.
   e. **Bark thickness measurement:** Importance, instruments, Bark quotient, Overbark, underbark, etc
   f. **Study of tree form:** Theories relating to tree taper, form factors, form quotient, taper tables formulae used, etc.
   g. **Age determination:** Ocular method, from records, branch whorl counting, growth ring, successive measurement, etc.

h. **Growth Measurement of trees:** Definition of kinds of growth – diameter, basal area, height, volume, quality, growth curves, Increment percent determination by Pressler's and Schneider's formulae, Stem and stump analysis, CAI, MAI.

i. **Forest Biometry:** Forest sampling, inventories, crop measurement, growth and yield estimation, application of statistics- Normal distribution, standard deviation, test of significance, correlation and regression.

3. FOREST UTILIZATION: (Weightage to be given -20% of total marks)

3.1 Wood Harvesting: Basic logging tools and their maintenance, Transportation of logs, Logging planning, Timber depot management.

3.2. Wood technology: Gross feature of wood (Pith, heart wood, sap wood, bark, earlywood, late wood, growth rings, etc) ; Minute structure of wood (Tracheids, fibres, vessels, rays, parenchyma, resin canals, etc): General properties of wood (Colour, luster, odour, grain, hardness, etc,) : Identification of timber with keys; Properties of wood, defects and abnormalities; etc.

3.3 Wood seasoning: Object, need, importance, method, types, etc.

3.4 Wood Preservation: durability and destroying agencies of wood: Preservatives and their characters; Methods of wood treatment: etc.

3.5 Wood based Industries: Suitability of species for different types of Industries: Plywood; particle board; fibre board; Improved wood; Katha; Agarwood; Sandal Wood; Cellullose and paper industries; etc.

3.6 Saw milling: Types; design and layout; Wood working; Rules; etc.

3.7 Grading of timber: Suitability of species for various works –Agricultureal implements; furniture, packing, coach and sleepers, musical instruments, sports goods, etc.

3.8 Non Wood Forests Produce (NWFP/NTFP): Definition; Fibres and flosses; Grasses, bamboo and canes; Essential Oils; Oil seeds; Gums, resin and oleoresin; Edible Plants, nuts and species; Rubber cultivation, tapping, processing and uses, Miscellaneous products like pine leaves, Katha, leaf fodder, animal products, dyes, etc.

3.9 Charcoal: Types of kiln, charcoal dust briquettes.

3.10 Medicinal plants: Conservation – need scope, traditional uses (ethno medicines), Institutions and agencies involved, Policy on trade, insitu and ex –situ conservation, etc.: Important medicinal plants of India and Nagaland- uses, methods of use and extraction, nursery techniques, etc.

4. FOREST MANAGEMENT: (Weightage to be given – 20% of the total mark)

4.1 Definition; scope; principles and objects; management of forests and its peculiarities; forest management for environment protection, soil and moisture conservation;

4.2 Sustained Yield; Concept and Meaning; Progressive Yield; Sustained yield in relation to environmental management; etc.

4.3 Rotation: Definition; Kinds; Factors affecting choice of rotation; conversion period; etc.

4.4 Normal Forest: Definition and concept; normality in regular forests and irregular forests, etc.

4.5. Growing stock and its increment: general consideration; Distribution of age classes in irregular forests, normal and actual, coppice forests, Growth estimation and reduction factors for density quality and price increment, etc.

4.6 Yield Regulation: General definitions-Felling series, felling cycles, cutting series, yield calculation, Silvicultural systems in relation to yield regulation; Methods of Yield Regulation (Regular forests- By area, reduced area and Hufnagl's modification, volume and increment method; Irregular Forests – Methods based on growing stock, Von Mantels's Law, Austrian Method, Brandis method, Smithe's safeguard formula, volume and increment method, etc.); Application of different method of yield regulation in forests management in India.

4.7 Management Plan/Working Plan: Definition, objects, scope, necessity for revision; Division of forests into various unit; Maps; Working Plan Code; Working Plan Preparation.

5. ADVERSE INFLUENCE ON FOREST (Weightage to be given – 5% of the total mark)

5.1 Susceptibility of Forest to damage caused by various agencies; its prevention and protection measures.
5.2 Human agency: Encroachment, poaching, illicit felling, etc.
5.3 Forest fire: Controlled fire for forest management; Types of Forest Fire; Control Measure; Fire Management Planning; Fire lines, etc.
5.4 Forest factors: Frost, Snow, hail, drought, water logging, etc.
5.5 Forest pest and pathogens: Role of insects and pest in forest ecosystem; Symptoms and nature of damages; prevention and control measures; Common diseases.
5.6 Mycorrhiza: Importance in forestry.
5.7 Protection of plantation and regeneration areas: Fencing, Fires, weeds and Climbers, grazing, etc.

6. SOCIAL AND FARM FORESTRY (Weightage to be given – 5% of the total mark)

6.1 Introduction: Definition, Scope, Importance and General concept, Classification of Forests on basis of function and object of management, Benefits of Social forestry
6.2 Community Forest: Scope and limitations, Joint Forest Management (JFM); Role of Forestry in Rural Development; Environment pollution and recreation; Place of Social Forestry in forest policy of India.
6.3 Agro-Forestry: Its need and Scope on agriculture lands; its role in rural economy; Agro Forestry models.
6.4 Social Forestry: Raising of trees for fodder, fuel, avenue plantation, canal bank plantation, choice of species.
6.5 Recreational Forestry and landscaping.

PAPER II:

1. FOREST POLICY AND LAW (Weightage to be given – 10% of the total mark)

1.1 National Forest Policies (NFP): Necessity; General basis of formulation; NFP 1894, 1952 & 1988 – Comparisons; Constraints in implementation; Forestry Action Plan.
1.2 The Indian Forest Act, 1927
1.3 The Wildlife (Protection) Act, 1972 and its amendments.
1.4 The Forest (Conservation) Act, 1980
1.5 Basics of Environment (Protection) Act, 1986.

2. NATURAL RESOURCE MANAGEMENT (Weightage – 30 % of the total mark)

2.1 Geology: Types of rocks; Important rock forming minerals.
2.2 Soil Science: Importance of soil, Physical, chemical and biological properties; Soil forming processes; Soil profile; Major soil groups; Rock, Soil-Plant relationship.
2.3 Landuse problems in India: Agrarian customs and agriculture practices; Distribution of forests in India; Soil erosion – principles, types, agencies, kinds and forms of erosion, causes and effects of erosion; etc.
2.4 Wasteland Management: Introduction, classification; Soil reclamation; Management of water logged areas; techniques adopted for development of wastelands.
2.5 Range management: Grassland types and their distribution in India; Ecological status of Indian grasslands; Principles of Grassland management.
2.6 Hydrology: Hydrological cycles and its importance; Rainfall and its measurement; Infiltration and percolation ; Evaporation and transpiration; Run-off and its calculation.
2.7 Soil and water conservation measures: Contour trenching and cultivation-designs and layout; Bunding and terracing: structure for erosion control and their designs; Gully control; Landslide control; Wind erosion and its control; wind breaks, shelter belts, sand dune fixation
2.8 Watershed Management: Unit of planning; codification of watershed- Sub, Micro, mini watershed; Agronomic practices in soil conservation; forestry conservation in soil conservation; Vegetative measure to check erosion at gully head, etc.

3. BIODIVERSITY CONSERVATION AND MANAGEMENT (Weightage – 30%)

3.1 Biodiversity: Definition, gene level, species level, ecosystem level; value of biodiversity – ecological, economical, culture values; India as a mega diversity country; Biogeographic regions of India: Endemism of flora and fauna, etc.
3.2 Important Flora and Fauna, etc.
3.3 Important management: definition; concept of carrying capacity; population structure; density and biomass; Home range and territory; etc.
3.4 Protected Area network; National parks and sanctuaries of India; Flagship species; Keystone Species; Man and animal conflict.
3.5 Insitu and exsitu conservation and the role of gene bank; Conservation breeding and reintroduction of animals; Role of NGOs in conservation; Ecotourism.
3.6 International efforts on biodiversity conservation: CITIES, CBD, Intellectual Property Rights; Bio piracy; Wildlife (Protection Act-1972 and Forest (Conservation) Act-1980 as corner stones on conservation ; Biodiversity Act; Environment Pollution ; Environment laws and EIA.
3.7 Biodiversity: Ecological and geopolitical significance of biodiversity; Biosphere reserves.

4. APPLICATION OF MODERN TOOLS & TECHNOLOGY: (Weightage – 10%)

4.1 Aerial Survey: Aerial Photography; types and specification of photos for forestry application; scale and horizontal measurement; tilt and displacement; Stereoscopy, maps; difference of maps and aerial photographs.

4.2 Remote Sensing: Basic principles of remote sensing ; spectral reflectance, thermal infrared and other spectral band from vegetation , soil and water; Visual interpretation and Digital Image Processing (DIP) of satellite data; Application of remote sensing techniques in forestry and allied subjects; future prospects of remote sensing; Global positioning System (GPS) – its principles and uses.

4.3 Computer application in forestry.

4.4 Geographic Information System (GIS) ; Basis concept of GIS, Scope and principles of GIS, Spatial and non spatial information ; Application of GIS in forestry and Wildlife management.

5. FOREST SURVEY AND ENGINEERING: (Weightage – 10%)

5.1 Forest survey: Principles of survey; Error in surveying; scope of survey in forestry; scales; Measurement of distance- linear measurement; ranging of chain and line; chaining on flat ground, sloping ground and hypotensal allowance; Chain surveying; Measurement of angles; Chain and compass surveying; plane table survey; leveling; Contours; Characteristics of contours; uses of contours; Map reading, etc.

5.2 Forest Engineering: Importance of forest engineering in forest management; building materials; properties of stones, brick, tile, sand; properties of cement and its storage; Mortars- Mixing proportions and curing; concrete-definition, proportion; Reinforced Cement Concrete (RCC)-definition, principles and advantage;

5.3 Construction: Site selection; Foundation-safe bearing capacity of soil, footing, damp proof course, precaution against termite; Superstructure-scaffoldings, wall thickness; Sills and lentils; Roofs; Flooring; Doors and Windows; drainage and sewages

5.4 Road construction: Necessity, classification, designs-shoulders, camber, gradient, sections, super elevation.

5.5 Retaining walls and breast walls.

5.6 Bridges-types of forest bridges. Irish bridge, culverts, cantilever, bailey bridge.

5.7 Conservation engineering: Check dams and its components; spurs, revetment, jetties; Embankment, Landscaping.

5.8 Estimating costing.

6. ECOLOGY AND ENVIRONMENT (Weightage – 10%)

6.1 Basic Concept: Definition, ecological principles, divisions of ecology.

6.2 Population Ecology: Definition, structure of population, dynamics of species population; Natural regulation of population size, importance of population ecology to forest management.

6.3 Biotic Community: Concept; Ecological dominance, tolerance and aggregation; Ecotone and edge effect; plant succession.

6.4 Principles of ecosystem Ecology: Component(biotic & abiotic), Ecosystem dynamics – food chains, food webs, trophic levels, ecological pyramids, habitat and niche, energy flow, Nutrient cycle; biomagnifications and its significance; Energy budgeting.

6.5 Conservation of natural resources; sustainable development.

6.6 Pollution: Pollution of – soil, Air & Water.

6.7 Global Warming and Climate Change.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

FRUIT TECHNOLOGY

PAPER-I

1. Horticulture:

Definition, importance and scope of horticulture, classification of horticultural crops, climatic zones of India and its relation to horticultural crops. Elementary ideas of plant propagation. Facors affecting production of horticultural crop. Nursery raising, pruning and training.

Brief study of fruits, like citrus, banana, papaya, pinapple, litchi, giara apple, pear, peach and plum. Brief study of vegetable crops like cabbage, cauliflowers, chilli, brinjal, beans, okra, bitter gourd and battle gourd.

2. Blericulture & Floriculture:

Scope and importance of vegetable, the type of vegetable growing classification of Vegetable crops. Brief account on the nutritive values, soil and climate requirements, varieties, cultural practices, harvesting and yield of important vegetable belonging to following groups with reference to hill region.

Solanaceous, bears, cole crops, leafy vegetables, tuber crops, other than potatos.

Importance and scope of ornamental gardening, classification of ornamental plants, different styles of ornamental gardening, lay out and maintenance of home and public gardening propagation, nutrition and care of ornamental plants such as annuals, shrubs, trees, creepers, hedges etc., orchids and bulbus places.

3. Fruit Cultures:

Importance and scope of fruit culture in NEH region, selection of site for orchards and layout of orchards, system of planting and care of planting, unfruitfulness. Brief study on the distribution, varieties, climate and soil, propagation, planting and after care, pruning and training, harvesting yield storage and transportation of important fruits like, citrus, pineapple, banana, apple, pear, peach, plum and jackfruit.

4. Silviculture, Species and Plantation Crops:

Concept, importance and scope of forests, species and plantation crops in economy and productivity of hill land, factors influencing their growth; growth characters of forest trees and crops, forest composition and forest types of India, natural and artificial regeneration, nursery and afforestation work, cultural operation of forest plants.

A brief study or, importance, climate, soil, varieties, cultivation practices, harvesting, yield and curaing of following crops.

Ginger, turmeric, cardamom, black pepper, coriander and fenugreek, tea, coffee, coconut, arecanut.

5. Fruit and Vegetable Preservation Practical:

Preparation of different fruits and vegetables products like, jam, jelly, marmlade, squashes, juices, pickles, dehydration of fruit and vegetables, carrning and bottling, quality test during storage.

6. Nursery Management and Plant Propagation:

Nursery selection of site and layout of nursery, care and maintenance of nursery, selection and raising of root stock, selection of bud stick and raising of bud stick farm, method of plant propagation- sexual and asexual and their merits and demerits. Type of vegetative propagation: cottage, laverage, buddage, graftage, division an separation, physiological and anatomical aspects of rooting in cuttings, graft union formation, polyombryony and its importance, stionic effect and polarity, incompatibility, causes and symptoms, plant growth regulators such as auxine, gibberellins, cytokinings and inhibotors, their role in horticultural crops.

PAPER-II

COMMERCIAL CULTIVATION OF FRUITS AND PLANTATION CROPS

Detail study of following fruits and plantation crops: Citrus, banana, pinapple, guava, litchi, papaya, aonla, apple, pear, peach, plum, walnut, cherry, tea, coffee, cardamom, rubber, arecanut, coconut, black pepper. With special reference to origin and history, importance, botany, climate and soil, varieties, propagation, planting and care manuring, training and pruning, harvesting and yield and problems with special reference to NEH region.

1. Forest Conservation & Production:

Principles of soil conservation, types of forest, and their management. Concept of normal forest, silviculture system, evaluation of forest growth, yield regulation under various systems of management, forestry as a quasi-commercial thing, increasing productivity of forest, principle of multiple use of forest, regeneration of forest plants, nursery management of forest plants, study of commercial forest plant of NEH region, afforestation and deforestation, forest products and their uses.

II. Preservation of Fruits & Vegetables:

Importance and scope of preservation industry in NEH region general principles of fruit and vegetable preservation. Type of spoilage and their control, method of preservation and processing like: Canning and dehydration. Squashes, and cordial, jam and jelly, marmalade, pickles.

III. Commercial Cultivation of Vegetables & Spices:

Scope and importance of commercial vegetables growing in NEH region, types of vegetables growing and layout of vegetable garden, classification of vegetable crops, physiological factors affecting vegetable production, seed treatment and seed bed preparation, detailed study on origin, botany, importance, climate and soil, planting requirement, varieties, manuring, interculture harvesting and yield, packing and storage of following crops with special reference to NEH region.

Gourds-battle gourd, bitter gourd, pumpkin, squash, cucumber. Melons-watermelon, miskmelon. Tubar crops-potato, sweet potato and tapioca. Lady's finger. Solanaceous-brinjal, chillies, tomatoes. Beans-Fyench bean, cluster bean, lime bean and winged bean, cole crops,

cabbage, cauliflower. Root crops- carrot, raddish and turnip and beet root, leafy vegetables-spinach, amaranthus, Parennial-Drum stick, asparagus, rhuabarh.

Detail study of following species with reference to hill region. Union and Garlic, Giner and turmeric, Candmon and black peper.

Scope of species in NEH region, role of growth regulations in vegetables and species.

IV. Ornamental Gardening:

Importance and scope of floriculture, aesthetic, recreational and commercial value, cultivation practices of seasonal annuals. Cultivation practices of roses, chrysanthemums, canna, bladioli, orchids and dehilia. Planning and maintenance of herebaceous and shrubs, borders, hedges, edges and lowns. Different types of garden-formal and information, ornamental foliage and flowering trees, succulents and climbers. Design and arrangement of beds, path, topiary, terraces, tank, fountain etc. Making and management of water and rock garden, land scaping and planning of parks public and residential building compounds and avenue plantation. Propagation in relating to ornamental plants. Role of growth regulators in ornamental plants, indoor gardening and decoration of plants, flower arrangement and flower shows, cut flowers.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

GEOLOGY

(PAPER-I)

1. GENERAL GEOLOGY: Energy in relation to Geo-dynamic activities. Origin and interior of the earth. Dating of rocks by various methods and age of the earth. Volcanoes-causes and products; volcanic belts. Earthquake cause, geological effect and distribution; relation to volcanic belts.

Geosynclines and their classification. Island arcs, deep sea trenches and mid-ocean ridges, sea-floor spreading and plate tectonics, Isostracy Mountains-types and origin. Brief ideas and about continental drift, origin of continents and oceans. Earthquake zone of India

II GEOMORPHOLOGY: Basic concept significance. Geomorphic process and parameters. Geomorphic cycles and their interprtation. Relief features; topography and its relation to structures and lithology, drainage systems, significance of weathering in geomorphology, geomorphic features of Indian subcontinent.

III STRUCTURAL GEOLOGY: Stress and strain ellipsoid, and rock deformation. Mechanics of folding and faulting. Linear and planer structures and their genetics significance. Significance and recognition of unconformities. Techtonic frame-work of India.

IV PALEONTOLOGY: Micro, and macro-fossils, Modes of preservation and utility of fossils. General idea about classification and nomenclature. Organic evolution and the bearing of paleontological studies on it.

Morphology, classification and geological history including evolutionary trends of brachipods, bivalves, gastropods, ammonoids, trilobites, echinoids and corals.

Principal groups of vertebrates and their main morphological characters, vertebrates life through ages; Siwalik vertebrates; Gondwana flora and its importance.

Types of microfossils and their significance with special reference to petroleum exploration.

V STRATIGRAPHY: Principles of Stratigraphy. Stratigraphic classification and nomenclature. Standard stratigraphicalk scale. Detailed study of various geological systems of Indian sub-continent. Boundary problems in stratigraphy.

Correlation of the major Indian formations with their world equivalents. Palaeogeographic reconstructions.

(PAPER-II)

1. CRYSTALLOGRAPHY: Crystallography and non-crystalline substance. Special groups. Lattice symmetry. Classification of crytals into 32 classes of symmetry, International system of crystallographic notation. Use stereographic projections to represent crystal symmetry. Twinning and twin laws. Crystal irregularities. Application of X-Rays for Crysrtal studies.

II OPTICAL MINERALOGY: General principles of optic. Isotropism and anisotropism; concepts of optical indicatrix. Pleochroism; interference colour and extinction. Optic oreintatio in crystals. Dispersion optical accessories.

III MINERALOGY: Elements of crystal chemistry-types of bondings, Ionic radii-coordination number. Isomorphism polymorphism & pseudomorphism, structural classification of Silicates. Detailed study of rock-forming minerals-their physical, chemical and optical properties, uses, if any. Study of the alteration products of these minerals.

IV PETROLOGY: Magma-its generation, nature and composition. Simple phase diagram of binary and termary systems, and their significance. Bowen's Reaction principle. Magmatic differentiation assimilation. Textures and structures, and their petrogenetic significance.

Classification of igneous rocks. Deccan basalts.

(a) Sedimentary- Petrography and petrogenesis of important rock types: Sandstones, limestones and shales

(b) Metamorphic- Petrography and petrogenesis of important rock types: Gneiss, Schist and Slates

(c) Igneous- Petrography and petrogenesis of important rock types: Granites, Charnokites and Deccan basalts.

Process of formation of sedimentary rocks. Diagenesis and lithification. Textures and structures and their significance. Classification of sedimentary rocks, classic and non-classic. Heavy minerals and their significance. Elementary concept of depositional environments, sedimentary facies and provenance . Petrography and common rock types.

Types of metamorphism. Metamorphic grade, Zone and facies. ACF,AKF and AEM diagrams. Textures, structures and nomenclature of metamorphic rocks. Petrography and petrogenesis of important rock types.

V ECONOMICS GEOLOGY: Concepts of ore, ore mineral and gangue, tenor of ores. Processes of formation of mineral deposits. Common forms and structure of ore deposits. Classification of ore deposits. Metalloginitic epochs. Study of important metallic and non metallic deposits, oil and natural gas fields, and coals fields of India. Minor economics National Mineral policy, Conservation and utilization of minerals. Radioactive minerals and their resources in India.

VI APPLIED GEOLOGY: Essentials of prospecting and exploration techniques. Principal methods of mining, sampling, ore-dressing and benefication. Application of Geology in Engineeering works.

Elements of soil and ground water geology and geochemistry, use of aerial photographs in geological investigations.

(a) Strategic, critical and essential minerals, marine mineral resources and laws of the sea.

(b) Concepts of watershed management and ground water provinces of India.

VII ENVIRONMENT GEOLOGY: Concepts of Environmental geology, soil degradation and mitigation, concepts of natural ecosystems and their interrelations and interactions, environmental changes due to influence of human dominated environment. Causes and mitigation of natural and man-induces geo-hazards.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

GEOGRAPHY (DEGREE)

PAPER-I

UNIT-I (Physical Geography)

1. Geomorphology: The place of geomorphology in physical geography; origin and evolution of the earth's crust; earths movements and plate tectonics; isostasy, earthquakes and volcanism; rocks, weathering and erosion; cycle of erosion-Davis and Penek.
2. Climatology: composition and structure of the atmosphere; precipitation, pressure and winds; air masses and fronts: atmospheric disturbances, cyclones, thunderstorms and tornadoes; classification of climate-Koppen and Thornwait.
3. Oceanography: Surface configuration of the ocean floor; ocean bottom relief; salinity; currents and tides; ocean deposits and coral reefs; marine resource.

UNIT-II (Human Geography)

Concept of man-environment relationship; determinism and possibilism; approaches to the study of human geography; emergence of man and races of mankind; world population distribution and growth; demographic transition and population problems; spatial distribution; concepts of over population problem; population conflicts-developed and developing world. Migration: internal, national, international-past and present. Human settlement-origin, concepts, physical, economic and social factors influencing rural/urban settlements; rural settlement pattern; urbanization; central place theory.

UNIT-III (Economic Geography)

Historical evolution of the world, economic system; world economic development-measurement and problems; classifying economic activity; world resources-their distribution and global problems; world agriculture-typology and agricultural regions; world industry-theory of industrial location, world industrial patterns and problems; international trade and world patterns; free trade initiatives.

PAPER-II

UNIT-I (Environmental Geography)

Environment and development; emerging environmental problems (issues)-related to physical environment-environmental degradation; environmental disaster; environmental management and sustainable development.

UNIT-II (Geography of India)

(i) Physical aspects: Geological history, physiography and drainage systems; origin and mechanism of the Indian monsoon; soil and vegetation.

(ii) Human aspects: Genesis of ethnic/racial diversities; tribal area and their problems; role of language; religion and culture in the formation of regions; land of diversities; unity within diversities; population distribution, density and growth population problems and policies.

(iii) Agriculture: types of agriculture; problems and prospects of agricultural systems. Land holdings, tenure and land reforms; agricultural efficiency and productivity; agricultural regionalization, green revolution, dry zone agriculture and land use policy.

(iv) Industry: History of industrial development, factors of localization, study of mineral based, agro-based and forest based industries; industrial decentralization and policy; industrial complexes and regionalization, identification of backward and rural industrialization.

(v) Transport and trade: Study of the network of roadways, railways, airways and waterways; competition and complementary in regional context: Interregional trade and the role of rural market.

(vi) Regional Development and Planning: Regional policies in Indian Five Year Plans; concept of planning; regionalization for planning for metropolitan regions; tribal and hill areas; regional disparities in development.

UNIT-III (Geography of North-East India)

Physiography, geological structure, climate, soil types and natural vegetation; resources-utilization and conservation-forest-mineral, power, water and human resources; industrial development-prospects and problems.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

HORTICULTURE

Paper-I

Definition, importance and scope of horticulture, classification of horticulture crops, climatic zones of India and its relation to horticultural crops. Elementary ideas of plant propagation. Factors affecting production of horticultural crops. Nursery raising, pruning and training.

Brief study of fruits, like citrus, banana, papaya, pineapple, litchi, guava, apple, pear, peach, plum, kiwi, strawberry, mango, pomegranate and passion fruit. Brief study of vegetable crops like cabbage, cauliflowers, chilli, brinjal, beans, okra, bitter gourd and bottle gourd.

OLERICULTURE AND FLORICULTURE

Scope and importance of vegetable, the type of vegetable growing, classification of vegetable crops. Brief account on the nutritive value, soil and climatic requirements, varieties, cultural practices, harvesting and yield of important vegetable belonging to following groups with reference to hill region.

Solanaceous, beans, cole crops, leafy vegetables, tuber crops, other than potato.

Importance and scope of ornamental gardening, classification of ornamental plants, different styles of ornamental gardening, lay out and maintenance of home and public garden propagation, nutrition and care of ornamental plants such as annuals, shrubs, trees, creepers, hedges etc., orchids and bulbous plants.

Importance and scope of aromatic and medicinal plants in the NEH regions.

POMOLOGY

Importance and scope of fruit culture in NEH region, selection of site for orchards and layout of orchards, system of planting and care of planting, unfruitfulness. Brief study on the distribution, varieties, climate and soil, propagation, planting and after care, pruning and training, harvesting yield storage and transportation of important fruits like, citrus, pineapple, banana, apple, pear, peach, plum and jackfruit.

SPICES AND PLANTATION CROPS

Concept, importance and scope of spices and plantation crops in economy and productivity of hill land, factors influencing their growth.

A brief study on, importance, climate, soil, varieties, cultivation practices, harvesting, yield and curing of following crops.

Ginger, turmeric, cardamom, black pepper, coriander and fenugreek, tea, coffee, coconut, arecanut and cashewnut.

FRUIT AND VEGETABLE PRESERVATION PRACTICAL

Preparation of different fruits and vegetables products like, jam, jelly, marmalade, squashes, juices, pickles, dehydration of fruit and vegetables, canning and bottling, quality test during storage.

NURSERY MANAGEMENT AND PLANT PROPAGATION

Nursery, selection of site and layout of nursery, care and maintenance of nursery, selection and raising of root stock, selection of bud stick and raising of bud stick farm, method of plant propagation- sexual and asexual and their merits and demerits. Type of vegetative propagation: Cuttage, Layerage, Buddage, Graftage, Division and separation, physiological and anatomical aspects of rooting in cuttings, Graft union formation, polyenbryony and its importance, Scionic effect and polarity, incompatibility, causes and symptoms, plant growth regulators such as auxin, gibberellins, cytokinins and inhibitors, Their role in horticultural crops.

Paper-II

COMMERCIAL CULTIVATION OF FRUITS AND PLANTATION CROPS

Detail study of fruits and plantation crops: Citrus, Banana, Pineapple, Guava, Litchi, Papaya, Aonla, Apple, Pear, Peach, Plum, Walnut, Cherry, Tea, Coffee, Cardamon, Rubber, Arecanut, Coconut, Blackpepper. With special reference to origin and history, importance, botany, climate and soil, varieties, propagation, planting and care manuring, training and pruning, harvesting and yield and problems with special reference to NEH region.

PRESERVATION OF FRUITS AND VEGETABLES

Importance and scope of preservation industry in NEH region. General principles of fruit and vegetable preservation. Type of spillage and their control, Method of preservation and processing like: Canning and dehydration. Squashes and cordial, Jam and Jelly, Marmalade, Pickles.

COMMERCIAL CULTIVATION OF VEGETABLES & SPICES

Scope and importance of commercial vegetables growing in NEH region, Types of vegetables growing and layout of vegetable garden, Classification of vegetable crops, physiological factors affecting vegetable production, Seed treatment and seed bed preparation, Detailed study of origin, botany, importance, climate and soils, planting requirement, varieties, manuring, interculture harvesting and yield, packing and storage of following crops with special reference to NEH region.

Gourds- bottle gourd, bitter gourd, pumpkin, squash, cucumber, melons- Water melon, muskmelon, Tuber crops-potato, sweet potato and tapioca, Lady's finger, Solanaceous- Brinjal, chillies, tomatoes, Beans- French bean, cluster bean, lima bean and winged bean, cole crops. Cabbage, cauliflower, Root crops- carrot, raddish and turnip and beet root, leafy vegetables- Spinach, Amaranthus, Parennial- Drum stick, asparagus, rhubarb.

Detailed study of following species with reference to hill region. Onion and garlic, Ginger and turmeric, Cardamom and black pepper.

Scope of spices in NEH region, Role of growth regulators in vegetables and spices.

Cultivation of mushroom.

ORNAMENTAL GARDENING

Importance and scope of floriculture, aesthetic, recreational and commercial value, cultivation practices of seasonal annuals. Cultivation practices of roses, Chrysanthemums, Canna, Gladiolus, orchids and dahlia, lilliums, anthurium, bird-of-paradise, marigold and bougainvillea. Planning and maintenance of herbaceous and shrubbery, borders, hedges, edges and lawns, Different types of garden- formal and informal, Ornamental foliage and flowering trees, succulents and climbers. Design and arrangement of beds, path, topiary, terraces, tanks, fountain etc. Making and management of water and rock garden, landscaping and planning of parks public and residential building compounds and avenue plantation. Propagation in relating to ornamental plants, Role of growth regulators in ornamental plants, Indoor gardening and decoration of plants, Flower arrangement and flower shows, Cut flowers, value addition in flower crops. Use of plastic-culture in horticultural crops. Post harvest management in horticultural crops.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

LAW

PAPER-I

1. THE CONSTITUTION OF INDIA:

1. Nature of the Indian Constitution, the distinctive features of its federal character.
2. Foundational Rights: Directive Principles and their relationship with Fundamental Rights, Fundamental Duties.
3. Right to Equality.
4. Right to Freedom of Speech and Expression.
5. Right to Life and Personal Liberty.
6. Religious, Cultural and Educational Liberty.
7. Constitutional position of the President and relationship with Council of Ministers.
8. Governor and his Powers.
9. Supreme Court and High Courts, their power and jurisdiction.
10. Union Public Service Commission and State Public Service Commissions, their powers and functions.
11. Principles of Natural Justice.,
12. Distribution of Legislative powers between the Union and the States.
13. Delegated legislation its constitutionality, judicial and legislative controls.
14. Administrative and Financial Relations between the Union and the States.
15. Trade, Commerce and Intercourse in India.
16. Emergency provisions.
17. Constitutional safeguards to Civil Servants.
18. Parliamentary privileges and immunities.
19. Amendment of the Constitution.

II. INDIAN CONTRACT ACT:

Law of Contracts:

1. Definition of contracts.
2. Basic elements of contract: offer, acceptance, consideration, contractual capacity.
3. Factors vitiating consent.
4. Void, voidable, illegal and unenforceable agreements.
5. Wagering agreements.
6. Contigent contracts.
7. Performance of contracts.
8. Dissolution of contractual obligations: frustration of contracts.
9. Quasi-contracts.
10. Remedies for breach of contract.

III. CODE OF CIVIL PROCEDURE:

1. Jurisdiction of Civil Courts.
2. Res Sub Judice and Res Judicial.
3. Foreign Judgement.

4. Place of Suing.
5. Transfer of Suits.
6. Parties to suit/frame of suit and suits by or against Government.
7. Appeals.
8. Reference Review and Revision.
9. Inherent Powers of Court.
10. Amendment of Pleadings.
11. Appearance & Non-Appearance of Parties.
12. Death, Marriage and Insolvency of Parties.
13. Suits by or Against Minors and Lunatics.
14. Summary Procedure.
15. Temporary Injunctions.

PAPER-II
(INDIAN PENAL CODE)

I. INDIAN PENAL CODE

1. Application of the code.
2. General exceptions.
3. Joint and constructive liability.
4. Abetment.
5. Criminal conspiracy.
6. Offences against the State.
7. Offences against public tranquility.
8. Offences by or relating to public servants.
9. Offences against human body.
10. Offences against property.
11. Offences relating to marriage: Cruelty by husband or his relatives to wife.

II. CRIMINAL PROCEDURE CODE:

The following chapters are deleted from the syllabus.

1. Chapter IX
2. Chapter XXV
3. Chapter XXVIII
4. Chapter XXX
5. Chapter XXXI
6. Chapter XXXVIII

III. INDIAN EVIDENCE ACT:

1. Relevancy and Admissibility of Facts.
2. Admission and Confessions.
3. Dying Declaration.
4. Expert Evidence and Relevancy of Character.
5. Facts requiring no proof and Oral/Documentary Evidence.
6. Burden of Proof and Presumptions.
7. Estoppel.
8. Witnesses.

IV. LAW OF CRIMES:

Law of Crimes: Concept of Crime; actus-rues, mens-rea, mens-rea is statutory offences, punishment, mandatory sentences, preparation and attempts.

V. LAW OF TORTS:

1. Nature of tortuous liability.
2. Liability based upon fault and strict liability.
3. Statutory liability.
4. Vicarious liability.
5. Joint Trot-feasors.
6. Remedies.
7. Negligence.
8. Occupier's liability and liability in respect of structures.
9. Detinue and conversion.
10. Defamation.
11. Nuisance.
12. Conspiracy.

False imprisonment and malicious prosecution

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

MATHEMATICS

PAPER-I

Linear Algebra

Vector space, bases, dimension of a finitely generated space, Linear Transformations, Rank and nullity of a linear transformation, Caylay Hamilton theorem, Eigen-vaalues and Eigenvectos.

Matrix of a linear transformation. Row and column reduction. Echelon form, Equivalence, congruence and similarity. Reduction to canonical forms.

Orthogonal, symmetrical, skew-symmetrical, unitary, Hermitian and skew-Hemitian matrices-their eigen-values, orthogonal and unitary reduction of quadratic and Hermitian forms, Positive definite quadratic forms. Simultaneous reduction.

Calculus

Real numbers, limits, continuity, differentiability, Meanvalue theorem, Taylor's theorem, indeterminate forms, maxima and minima. Curve Tracing.

Asymptotes

Functions of several variables, partial derivatives, maxima and minima, Jacobin. Definite and indefinite integrals, Double and triple integrals (techniques only). Application to Beta and Gamma Functions. Areas, Volumes, centre of gravity.

Analytic Geometric of two and three dimensions.

First and second degree equations in two dimensions in Cartesian and polar coordinates. Plane, sphere, parabolic, Ellipsoid, hyperboloid of one and two sheets and their elementary properties. Curves in space, curvature and torsion. Frenet's formulae.

Differential Equations

Order and Degree of a different equation; differential equation of first order and first degree, variable separable. Homogeneous, Linear, and exact differential equations. Differential equations with constant coefficients. The complementary function and the particular integral of e^{ax}, $\cos^{ax}$, $\sin^{ax} x^m$, e^{ax}, $\cos^{bx}$, e^{ax}, $\sin^{bx}$

Vector, Tensor, Statics, Dynamics and Hydrostatics.

(i) Vector Analysis-vector Algebra Differentiation of vector function of a scalar variable, Gradient, divergence and curl in Cartesian, cylindrical and spherical coordinates and their physical interpretation, Higher order derivatives. Vector identities and Vector equations, Gauss and Stokes Theorems.

(ii) Tensor Analysis-Definition of a Tensor, Transformation of coordinates, contravariant and covariant tensors. Addition and multiplication of tensors, contraction of tensors. Inner product, fundamental tensor, Christoffel symbols, covariant differentiation. Gradient, curl and divergence in tensor notation.

(iii) Statics-Equilibrium of a system of particles, work and potential energy. Friction, common Catenary. Principle of virtual work. Stability of equilibrium. Equilibrium of forces in three dimensions.
(iv) Dynamics-Degree of Freedom and constraints. Rectilinear motion. Simple harmonic motion. Motion in a plane. Projectiles. Constrained motion. Work and energy. Motion under impulsive forces. Kepler'slaws. Orbits under central forces. Motion of varying mass. Motion under resistance.
(v) Hydrostaticss-Pressure of heavy fluids. Equilibrium of fluids under given system of forces. Centre of pressure. Trust on curved surfaces. Equilibrium of floating bodies. Statibility of equilibrium and pressure of gases, problems relating to atmosphere.

PAPER II

SECTION A

Algebra, Real Analysis, complex Analysis, Partial Differential equations.

SECTION-B

Mechanics, Hydrodynamics, Numerical Analysis, Statistics including probability, operational Research.

Algebra

Groups, subgroups, normal subgroups, homomorphism of groups, quotient groups. Basic isomorphism theorems. Slow theorems. Permutation Groups. Cayley's theorem. Ring's and Ideals, Principal Ideal domains, unique factorization domains and Euclidean domains. Field Extensions. Finite fields.

Real Analysis

Matric spaces, their topology with special reference to R" sequence in a matric space, Cauchy sequence, Completeness. Completion, Continuous functions, Uniform continuity. Properties of continuous functions on Compact sets. Riemann Steilities Integral, Improper integrals and their conditions of existence. Differentiation of functions of several variables. Implicit function theorem, maxima minima, Absolute and Conditional Convergence of series of real and Complex terms, Rearrangement of series, Uniform convergence, infinite products, Continuity, differentiability and inerrability for series, Multiple, integrals.

Complex Analysis

Analytic functions, Cauchy's theorem, Cauchy's integral formula, power series., Taylor's series, Singularities, Cauchy's Residue theorem and Contour integration.

Partial Differential Equations.

Formation of partial differential equations, Types of integrals of partial differential equations of first order, Charbits methods, partial differential equation with constant coefficients.

Mechanics

Generalised Coordinates, Constraints holonomic and non-holonomic systems. D' ALmebert's principles and Langranges' equations, Moment of Inertia, Motion of rigid bodies in two dimension.

Hydrodynamics.

Equation of continuity, momentum and energy. Inviscid Flow Theory: Two dimensional motion, Streaming motion, sources and sinks.

Numerical Analysis

Transcendental and Polynomial Equations Methods of Tabulation, bisection, regulartalsl, secants and Newton-Raphson and order of its convergence.

Interpolation and Numerical Differentiation: Polynomial interpolation with equal or unequal step size. Spline interpolation Cubic splins. Numerical differentiation formulae with error terms.

Numerical Integration:- Problems of approximate quadrative, quadrature formulae with equispaced arguments, Causssion quadrature Convergence.

Ordinary Differential Equations:- Euler's method, multistepppredictore Corrector methods-Adam's and Milne's method, convergence and stability, Runge-Kutta methods.

1. Statistical methods:- Concept of statistical population and random sample. Collection and random sample. Collection and presentation of data. Measure of location and dispersion. Moment and Shepard's corrections. Comulants, Measure of Skewness and Kurtosis.

Curve fitting by least squares Regression, correlation and correlation ratio. Rank correction, Partial correlation coefficient and Multiple correction co-efficient.

2. Probability: Discrete sample space, Events, their union and intersection etc. Probability Classical relative frequency and axiomatic approaches, Probability in continuum, probability space, Conditional probability and independence, Basic Laws of probability, Probability in continuum, probability space, Conditional probability and independence, Basic Laws of Probability, Probability of combination of events, Bayes, theorem, Random variable Probability function, Probability density function. Distributions function, Mathematical expectation, Marginal and conditional distributions, Conditional expectation.

3. Probability distributions: Binomial Poisson, Normal Gamma, Beta, Cauchy, Multinomial, Hypergeometric, Negative Binomial, Chebychev's lemma,

(Weak)law of large numbers, Central limit theorem for independent and identical varieties. Standard errors, Sampling distribution of t, F and Chi-square and their uses in test of significance. Large sample test for mean and proportion.

Operational Research

Mathematical Programming :- Definition and some elementary properties of convex sets, simplex methods, degeneracy, duality, and sensitivity analysis, rectangular games and their solutions, Transportation and assignment problems, Kuha Tucker condition for non-linear programming. Bellman's optimality principle and some elementary applications of dynamic programming.

Theory of Queues: Analysis of steady state and transient solutions for queuing system with Poission arrivals and exponential service time.

Deterministic replacement models. Sequencing problems with two machines, n jobs, 3 machines, n jobs (Special case) and n machines 2 jobs.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

MECHANICAL ENGINEERING (DEGREE)

PAPER-I

1. **THEORY OF MACHINES:** Kinematic and dynamic analysis of planer mechanism. Gams Goars and gear trains, Flywheels. Governors, balancing of rigid rotors and field balancing. Balancing of single and multicylinder engine. Linear vibration analysis of mechanical systems. Critical speeds and whirling of shafts automatic controls.
2. **MACHINE DESIGN:** Design of Joints: Cotters, keys, splines, welded joints, threaded fasteners, joints formed by interference fits. Design of friction drives: Couplings and clutches, belt and chain drives, power crews. Design of power transmission systems: Gears and gear drives shaft and azie, wire ropes.
3. **STRENGTH OF MATERIALS:** Stress and strain in two dimensions, principle stresses and strains, Mhor's construction, linear elastic materials, isotropy and anisotropy, stress-strain relations, uniexial loading, thermal stresses. Beams: Bending moment and sheer force diagram, bending stresses and deflection of beams. Shear stress distribution. Torsion of shafts, helicasprings. Combined stresses, thick-and thin-walled pressure vessels. Struts and columns. Strain energy concepts and theories of failure.
4. **ENGINEERING MATERIAL:** Basic concepts on structures of solids. Crystalline materials. Defect in crystalline materials. Alloys and binary phase diagrams. Structure and properties of common engineering materials. Heat treatment of steel, plastics, ceramics and composite materials, common applications of various materials.
5. **PRODUCTION ENGINEERING:** Metal Forming: Principles of forging, drawing and extrusion; high energy rate forming, powder metallurgy.
   Metal Casting: Die casting, investment casting, shall moulding, centrifugal casting, gating and rising design, melting furnances.

   Fabricating Processes: Principles of gas, arc, shielded arc welding, advanced welding processes, weldability, metallurgy of welding.

   Metal Cutting: Turning, methods of screw production, drilling, boring milling, gear manufacturing, production of flat surfaces, grinding and finishing processes, computer controlled manufacturing systems, CNC, DNC, FMS, automation and robotics, cutting tools materials, tool geometry, mechanism of tool wear, tool life and machinability, measurement of cutting forces. Economics of machining, unconventional; machining processes. Jigs and fixtures. Fits and tolerance, measurement of surface texture, comparators alignment tests and reconditioning of machine tools.

6. **INDUSTRICAL ENGINEERING:** Production Planning and Control: Forecasting moving average, exponential, smoothing, operations scheduling, assembly line balancing, product development, break-even analysis, capacity palnning, PERT and CPM.

   Control Operations: Invertory control-ABC analysis, EDQ model, materials requirement planning, job design, job standards, work measurement, Quality management-Quality analysis and control, operations research: Linear programming-Graphical and simpled methods, transportation and assignment models. Single server queuing model. Value Engineering: Value analysis for cost/value.

7. ELEMENTS OF COMPUTATION: Computer organization, flow charting, features of common computer language-FURTRAN. Base III, Lotus 1-2-3. C and elementary programming.

PAPER-II

1. THERMODYNAMICS: Cycles and IC engines, basic concepts, open and closed systems. Heat and work. Zeroth, first and second law, application to non-flow and flow processes. Entropy, availability, irreversibility and Tds relations. Claperyron and real gas equations, properties of ideal gases and vapours. Standard vapour, gas power and refrigeration cycles. Two stage compressor. C-I and S.I engines. Pre-ignition, detonation and diesel-knock, fuel injection and carburetion, superogarging. Turbo-prop and rocket engines, engine cooling, emission and control, flue gas analysis, measurement of calorific values. Conventional and nuclear fuels, elements of nuclear power production. Heat transfer and refrigeration and air-conditioning. Modes of heat transfer. One dimensional steady and unsteady conduction, composite slab and equivalent resistance.

2. Heat dissipation from extended surfaces, heat exchangers, overall heat transfer coefficient, empirical correlations for heat transfer in laminar and trubulent flow and for free and forced convection, thermal boundary layer over a flat plate. Fundamentals of diffusive and connective mass transfer, black body and basic concepts in radiation, enclosure theory, shape factor, not work analysis. Heat pump and refrigeration cycles and systems, refrigerants. Condensers, evaporators and expansion devices, psyhtrometry, charts, and application to air conditioning, sensible heating and cooling effective temperature, confort, indices, load calculations, solar refrigeration, control, duct design.

3. FLUID MECHANICS: Properties and classification of fluids, manometry, forces on immersed surfaces, Center or pressure, Buoyancy, elements of stability of floating bodies. Kinematics and Dynamics.

Irrotational and incompressible, inviecid flow velocity potential, pressure field and forces on immersed bodies. Bernoulli's equation, fully developed flow through pipes, pressure drop calculations, measurement of flow rate and pressure drop. Elements of boundary layer theory, integral approach, laminar and turbulent flows, seoerations, flow over weirs and notches. Open channel flows, hydraulic jump. Dimensionless numbers, dimensional analysis, similitude and lodelling. One dimensional isentropic flow, normal shock wave, flow through convergent-divergent ducts, oblique shock-wave, rayleigh and fanno lines.

4. FLUID MACHINERY AND STEAM GENERATORS: Performance, operation and control of hydraulic pump and impulse and reaction turbines, specific speed, classification. Energy transfer coupling, power transmission, steam generators fire-tubes and water-tube boilers. Flow of steam through nozzles and diffusers, wetness and condensation. Various types of steam and gas turbines, velocity diagrams. Partial admission, reciprocating, centrifugal and axial flow compressors, multistage compression, role of mach number, reheat, regeneration, efficiency, governance.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

MECHANICAL ENGINEERING (DIPLOMA)

PAPER-I

1. APPLIED MECHANICS:

(i) Coplanar & Concurrent Forces: Forces, types of forces, coplanar & concurrent forces, resultant of forces, condition of equilibrium. Numerical problems.

(ii) Friction: Definition, slitting & rolling friction, laws of sliding friction, co-efficient of friction, angle of friction numerical problems.

(iii) Simple machine: Machine, velocity ratio, mechanical advantage, efficiency, law of machine, pully, differential pully block, wheel & axle. Numerical problems.

(iv) Centre of gravity & moment of inertia: Centre of gravity of plane figures, moment of inertia & radius of gyration of plane figures. Numerical problems.

2. STRENGTH OF MATERIALS:

(i) Stress and strain: Load, types of loads, stress, types of stresses, relation between stress and strain, Hook's law, modules of elasticity, modulus of rigidity Linear & laterial strain, poison's ratio, volumetric stress and strain, bulk modulus. Relation between E.G. & K. Riveted & welded joint, strength & efficiency, stresses due to change in temperature. Numerical problems.

(ii) Sheer forces & bending moment: Definition, S.F. & B.M. diagram, simply supported & over hanging beams with concentrated & uniformly distributed load, cantilever with concentrated & uniformly distributed load. Numerical problems.

(iii) Torsion & defection of beams: Angle of twist, torsion equation, methods of determining defection of beams-simple supported & cantilever, loaded with concentrated load & U.D.L. numerical problems.

3. FLUID MECHANICS:

(i) Fluids & properties of fluids: Specific weight, density, pressure, pressure measuring devices. Transmission of pressure hydraulic press, total pressure, centre of pressure, meter centre, metacentric height, equilibrium of floating bodies. Numerical problems.

(ii) Flow of fluid: Types of fluid flow, continuity equation total energy of flowing fluid total heat. Bernoulli's equation, co-efficient of velocity, discharge & contraction, petot tube, ventrimeter. Numerical problems.

(iii) Flow through pipes, Reynolds number, pipe friction equation. Numerical problems.

(iv) Open channel flow: Difference between open channel and pipe flow. Chezy's equation, economic section.

4. THERMODYNAMIC:

(i) Introduction: Difference between heat and temperature, measurement of heat and temperature.

(ii) Properties of gas: Definition, properties of perfect gas, behavior of perfect gas with relation to pressure, volume and temperature. Characteristics of gas equation, internal energy, enthalpy & entropy-definition of sp. Heat of gasses, critical temperature.

(iii) Laws of thermodynamics: General energy equation, first & second law of thermodynamics, process and cycles.

Difference thermodynamics processes constant pressure, constant volume, isothermal, adiabatic, polytrophic & throttling process.

(iv) Air cycles: Carnet cycle & reversed carnet cycle, application of the cycles in engines and refrigerators.

5. THEORY OF MACHINES:

(i) Link motion: Definition, structure, link, kinetic pair, sliding, turning & screw pair, kinematics chain-mechanism, machine, inversion. Crank and slotted link quick return motion mechanism, pantograph, instantaneous centre, velocity diagram.

(ii) Belt, Rope & Chain Drive: Friction drive, types of belt drive, velocity ratio, effect of belt thickness & slip on velocity ratio, creep of belt, open & cross drive, power transmitted by belt, centrifugal tension, width of belt, V-belt, rope drive & chain drive. Numerical problems.

(iii) Clutch, Brake & Dynamometer: Single plate clutch, multiple plate clutch, brake-function & types.

Dynamometer-function, type-pony brake and rope brake dynamometer, torsion dynamometer.

6. FLUID MACHINES:

(i) Air compressor: Classification-reciprocating air compressor, single stage compressor, multi stage compressor power, efficiency, capacity control.

Rotary compressor- fan, blower, cycle work, power & efficiency, troubles in air compressor & their remedies.

(ii) Impact of jet: Impact of jet on plane and curved vanes, velocity diagram, work power & efficiency. Numerical problems.

(iii) Pump: Reciprocating pump-types, working procedure, efficiency, air vessel, co-efficient or discharge, slip, power-centrifugal pump-types-single stage & multistage, working principles, velocity diagram, power, efficiency, layout of pumping system.

(iv) Water Turbine: Classification, velocity diagram, work, power, efficiency, draught tube, specific speed, characteristic curves, troubles & their remedies.

7. MANUFACTURING PROCESS:

(i) Manufacturing of Iron & Steel: Introductive, pig iron, cart-iron, rough iron, steel, effect of carbon, mild steel, medium-carbon & high carbon steel.

(ii) Introduction to Metallurgy: Crystalline structure & grain directive, micro structure, thermal equilibrium diagram of steel, transformation of Austenite during non-isothermal cooling & isothermal decomposition of Austenite.

(iii) Heat Treatment of Steel: Heat treatment process full annealing, process annealing, isothermal annealing, hardening, tempering & defects.

(iv) Soldering: Soft soldering, hard soldering & breezing.

(v) Wilding: Oxy-acetilene wilding-process & equipments, flame cutting, operation & safety.

Metal are wilding-wilding process, ilutrode, uses.

(vi) Forging: Forging practice, different forging methods & machine, forging defects, inspection & dafety.

PAPER-II

1. HOT ENGINE:

(i) Steam boiler: Function of steam boiler, types of boiler and working principles of different types of boiler, boiler construction, mountings, accessories, pipe fittings. Boiler fails, burning equipments & ash hangling.

(ii) Steam Engine: Working principle of steam engine, ranking cycle, engine componansity & function, indicator diagram, effective pressure, I.H.P, B.H.P, thermal efficiency mechanical efficiency.

(iii) Internal Combustion Engine: Introduction difference between I.C. engine & external combustion engine, classification-otto, diesel, dual combustion, two stroke, four stroke, single-acting, double acting, vertical, horizontal.

Cycle of operation n-four stroke otto, diesel & dual combustion cycle, cycle efficiency comparison between otto & diesel cycle.

S.I. engine-pertol engine, engine parts, cylinder, piston ring, connecting rod, crank, crank case, cam & cam shaft.

Carburetion of fuel, air fuel mixture, carburetor, choke, gear value timing.

C.I. engine-diesel engine & engine parts, fuel injection system, air injection & airless injection, fuel pump, fuel injectors combustion of C.I. engine-cooling system of I.C. engine-air cooling & water cooling lubrication of I.C. engine-purpose of lubrication, properties of lubricants, parts to be lubricated & the common methods used in lubrication.

2. PRODUCTION CONTROL AND MATERIAL MANAGEMENT:

(i) Organization: Introduction, principle of organization, level organization, senior executive, intermediate executive, junior executive.

(ii) Foremanship and leadership: Finction of foreman, qualification quality of foreman, the art of leadership, foreman as leader, solving problems-sequence of metros study, breaking down a job, aspect of testing, metros to be examined.

(iii) Production Control & Quality Control: Introduction, planning, casting, order quality, rating, scheduling, dispatch, progress, control, material control, benefit of quality control.

3. MACHINE POLLS:

(i) Metal Cutting & Cutting Tools: Metal forming, tool geometric and chip formation, mechanism of cutting, economic of cutting.

(ii) Lather: Finction, lathe part, fuel mechanism.

(iii) Lathe tool, Accessories & attachment & operation: Different types of tools used in lathe, check, face plate, plate & carried, strait turning, shoulder turning, eccentric turning, chamfering, knurling, facing, grooming, spinning, taper turning & trees cutting.

4. PRIME MOVER AND BOILER:

(i) Boiler: Properties of steam, boiler & component, types boiler & their working

principles, boiler mounting & accessories mance, fuel, fuel burner & combustion, feed water treatment, boiler cleaning.

Steam turbing: Function, types, estimation of work, power & efficiency.
Gas turbing: Working principle, compressor, combustion chamber, starting motor, cycle & efficiency.
I.C. Engine: Working principle of petrol & diesel engine, two stroke cycle & four stroke cycle, single suction & double acting, vertical & horizontal engine component & parts, fuel ignition cooling & exhaust system, common fault & rectification.
Water turbine: Classification estimation of work, power and efficiency.

5. AUTOMOBILE ENGINEERING:

(i) Fuel system for petrol engine, fuel system or diesel engine, intake & exhaust system, engine lubrication, cooling system, ignition system.

(ii) Suspension system, steering, brake, clutch, gear box rear wheel transmission, chasses lubrication, body recondition, garage tools & equipments.

6. MACHINE TOOLS:

(i) Drilling Machine: Types, description of different types, spindle drive mechanism, operation, cutting speed & feed.

(ii) Milling Machine: Types description & function, milling cutter tool holder, care of milling cutters & holding devices, dividing head, index plate, indexing & choice of gears calculations.
Cutter setting, horizontal & vertical boring.

(iii) Grinding: Kinds of grinding, types of grinding machine, composition of grinding wheels.
Selection of grinding wheel, mounting, dressing, tiring, balancing.
Capstan & Turret Lathes: Principle parts, difference between capstan & turrets lathe, operation, tooling scheduling chart, cutting speed, fuel & depth of cut.

7. PLANT MAINTENANCE ENGINEERING.

(i) Maintenance & installation of Mechanical Equipments: Instrument used for maintenance work, maintenance of guides surface of machine tools, fitting of key, bearing coupling, clutched & their defects & repair.
Installation of engine & machine, marking & leveling of foundation alignment courting & fixing of engine machine.
Maintenance of mechanical equipments etc. fans exhaust system, blower & dust collecting equipments, corrosion control by using chemical detergent.

(ii) Power Plant: Test, repair & maintenance of boiler & muting, maintenance of feet water heater, economizer, pre-heater, and fuel pump, fuel burner, water treatment plant.
Periodic inspection & maintenance, over hauling of I.C. engine, ignition & fuel system maintenance.

(iii) Electrical maintenance: Examination & retesting of electrical fitting, motors switches etc. locating fault, repair, safety procedure to be adopted.

8. DRAWING ESTIMATING AND COSTING:

Bill of material, element of estimating & costing of furniture's & patters, estimation, estimating & costing of casting and different component parts, estimating & costing of sheet metal work.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

MEDICAL SCIENCE

PAPER-I

1. ANATOMY:

1. Tissues and structures: Muscles, tendons, joints, blood vessels, lymphatic.
2. Early Embryology, Common Congenital Abnormalities.
3. Head and Neck: Blood supply, lymphatic drainage and cranial nerves.
4. The Limbs: Major muscles of the limbs, blood vessels, nerve supply and lymphatic drainage.
5. Thorax: Thoracic cage, breast, lungs, heart, major blood vessels.
6. Abdomen and Pelvis: Abdominal wall, inguinal canal, liver, gall bladder, stomach & duodenum, small and large intestine, kidney, ureter urinary bladder, spleen, pancreas, the pelvis and perineum.

2. HUMAN PHYSIOLOGY:

1. Development, regulation and fate of different blood cells.
2. Nervous System: Functions of cerebral cortex, cerebellum, hypothalamus, basal ganglia, nervous, nerve pathways.
3. Endocrine glands and functions of hormones.
4. Digestive System: Digestion, digestive enzymes absorption and metabolism of carbohydrates, fat and proteins.
5. Circulatory System: Regulation of cardiac-vascular functions, cardiac excitability and impulse, E.C.G. blood pressure.
6. Mechanics of respiration and regulation of respiration.
7. Glomerular and tubular functions of kidneys.

3. PATHOLOGY:

1. General Pathology: Inflammation and repair, disturbance of growth, genetic disorders, neoplasia.
2. Systematic Pathology: Pathogenesis and pathology of rheumatic heart diseases.
   Ischemic heart disease.
   Etology, oathogenesis and pathology of peptic ulcer, Ca, Stomach.
   Ethology, Pathogens and pathology of cirrhosis of liver.
   Pathology of glomerulus-nephritis and nephritic syndrome.
   Eitopatogenesis of HIV infection and AIDS.
   Acute and chronic infections of lungs.
3. Clincial Pathology: Routine hematological investigations, urine and stool.
   Renal function tests, hepatic function tests.
   Blood chemistry, normal values and changes in diseases conditions.
4. Parasitology and Microbiology. Helminthes, protozoa, fungi and micro bacteria.
   Methods of disinfections and sterilization.
   Principles of immunology, active and passive.

4. PHARMACOLOGY AND THERAPEUTICS:

1. Pharmacody Namics: Mechanism of drug actions.
2. Analgesics, antipyretics and anti-inflammatory drugs.

3. Drugs Acting on Cardio-Vascular System: Cardiac glyosides, vasco-dilators and anti-hypertensives.
4. Drugs Acting on Central Nervous System: General anesthetics, local anesthetics, hypnotics, sedatives narcotics, drug addiction and abuse.
5. Chemotherapy for microbial diseases, parasitic diseases and neoplasia.
6. Drugs acting on urine motility.
7. Drugs acting on alimentary system.
8. Vitamins and hormones.
9. Drugs acting on renal function and electrolyte metabolism.

5. FORSENIC MEDICINES AND TOXICOLOGY:

1. Forensic examination of injuries and wounds.
2. Physical and chemical examination of blood and seminal stains.
3. Forensic examination for establishing identification of persons, pregnancy, abortion, rape and virginity.
4. Forensic examination of poisoning.
5. Methopology, interpretation in conduct of post mortem.
6. Scope and importance of jurisprudence in medical practice.

PAPER-II

I. GENERAL MEDECINE:

1. Cardio-vascular system.
   Rheumatic heart diseases, valvular heart disease, hypertension.
2. Respiratory System.
   Chronic bronchitis and emphysema, tuberculosis, bronchial asthma.
3. Alimentary system.
   Reptic ulcer, gastritis, viral hepatitis, cirrhosis of liver, amoebiases.
4. Kidney and genito-urinary system.
   Glomerulonephritis, nephritic syndrome, chronic renal failure.
5. Endorcine and metabolic diseases.
   Hyperthyroidism, hypothyroidism, diabetes mellitus.
6. Diseases of Blood.
   Anemias, leukemias, lymphomas.
7. Connective tissues, bones and joints.
   Rheumatoid arthritis, systemic lupus erthematisis (Ele)
8. Neurology: Stroke (Cerebra-vascular accident), headache, epilepsy, viral encephalitis, viral and bacterial meningitis.
9. Diseases due to protozoa, helminthes and bacteria.
1. Wounds, infections, asepsis and antisepsis.
2. Haemorrage, shock, blood transfusion.
3. Lymphanodes, and lymphatics, arteries and veins.
4. Fractures and dislocation of joints.
5. Head injury and its management.
6. Thyroid and parathyroid disease and treatment.
7. Diseases of breast.
8. Diseases of stomach and duodenum.
9. Diseases of liver and gall bladder, types of jaundice.
10. Diseases of small and large intestine, intestinal obstruction, vermiform appendix.

11. Rectum and anal canal.
12. Hernias: Different types, complications and management.
13. Diseases of kidney, ureters, urinary bladder and urethra.
14. Diseases of prostate and testis.

II. OBSTETRICS & GYNAECOLOGY:

1. Pregnancy, diagnosis and antenatal care.
   Different stages of labour and management.
2. Post morten haemorrhage, sepsis and management.
3. Etopic pregnancy, diagnosis and management.
4. Principle and method of contraceptive devices: TUD, oral, pills, tubectomy, vasectomy.
5. Abortion: Medical termination of pregnancy including legal aspect.
6. Normal menstrual cycles: Menstrual dysfunctions and management.
7. Diseases of cervix including neoplasia.
8. Myoma of Uterus: Abnormal uterine bleeding and management.
9. Pelvic inflammatory diseases.
10. Tumors of ovary.

3. SOCIAL AND PREVENTIVE MEDECINE:

1. Concepts of Health and Diseases: Definition and dimension of health, indicators of health, public health and preventive medicine.
2. Epidemiology: Principle of epidemiology, epidemiology of communicable disease.
3. Demographic Trends in India: Family planning. Concept and methods.
4. Nutrition and health: Food and nutrition, nutritional diseases, food adulteration.
5. Environment and Health: Purification of water, air pollution and disposal of waste.
6. Health information, education, education and communication. Components and importance of health information, education and communication in community health.
7. Aims, objectives and approach and approach of some important Centrally Sponsored Schemes: Family Welfare, MCH, NMEP, NLEP, B.C.G. & T.B. control, blindness control programme, AIDS & STD.

4. EAR, NOSE & THROAT:

1. Common Disease of Nose and Sinuses: Epistaxiz, DNS, etiology, pathology and treatment of paranasal sinuses.
2. Diseases of Pharynx, Fauces and Larynx: Pharyngitis, adenoids, tonsillitis, chronic inflammatory conditions of larynx, indications and methods of tracheotomy.
3. Deafness: Types and diagnosis, C.S.O.M. diseases of labyrinth.

4. **OPHTHALMOLOGY:**

1. Common disease of eyelids and conjunctiva and treatment.
2. Refractive error of the age and correction.
3. Cataract and its treatment.
4. Glucoma and its treatment.
5. Diseases affecting retina.
6. Neutral pathway of vision.

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COMBINED TECHNICAL EXAMINATION

SYLLABUS – MICROBIOLOGY

PAPER-I:

Organic Mechanisms in Biology

1. Common Mechanisms in Biological Chemistry – Overview of Digestion, Absorption, Metabolism (Anabolism & Catabolism), Nutrition, Photosynthesis, Respiration, Excretion.
2. Biomolecules – Carbohydrates (Anomaric carbon, Mutarotation, Simple Chemical reactions of Glucose, Reducing & Non-reducing Sucrose, Maltose & Lactose, Elementary idea of structure of Starch & Cellulose); Proteins (Denaturation of proteins, Enzyme Kinetics), Nucleic acids (Mechanisms of Replication, Transcription & Protein synthesis, Genetic code); Hormones (classification, structural features & functions in bio-systems); Vitamins (classification, functions of vitamins in bio-systems).
3. Lipid Metabolism – Structures and roles of Fatty acids & Glycerols, beta oxidation of saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd chain fatty acids, energy yield, ketone bodies.
4. Carbohydrate Metabolism – Aerobic & Anaerobic glycolysis, sequence of reactions in glycolysis, regulation in glycolysis, citric acid cycle, glycogenesis, glycogenolysis (sequence of reactions & regulation), Pentose-phosphate pathway (sequence of reactions & regulation), extraction of energy from food sources.
5. Amino acid Metabolism – Amino acid breakdown (amino acid deamination, Urea cycle, metabolic breakdown of individual amino acids – glucogenic & ketogenic amino acids), amino acids as biosynthetic precursors (haem biosynthesis & degradation, biosynthesis of epinephrine, dopamine, seretonin, GABA, histamin, glutathione); biosynthesis of essential & non-essential amino acids.
6. Nucleotide Metabolism – biosynthesis of purine & pyrimidine (de novo & salvage pathway);degradation of purine & pyrimidine.

Principles of Transmission Genetics

1. Science of Genetics – an overview of modern history of Genetics before 1860, 1860-1900, 1900-1944, 1944-Present, about 3 general areas of Genetics (Classical, Molecular & Evolutionary).
2. Mendelism & Chromosome Theory – Mendel's principles, applications of Mendel's principles, Chromosome Theory of Heredity (Sutton-Boveri), Inheritance patterns, phenomenon of Dominance, Inheritance patterns in Human (Sex-linked, Autosomal, Mitochondrial, Unifactorial, Multi-factorial). .

3. Extension of Mendelism – Deviation from Mendel's Dihybrid phenotype, Linkage, Sutton's view on linkage, Morgan's view on linkage, Bateson & Punnet's Coupling & Repulsion hypothesis.
4. Linkage & Crossing over - Chromosome theory of Linkage, kinds of linkage, linkage groups, types of Crossing over, mechanism of Meiotic Crossing over, kinds of Crossing over, theories about the mechanism of Crossing over, cytological detection of Crossing over, significance of Crossing over.
5. Allelic Variation & Gene function – Multiple allele, Genetic interaction, Epiststic interactions, Non-Epistatic inter-allelic genetic interactions, Atavism/Reversion, Penetrance (complete & incomplete), Expressivity, Pleiotropism, Modifier/
Modifyinggenes.
6. Non-Mendelian inheritance – Evidences for Cytoplasmic factors, cytoplasmic inheritance, extra- nuclear inheritance (mitochondrial, chloroplast), non-chromosomal inheritance, maternal inheritance, uniparental inheritance.
7. Chromosomal variation in Number & Structure – Euploidy, Non-disjunction & Aneuploidy, Aneuploid segregation in plants, Aneuploidy in Human, Polyploidy in Plants & Animals, Induced Polyploidy, applications of Polyploidy, Chromosomal Mosaics, Polytene chromosome in Diptera, Deletion, Duplication, Inversion, Translocation, Position Effect, Centromeric & Non-centromeric breaks in chromosomes, chromosomal rearrangements in Human being, Chromosomal aberrations & evolution.
8. Chromosome Mapping - Haploid mapping (2 point & 3 point cross), Diploid mapping (Tetrad analysis), determination of linkage groups, determination of map distance, determination of gene order, cytological mapping.
9. Human Cyto-Genetics – Human karyotype, Banding techniques, classification, use of Human Cyto-genetics in Medical science, Chromosomal abnormalities in spontaneous abortions, viable monosomies & trisomies, chromosomal deletions & duplications, genetics of chromosomal inversions & translocations, human traits, Genomic position effects on Gene expression.
10. Pedigree analysis – Symbols of Pedigree, Pedigrees of Sex-linked & Autosomal (dominant &recessive), Mitochondrial, Incomplete dominance & Penetrance.
11. Formulating & Testing Genetic Hypothesis –problems of Sex-linkage, problems of genes with Multiple alleles, problems of gene interactions, Chi-square, t-test.

Principles of Microbiology

1. Overview of history of Microbiology - Biogenesis and abiogenesis Contributions of Redi, Spallanzani, Needham, Pasteur, Tyndal, Joseph Lister, Koch [Germ Theory], Edward Jenner and Flemming [Penicillin], Scope of Microbiology.

2. Classification of Microbes - Systems of classification, Numerical taxonomy, Identifying characters for classification, General properties and principles of classification of microorganisms Systematics of bacteria, Nutritional types [Definition and examples]. Classification on the basis of oxygen requirement

3. Concept of Sterilization - Definition of sterilization, dry and moist heat, pasteurization, tyndalization; radiation, ultrasonication, filtration. Physical and Chemical methods of sterilization; disinfection sanitization, antisepsis sterilants and fumigation. Determination of phenol coefficient of disinfectant.
4. Stains and staining techniques – Definition of auxochrome , chromophores, dyes, Classification of stains, Theories of staining, Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella staining, endospore staining.
5. Microbes in Extreme Environment – Nature, special features of the thermophilic, methanogenic and halophilic Archaea; photosynthetic bacteria, Cyanobacteria some Archaea who live in extreme conditions like cold, and space.
6. Pathogenic Microorganisms – List of common bacterial, fungal and viral diseases of human beings [Name of the disease, causative pathogen, parts affected]
7. Basic concepts of Virology - General characteristics of viruses, differences between bacteria and viruses. Classification of viruses Physical and chemical Structures of different Viruses on the basis of capsid symmetry - enveloped (Herpes virus), helical (TMV) and icosahedral (Polyoma viruses), Capsids, complex (Bacteriophage, and Virion size, enveloped (Herpes), helical (TMV) and icosahedral (Polyoma), Capsids.

Microbial Growth & Reproduction

1. Basic concepts of Microbes : General characteristics and functions of Microbes, Physical and Chemical Structures of different Microbes, Importance of Cell shape cell size in rods and cocci, septum formation, cell elongation, brief outline of Microbial cell wall synthesis and cell separation, Bacterial Sporulation - Endospore formation in Bacillus, Occurrence of Ca-dipicolinate (DPA) and soluble Proteins (SASP), Spore germination
2. Kinetics of Bacterial growth: Different types of bacterial culture (Batch, Synchronous, Arithmatic) – Definition and brief description. Growth Phases, Growth Kinetcs, Calculation of duration of Phases and generation time, Growth yields, Methods of growth determination, Environmental factors affecting growth - temperature, pH, osmotic pressure and nutrient concentration per cell.
3. Microbial Reproduction : Different modes of Microbial DNA replication, Mechanism of DNA replication – rolling circle model & Theta structure-Bidirectional replication, Fats proteins, Divisomes, MreB Proteins, Impairment

of proof reading in mutants, Mutant genes in bacteria, mutation frequency, Rate of mutation, Repair of UV-damage, Photo reactivation, Excision repair, SOS response.
4. Sexuality and bacterial recombination - Rarity in Bacteria, Male and femaleness in bacteria (F+, F' and Hfr), Plasmids and pilus mediated transfer of genes in the conjugation process in E.coli, Homologous Recombination, Site specific Recombination

Microbial Genetics

1. Prokaryotic Genomes - Physical organization of bacterial genomes (Structure of the bacterial nucleoid, Replication and partitioning of the bacterial genome and Genome of Archaea).
2. Mechanism of genetic exchange : Plasmid and bacterial sex, Types of plasmids (F Plasmid : a Conjugate plasmid', Mobilization of Non-conjugative plasmid, R plasmid, Col plasmid Copy number and incompatibility), Episomes. Transposable elements (Insertion sequence and transposons, Integrons and Antibiotic-Resistance cassettes, Multiple Antibiotic Resistant bacteria, Mu–virus); Bacterial Genetics (Mutant phenotype, DNA mediated Transformation; Conjugation (Cointegrate Formation and Hfr Cells, Time–of–Entry Mapping, F' Plasmid); Transduction (Generalized transduction, Specialized Transduction)- gene mapping.
3. Molecular Mechanism of gene regulation in prokaryotes – Transcriptional regulation in prokaryotes (inducible and repressible system, positive regulation and negative regulation); Operon concept – lac, trp, Ara operons.
4. Bacteriophages: Stages in the Lytic Life Cycle of a typical phage, Properties of a phage infected bacterial culture, Specificity in phage infection, E. coli PhageT4, E.coli Phage T7, E.coli phage lambda, Immunity to infection, Prophage integration, Induction of prophage, Induction & Prophage excision, Repressor, Structure of the operator and binding of the repressor and the Cro product, Decision between the lytic and lysogenic Cycles, Transducing phages, E.coli phage phiX174, The lysogenic Cycle.
5. Bacteriophage Genetics - Benzer's fine structure of gene in bacteriophage T4 : Plaque Formation and Phage Mutants, Genetic recombition in the lytic cycle, (concept of recon, muton, cistron).

Principles of Immunology

1. Immune Response - an overview, components of mammalian immune system, molecular structure of Immunoglobulins or Antibodies, Humoral & Cellular immune responses, T-lymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), T-cell receptors, genome rearrangements during B-lymphocyte differentiation, Antibody affinity

maturation class switching, assembly of T-cell receptor genes by somatic recombination.

2. Regulation of immunoglobulin gene expression – clonal selection theory, allotypes & idiotypes, allelic exclusion, immunologic memory, heavy chain gene transcription, genetic basis of antibody diversity, hypotheses (germ line & somatic mutation), antibody diversity, alternate pathways of transcript splicing, variable joining sites & somatic mutation, role of antibody (alone, in complement activation & with effector cells), monoclonal antibodies.

3. Major Histocompatibility complexes – class I & class II MHC antigens, antigen processing.

4. Immunity to infection – immunity to different organisms, pathogen defense
strategies, avoidance of recognition, inactivation of host-immune effector mechanisms.

5. Immuno-techniques - Blood grouping, Antigen-Antibody reactions : agglutination, precipitation, immuno-electrophoresis, Coomb's test, ELISA, RIA.

6. Vaccines & Vaccination – adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, tumor vaccines, principles of vaccination, passive & active immunization, immunization programs & role of WHO in immunization programs.

7. Auto-immune diseases – autoimmunity & auto-immune diseases, factors contributing development of auto-immune diseases, mechanism of development, breakdown of self-tolerance, rejection of transplants, molecular mimicry, diagnosis
& treatment of auto-immune diseases, replacement therapy, suppression of auto-immune processes, nature of auto-antigens, immunodeficiency, AIDS.

8. Immune Response of Plants.

Plant and Animal Tissue Culture,Techniques and its application

1. Introduction to Techniques - Introductory history, Laboratory organization, Media, Aseptic manipulation.

2. Basic concepts in cell culture - cell culture, Cellular Totipotency, Somatic Embryogenesis.

3. In vitro culture : approaches & methodologies - preparation steps for tissue culture, surface sterilization of plant tissue material, basic procedure for aseptic tissue transfer, incubation of culture.

4. Tissue nutrition : Growth Hormones - Plant cells (Composition of culture media, Growth hormones, Vitamins, Unidentified supplements, selection of media); Animal cells (substrate on which cells grow, Feeder layer on substrate, gas phase for tissue culture, media and supplements).

5. Tissue culture methodologies - Plant cells (Callus Culture, Cell Suspension Culture, Organ Micro-culture, plant micro-propagation, Somatic Embryogenesis); Animal cells (Source of tissue, primary culture, differentiation of cells, growth kinetics, animal cell lines and their origin and chracterization).
6. Cloning & Selection of specific cell types – cloning, somatic cell fusion and HAT selection, Medium suspension fusion, selection of Hybrid clone, production of monoclonal antibodies.
7. Organ Culture - Culture of embryonic organs, whole embryo culture, culture of
adult organs.

Microbial Diversity & Classification

1. Microbial Classification: Whittaker's five kingdom classification of living system,
2. Archaebacteria : – Cell structure, metabolic character, function and reproduction of Methanogens, Halophiles, Tharmoacidophiles.
3. Eubacteria : Cell morphology, function, reproduction and of a) Photosynthetic eubacteria (cyanobacteria).
b) Gliding bacteria (Myxobacteria and Cytophaga group).
c) Gram negative eubacteria (Spirochetes, Rickttsias, Chlamydias)
d) Gram positive eubacteria (Actinomycetes).
e) Spore forming bacteria (spore formation and germination),
f) Fermentative bacteria – metabolic character,
g) Sulfur bacteria and Nitrogen fixing bacteria
h) The mollicutes.
4. Brief description of eukaryotic Algae & Fungi and protozoa : General characteristics, vegetative
& reproductive structure of the following groups of Microorganism particularly

Algae Cyanophyta, Cholorophyta Bacillariophyta, Phacophyta, Rhodophyta
Fungi Phycomycetis, Bacidiomycetis, Zygomyetes, Oomycets, Asomycetes, Deuteromycetes (imperfect and perfect stages)
Protozoa Giardia, Entamoeba and Plasmodium)
5. General Properties of other viruses, viroids and prions : Viroids, prions, Filamentous DNA phages, Single stranded RNA phages, Cauliflower Mosaic, Virus of Plants; HIV, Vaccinia and Simian virus of animals, Insect virus.

Immunology

1. Antigen-Antibody reactions – Agglutination (Blood grouping testing).
2. Antibody titration (Ouchterlony Double Diffusion).
3. Antigen-Antibody reactions – Immuno-electrophoresis,

Rocket immuno-electrophoresis.
4. Antigen-Antibody reactions – Coomb's test.
5. Antigen-Antibody reactions – ELISA.

Molecular Genetics

1. How to clone a gene - What is clone, Overview of the procedure, Gene library, Hybridization.
2. Purification and Separation of nucleic acids – Extraction and Purification of nucleic acids, Detection and Quantitation of Nucleic acids, Gel Electrophoresis.

3. Cutting and Joining DNA – Restriction Endonucleases, Ligation, Alkaline Phosphate, DoubleDigest, Modification of Restriction Fragments ends, Other Ways of joining DNA Molecules.
4. Vectors – Plasmid vectors, Vectors based on the lambda Bacteriophage, Cosmids, M13 vectors, Expression vectors, Vectors for cloning and expression in Eukaryotic cells, Super vectors : YACs and BACs.
5. Amplifying DNA : PCR and Cell based DNA Cloning – The importance of DNA Cloning, PCR : basic features and application, Principles of Cell-based DNA Cloning, Cloning System for amplifying different sized fragments, Cloning System for producing single-stranded and mutagenized DNA.
6. Nucleic Acid Hybridization : Principle and application - Preparation of nucleic probes, Principle of Nucleic acid hybridization, Nucleic acid hybridization assays, and microarrays.

Computational Biology & Bio-informatics

1. Introduction to Genomics - information flow in biology, DNA sequence data, Experimental approach to genome sequence data, genome information resources.
2. Functional Proteomics - protein sequence and structural data, protein information resources and secondary data bases.
3. Computational Genomics - Internet basics, biological data analysis and application, sequence data bases, NCBI model, file format.
4. Sequence alignment & data base search - Protein primary sequence analysis, DNA sequence analysis, pair wise sequence alignment, FASTA algorithm, BLAST, multiple sequence alignment, DATA base searching using BLAST and FASTA.
5. Structural data bases - Small molecules data bases, protein information resources, protein data bank.

Biodiversity & Taxonomy

1. Basic concept of Biodiversity – What is Biodiversity, Why should we conserve it, Elements of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity, Patterns of Species Diversity.
2. Global patterns of Biodiversity – measuring biodiversity, Cataloging and Discovering Species, Geographical Patterns of Species Richness, Biogeography, Importance of Distribution Patterns (Local Endemics, Sparsely Distributed Species, Migratory Species), GAP Analysis.
3. Biodiversity & Conservation – Overexploitation threatening living species, International Trade, Animals threatened by International trade, Problems in Controlling International Trade (Enforcement, Reservations, Illegal Trade), Free Trade & the Environment, Free Trade & Conservation, Common patterns of Overexploitation.
1. Exotic Species – Plants, Invertebrates, Fishes, Amphibians, Reptiles, Birds, Mammals, Detrimental Effects of Exotic Species.
2. Endangered Species Conservation – The US Endangered Species Act, State Endangered Species Acts Successes and Failures of the Endangered Species Act Role of ESA in Habitat Protection, Critical Habitat, Problems with the Endangered Species Act, Habitat Conservation Plans.
6. Ethics of Conservation – Values of Biodiversity, Biopiracy, Hybridized plants, GM crops (benefits & criticism), Economic Value of Biodiversity & Legal, Ethical and Conservation issues related to uses of biodiversity, Global Conservation Issues.

Taxonomy

7. Basic concept of Taxonomy – Classification, Construction of Phylogenetic tree, Systematics, Cladistics, Cladograms, Phenetics, Nomenclature.
8. Taxonomy in relation to Chromosomal morphology & Evolution – Chromosomal evolution, why location of genes matter, evolutionary oddities about chromosomes, evolutionary effect of rearrangements of chromosomes, karyotypic orthoselection, chromosomal evolution & speciation.
9. Molecular Taxonomy in relation to DNA characteristics & Protein sequences – modes of molecular evolution, Neutral theory of Molecular evolution, genetic markers for taxonomic purposes, comparing total genome by DNA-DNA hybridization, comparing DNA sequences, Cladistics, biological identification through DNA barcodes, chromosome painting, establishing molecular homology using protein sequences.

Microbial Biotechnology

1. Commercial Production of Microorganisms – Industrial Fermenters, Single-cell Protein.
2. Bioconversions – Biomining and bioleaching of ores (Use of thermophilic
microorganisms in industrial microbiology Bio-gas, Bio-leaching, Bio-diesel.

3. Microorganisms & Agriculture – Microorganisms in Agricultural Waste water treatment, Vermiculture, Microbial pesticides.
4. Products from Microorganisms – Metabolites, Enzymes, Antibiotics.
5. Bioremediation – Petroleum prospecting and formation of oil spills,, Wastewater treatment, chemicaldegradation, heavy Metals.
6. Principles of Microbial growth – introduction, the ways of growing microorganisms, ways to increase yield of microbes, Batch, fed-batch and continuous cultures (definition and kinetics).

Paper II

DNA Typing, Proteomics & Beyond

1. DNA Typing : DNA polymorphisms: the basis of DNA typing, Minisatellite analysis, Polymerase chain reaction based analysis, Short tandem repeat analysis, Mitochondrial DNA analysis, Y chromosome analysis, Randomly amplified
polymorphic DNA (RAPD) analysis.
2. Proteomics and beyond : Analysis of the transcriptome, Proteomics-Expression analysis & Characterization of proteins, Metabolomics & global biochemical networks.
3. High-throughput analysis of gene function - DNA microarrays, Protein arrays, Mass spectrometry
.4. Single Nucleotide Polymorphisms - The nucleolar proteome, Mapping disease-associated SNPs : Alzheimer's disease.

Recombinant DNA Technology

1. Gene Recombination and Gene transfer : Bacterial Conjugation, Transformation, Transduction, Episomes, Plasmids, Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion, Microlaser.
2. Changing genes: site-directed mutagenesis and Protein engineering: Primer extension is a simple method for site directed mutation, PCR based site directed mutagenesis, Random mutagenesis, Use of Phage display techniques to facilitate the selection of mutant peptides, Gene shuffling, production of chimeric proteins.
3. Genetic engineering in animals: Production of transgenic mice, ES cells can be used for gene targeting in mice, Applications of gene targeting, Using Yeast to study Eukaryotic gene function, Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines, Transgenic animals, Production of proteins of Pharmaceutical value.
4. Genetic engineering in plants: Use of Agrobacterium tumefaciens and Arhizogenes, Ti plasmids, Strategies for gene transfer to plant cells, Direct

DNA transfer to plants, Gene targeting in plants, Use of plant viruses as episomal expression vectors.

Environmental Biotechnology

1. Components of Environment – Hydrosphere, lithosphere, atmosphere and biosphere – definitions with examples; Interaction of man and environment; Environmental Studies as a multidisciplinary subject.
2. Global Environmental Problems – Green House Effect, Acid rain, El Nino, Ozone depletion, deforestation, desertification, salination, biodiversity loss; chemical and radiation hazards.
3. Environmental pollution and degradation – Pollution of air, water and land with reference to their causes, nature of pollutions, impact and control strategies; noise pollution; environmental damage by agriculture, perspectives of pollution in urban, industrial and rural areas. Habitat Pollution by Chlorinated Hydrocarbons (DDT, PCBs, Dioxin etc), Organophosphates, Heavy Metals, Die-offs, Endocrine disrupting chemicals, Nutrient pollution.
4. Environmental Management – Concept of health and sanitation, environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases, health hazards due to pesticide and metal pollution, waste treatment, solid waste management, environmental standards and quality monitoring.
5. Environmental Protection Act – Environmental Laws, national movements, sustainable development, environmental policies, environmental economics, environmental ethics – holistic approach of environmental protection and conservation, IUCN – role in environmental protection. Concept with reference to UN – declaration, aim and objectives of human right policies with reference to India, recent north-south debate on the priorities of implementation, Environmental Protection Agency (EPA).
6. Bioremediation – Oil spills, Wastewater treatment,chemical degradation, heavy Metals.

Industrial Microbiology

1. Bioreactor / Fermenter – types & operation of Bioreactors, physico-chemical standards used in bioreactors, limitations of bioreactors, stages of fermentation processes, Media design for fermentation processes, Solid substrate fermentation, Fermenters (Stirred tank, bubble columns, airlift. Bioreactors, Static, Submerged and agitated fermentation), advantages & disadvantages of solid substrate & liquid
fermentations.
2. Technology of Microbial cell maintenance – steps to maintain microbial culture in an aseptic & sterile environment (how to inoculate, preserve & maintain), Strain preservation, maintenance and strain improvement by mutation of gene transfer

processes
3. Downstream processing – extraction, separation, concentration, recovery & purification, operations (Insulin, Vitamins, Metabolites), Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), Citric acid, lactic acid, α-amylase, protease penicillin, tetracycline and vitamin B12, with reference to easily available raw materials, Production of herbal drugs. .
4. Enzyme technology – nature of enzymes, application of enzymes, limitations of
microbial cells used as catalysts in fermentation, multi-enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes, technology of enzyme production, use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes.
5. Biological fuel generation – photosynthesis, sources of biomass, ethanol from biomass, methane from biomass, hydrogen, microbial recovery of petroleum.
6. Biotechnology in specific medical & industrial applications - Retting of jute, microbial process for immunization (Production of monoclonal antibodies), Deterioration of paper, textiles, painted surfaces and their prevention, Biofilms, microbial biopolymers, biosurfactants, Microbial culture selection with high yield potential.

Model Organisms in Human Genome Project

1. Genome – about genomes of model organisms (E. coli, Yeast, Arabidopsis thaliana, C. elegans, Drosophila melanogaster, laboratory mouse, Zebra fish, Human), types of genomes, genomes & genetic variation, comparison of different genomes, genome evolution.
2. Genomics – about the genomics, history, comparative genomics, comparative genomic hybridization, functional genomics.
3. Genome projects – an overview of genome projects of human and other model organisms of Human Genome Project.
4. Human Genome Project (HGP) – an overview of the project, goals of the project, major scientific strategies & approaches used in HGP, expected scientific & medical benefits of this project, about the organizations behind this project.
5. How Human genome was mapped – physical mapping, genetic mapping, gene ontology, gene annotation.
6. Technologies used in HGP – RFLP, microsatellite markers, STS, EST, DNA
sequencing, DNA microarray.

Medical Microbiology

1. Beneficial Microbial Interactions with Human : Normal microbial population of healthy human body - Skin, mouth, upper respiratory tract, intestinal tract, urino-genital tract, eye.
2. Harmful Microbial Interactions with Human : Entry of pathogens into the host, types of bacterial pathogens, Mechanism of bacterial pathogenicity, colonization and growth, Virulence, Virulence factors – exotoxins, enterotoxins, endotoxins, neurotoxins. – avoidance of host defense mechanisms, damage to host cell, Host factors for infection and innate resistance to infection.
3. General Account of Epidemiology : Principles of epidemiology, Current epidemics (AIDS,Nosocomical, Acute respiratory Syndrome,) Measures for prevention of epidemics –Global health consideration, Emerging and reemerging infectious diseases Biological warfare and biological weapons.
4. Person to person Microbial disease : Names of pathogen, disease symptoms, and preventive measures
Airborne transmission of diseases by airborne pathogens Streptococcal diseases, Corynebacterium and Diptheria, Bordetella and Whooping cough, Mycobacterium-Leprosy and Tuberculosis, Nisseria meningitides meningitis and meningococcemia, Viruses and respiratory tract infection
Direct contact transmission of diseases : Staphylococcus, Helicobactor pylori and Gastric ulcers, Hepatitis viruses
Sexually transmitted diseases : Gonorrhea and syphilis, AIDS and HIV
5. Animal transmitted, Artropod transmitted , Soil borne and Water borne microbial diseases

Animal transmitted disease : Rabies, Hantavirus pulmonary syndrome
Artropod transmitted disease: Rickettsia, Malaria, Plague
Soil borne diseases : Tetanus,
Water borne microbial diseases: Cholera, Typhoid, Amoebiasis, Giardiasis,.
6. Chemical control of Pathogens – Definition and Classification of antibiotics on the basis of structure and mode of action. Assay of antibiotics, antibiotic spectrum Naturally produced drugs. Antibiotics produced by bacteria, actinomycetes and fungi used in chemotherapy. Semisynthetic antibiotic. Sulfa drugs their use and mechanism of action. Naldixic acid, nitrofurans, isonicotinic hydrazide, metronidazole; Prophylactic agents. Drug toxicity, Drug resistance – chromosomal mutation and plasmid-borne multiple drug resistance. cyclic polypeptide antibiotics of bacteria.

Food & Agricultural Microbiology
Food Microbiology
1. Food Microbiology - Microbiology of milk, Cheese, Yogurt (curd), Idli, Kinema;

Spoilage of food (fresh and cooked, canned food, Vegetables, fruits, fish, poultry product, meat and meat products,
2. A brief account on common food–borne infections and toxicoses - Salmonellosis, Botulism, Cholera, Mycotoxicosis, E.coli –poisoning.
3. A brief account on Food preservation – pasteurization, appertization, aseptic packaging; use of high temperatures, freezing, dehydration, ionizing radiation, osmotic pressure; use of chemicals - organic acids, esters, sulphur- dioxide, salts and high sugar concentration (sweets etc.)

Agricultural Microbiology

1. Nature of soil - Soil as microenvironment, Soil organic matters and humus, Soil and surface environment, Soil pores and movement of gases for microbial activity, Microbes in soil surface and different zones of soil. Decomposition of Plant and animal residues by microorganisms in soil.

2. Brief account of microbial interaction : Symbiosis, neutralism, Commensalism, Competition, Ammensalism, Synergism, Parasitism.
3. Microorganisms in the rhizosphere, root surfaces and phylloplane - Biofertilizers- Biological Nitrogen fixation- symbiotic and asymbiotic, mass production by Rhizobium, Azotobacter and Cyanobacteria i.e nitrosofying, nitrifying ammonifying and photosynthetic bacteria, Denitrification of nitrate fertilizers to N2 and N2O (a green house gas) by denitrifying bacteria. free living and in association with Azolla, Phosphate solubilizing bacteria. Soil anerobic methanogens in rice field.
4. Biological control of soil-borne microbial pathogens and nematodes - Microbial pesticides. Interaction of synthetic pesticides with soil microorganisms. Entomopathogenic fungi.
5. Plant diseases: Mode of entry of pathogens, disease symptoms, Brief account of algal disease, fungal disease,bacterial disease, viral disease, diseases caused
by mycoplasmas and nematode Specially - brown spot of rice, black stem rust of wheat, stem rot of jute, rice disease by Tungo virus, grey blight of tea, red rot of sugarcane, TMV, Blast of rice, leaf blight of potato, Powdery mildew of cucurbit)- decimination and control measurement.

Microbial Technology : Social, Legal & Ethical Issues
1. An overview of Patient Statute : Title 35 Patents, requirement of a Patent disclosure, applications for Patent involving the action of microorganisms, Classification & Examination in the United States Patent & action of microorganisms, Statutory proposals, Patent & Trademark office guidelines.
2. Patent Practice & Problems : Review of case law, public & international depositories, patentability of microorganisms, Genetic engineering.

3. Social issues - public opinions against the microbial technologies. 4. Ethical issues – ethical issues against the microbial technologies.

Paper I

Atomic Structure :

Bohr,s atomic model & limitation. Idea of de Broglie matter weaves. Hisenberg's uncertainty principle. Schrödinger's wave equation. Significance of wave function. Quantum numbers. Multielectron system-Pauli's exclusion principal, Hunds rules of maximum multiplicity. Stability of half filled full field orbitals, Afbau principal & its limitation. Electronic configuration of atoms.

2. Units & dimention : (SI units to be used & encouraged).

Kinetic Theory of Gases : Distribution of molecular, velocities root-mean-square velocity, elementary kinetic molecular theory of ideal gases, deduction of kinetic gas equation. $P=\frac{1}{3}mnc^2$,deduction of gases laws.

3. Bonding in organic compounds :

Classification, trivial names and IUPAC system of nomenclature of organic compounds. Nature of

covalent bond and its orbital representation. Hybridization, bond energy, polarity of bond & dipole moment of molecules, inductive effect, hydrogen bond, conjugation, resonance.

Hemolytic & heterolytic fission of bonds electrophiles & nucleophiles, carbonation, carbon ions and radicals- there stability, geometry & generation.

4. Stereochemistry:

Dissymmetric Molecules: Different types of Isomerism,Structural Isomers,Geometrical, Stereoisomerism, Configurational Isomers, Conformational Isomers, Concept of asymmetric carbon atom, Enantiomers, Diastereiosmers, Stereogenic atom / center, Chirotopic / Achirotopic Centre, Protereoisomerism, Concept of Topicity of Ligands and Faces (Homotopic, Enantiotopic, Diastereotopic atoms and groups; Prochiral, Homotopic, Enantiotopic, Diastereotopic Faces), Projection Structures of Streoisomers (Fischer, Swahorse, Newman, Flying-Wedge projection and Interconversion of these projections formulas) of simple molecules containing one or two asymmetric carbon atom, Optical isomerism, Optical activity, Element of symmetry and chirality, Meso compounds, Chiral centers and the number of stereoisomers, Racemic modifications, Racemic mixture or (+/-)-Conglomerate, Racemic Compounds or racenate, Stereochemical nomenclature of Stereoisomers containing chiral centers(R/S and E/Z or cis-trans or sec cis- sec trans of C=C system);D,L system of designation; Pro-R, Pro-S, Re, Si, Erythro, threo, Pref and Praf designation of enantiotopic groups and atoms; Chirality of Organic molecules without chiral center and concept of chiral axis.

5. Reaction Mechanism:

SN1 & SN2 reaction, E1&E2 reaction (elementary treatment) of aliphatic hydrocarbon.
Saytzeff & Hofmann elimation. Nucleophilic and electrophilic aromatic substitution.

6. Electrolytic conductance :

specific, equivalent and molar conduction, their variation with concentration in case of strong and weak electrolytes, measurement of conduction, Kohlrausch law of independent migration of ions, ionic mobility and conductance, transferrance number, conduct metric titration.

7. Phase Rule:

Phase, component, system, degrees of freedom. The phase rule. Phase diagram of
one component system: water.Heterogeneous systems: Nerast distribution law, miscibility and distillation of binary liquid mixture, aziotroic mixtures, critical solution temperature (elementary idea).

8. Radioactivity and Nuclear Structure of Atoms:

Radioactive disintegration series, group displacement law, law of radioactive decay, half-life and average life of radio elements, radio active equilibrium, measurement of radioactivity. Stability of atomic nucleus, n/p ratio.
Radioisotopes and their application: Determination of age of earth, radio carbon dating, Medicinal and agriculture use of isotopes, hazards of radio activity.

9. Chemical analysis :

Gravimetric Analysis- Solubility product and common ion effect, requirement of gravimetry, Techniques of Precipitations, filtration, washing, drying, igniting and weighing precipitates. Gravimatric estimation of chloride & nickel.
Volumetric analysis – primary and secondary standered substance/(solution). Principles of acid- base, oxidation- reduction and complexometric titration. Acid-Base, redox and metal ion indicators.
Analysis of real samples: Sampling techniques, methods of dissolution of solid samples for chemical analysis. Determination of hardness water. Estimation of glucose& phenol. Accuracy
and precision in quantitative analysis, errors, standard deviations.

1. Chemical Bonding and Structure:

(a) Ionic Bonding:

General characteristics of ionic compounds: ionization energy, electron affinity etc. Sizes of ions, radius ratio rule and its limitation. Lattice energy, Born-Haber cycle.

(b) Covalent Bonding:

General characteristics of covalent compounds, valence bond approach, directional character of covalent bond, hybridization involving s-, p- and d-orbitals. Valence State Electron Pair Repulsion (VSEPR) concept, shapes pf simple molecules and ions.

Fajan's Rules. Hydrogen bonding and its effect of physical and chemical properties. Others types of molecular interaction.

2. Double & complex salt:

Werner;s theory of co ordination compounds. Chalets. Polydentate ligands including naturally occurring ones. Electronic interpretation of compounds formation. Stepwise and

overall stability constants. (elementary idea only) Geometrical & optical isomerism. Nomenclature of co or dination compounds.

3. The noble gases:

Occurrence, general properties, electronic structure 7 position in the periodic table. Elementary Xenon compounds (bonding and structures excluded).

4. Real gases:

Deviations from ideal behavior vander Waal's equation. Andrews exprement, critical

phenomena in light in Vander wlla's equation state, community of state.

5. First law of thermodynamics:

Cyclic process, Reversible & irreversible process , internal energy, enthalapy, work

done an isothermal & adiabatic pricess, heat capacities, Cp-Cv =R for an ideal gas.

6. Viscosity:

Definition & determination of Oswald's viscomers, variation with temperature for

liquid and gases.

7. Alkanes, Alkenes, Alkynes:

Isomerism, synthesis , chemical reactivity of alkanes, Mechanism of free radical helogination of alkanes, sulphonation of alkanes. Chemical reactivity, hydrogenation, heat of hydrogenation and stability of alkanes, electrophilic addition reaction & mechanism, helogination, hydrohelogination, hydration, hydroboration, Markownikoffs rule, peroxide effect, 1-3 dipolar addition.9only formation no details mechanism is required). Alkyne synthesis hydration, substitution reactions, polymerization.

8. Aromatics Hydrocarbons Aromatic substitution reactions :

Isomerism of aromatic compounds, their nomenclature, structure of benzene ring. General mechanism of aromatic electrophilic substitution (elementary treatment) Methods of synthesis, nitration, Sulphonation, halogenation.

Friedel-crafts alkylation and acylation, reaction, nuclear and side chain helogination.

9. Stereochemistry:

Conformation of Acyclic organic molecules: Strain in molecules, Bond stretching and

compression, Bond angle bending: Bond angle strain, Bond torsion: Torsional strain, Steric repulsion: van der Waals strain, Nomenclature for distinguishing

conformations of organic molecules, Dihedral angle and Torsion angle, Torsional curves of a few simple acyclic compounds(ethane, propane, n-butane), Butane-gauche interaction, calculation of % of anti and gauche forms n- butane at 2980K, Conformation of some H- bonded acyclic molecules. Conformation of cyclic organic molecules mainly Cyclohexane: Chair and Boat Form, Topomerisation of Chair form of cyclohexane; The Conformational preference of subsituent in chair cyclohexane, Conformations of a few substituted chair form of cyclohexane (1, 2- or 1 ,3- or1 ,4-dimethylcyclohexane), Conformations of cyclohexane-1,4-dione, 2- alkyl and 3-alkyl ketone effect, α - haloketone effect, Conformations of cyclohexene: A1,2 strain, Concept of I- strain.

10. Solubility and solubility product:

Common ion effect. Principal and reaction involved in the group separation and identification of cations and anion in the Qualitative inorganic analysis.

Paper II

1. i) Comparative study of the following groups of elements:

a) B, Al; b) C, Si, Ge, Sn, Pb;

c) N, P, S, As, Sb, Bi; d) O, S, Se, Te e) F, Cl, Br, I

in respect of electronic configuration, elements states, oxidation states, hydrides, halides oxides, and oxyacides.

ii) Bonding in diborene

2. Second law of thermodynamics :

Carnot cycle, Elementary treatment of entropy, free entry, work function & criterion of

equilibrium. Gibbs Helmohltz equation, Clasious clapeyron equation and its application.

3. Homogeneous chemical equilibrium :

Law of mass action and equilibrium constant Kp,Kc,Kx and their relationship.

Le-chatelier principal- effect of temperature, pressure and addition of products of relation and inert gases. Vant's hoff equation (derivation not required) and its application.

4. Alcohols & Ethers:

Methods of synthesis, physical properties, distinction of primary, secondary and

tertiary alcohols. Chemical reactivity. Ethers, methods of synthesis, Chemical reactivity.

5. Phenols:

Synthesis, physical properties acidic character of phenols, chemical reaction –

Reimer-Tiemann reaction, Fries rearrangement, Kolbe's reaction, phenol formaldehyde resins (Lederer-Manasse reaction) Cresols nitro and amino phenols.(Synthesis only).

6. Aldehydes and ketones:

Methods of synthesis of aldehydes and ketones, chemical reactivity of carbonyl group, cannizero reaction and adol condensation, relative reactivities of aldehyde and ketones. Perking reaction, benzoine condensation, Claisen condensation.

7. Carboxylic acid and their derivatives:

Methodes of synthesis, acidity of aliphatic and aromatic acid, effects of substitutents on acidity (simple cases). Chemical reactivity. Mechanism of esterification (AAC2): methods of synthesis and reaction of acid halides, amides, esters and anhydrides.

8. Organic compounds containing nitrogen:

Aromatic nitro compounds their synthesis, reduction under different conditions.

Methods of synthesis of aliphatic amines, Hinsberg's method of separation, Hofmann degradation, Gabrie's phthalimide synthesis, distinction between primary secondary & tertiary amines. Methods of synthesis of aromatic amines. Diazotizations and its mechanism. Synthetic application of aromatic diazonium salts.

9. Acids-Bases and Solvents:

Modern concepts of acids and bases: Arrhenius theory, theory of solvent system, Bronsted and Lowry's concept, Lewis concept with typical examples, applications and limitations. Strengths of acids and bases (elementary idea). Ionization of weak acids and bases in aqueous solution, ionization constants, ionic product of water, pH-scale.

10. Ionic Equilibrium:

Strong and weak electrolytes degree of dissociation. Ostwald's dilution law. Hydrolysis, buffer, calculation of pH, salt effect, elementary, elementary idea of activity & activity co-efficient of electrolytes, ionic strength, buffer reaction of blood.

11. EMF :

Electro chemical cells, half-cell, electrodes potential standard electrode potential, Nernst equation, redox potential, reference electrode,standered cell, measurement of emf, determination of pH, potentiometric titration, storage battery, corrosion.

1. Interhalogen compounds:

Basic properties of iodine, pseudo halogens.

2. Dilute solution:

Rault's law, ideal solution, non- ideal solution, and qualitative treatment of colligative

properties relative lowering of vapour pressure, elevationof boiling point, and osmotic pressure-their application in finding molecular weight. Van't Hoff 'i' factor, plasmolysis, haemolysis, isotonic solution, normal saline, role of osmosis in living organism.

3. Some Reaction of Synthetic Importance: (Mechanism and Importance)

Aldol Condensation, Arndt-Eistert Synthesis, Bayer-Villiger Reaction, Bischler-Napieralski Synthesis, Cannizzaro Reaction, Claisen Condensation, Claisen-Schmidt or Claisen Reaction, Dakin Reaction, Dieckmann Reaction, Diel's-Alder Reaction-Diene Synthesis, Elbs Persulphate Oxidation, Fischer-Indole Synthesis, Fitting-Reaction, Friedal Craft Reaction, Knoevenagel Reaction, Leuckart Reaction, Mannich Reaction, Meerwein-Ponndorf-verley Reduction, Michael Reaction, Oppenaure Oxidation, Peehmann Reaction, Perkin Reaction, Reformatsky Reaction, Reimer-Tiemann Reaction, Sommelet Reaction, Ullmann Reaction, Willgerdot Reaction, Witting Reaction, Wolf-Kishner Reduction.

4. Some Reagent of Synthetic Importance:

Alluminium isopropoxide, Alluminium-t-butoxide, Anhydrous alluminium chloride, Boron trifluoride, N- Bromosuccinimide(NBS), Diazoacetic ester, Diazomethane,

Dicyclohexylcarbodimide(DCC), Girard Reagents, Lead tetraacetate, Liquid ammonia, Lithium alluminium hydride, Osmium tetraoxide, Ozone, Perbenzoic acid, Periodic acid,

Platinum and Palladium catalyst, Polyphosphoric acid, Raney nickel, Selenium, Selenium dioxide, Sodamide, Sodium borohydride, Trifluoroacetic acid.

5. Molecular Rearrangements:

Introduction, Rearrangements to electron deficient atoms(C, N, O)(Pinacol-

pinacolone Rearrangement, Wagner-Meerwein Rearrangement, Wolf Rearrangement, Allylic Rearrangement, Sommelet-Hauser Rearrangement, Holfmann Rearrangement, Curtiuss Rearrangement, Schmidt Rearrangement, Lossen Rearrangement, Beckmann Rearrangement, Neber Rearrangement, Baeyer-Villiger Reaction, Cumene- Hydroperoxide Rearrangement, Dakin Rearrangement); Intermolecular aromatic rearrangement (Orton Rearrangement, Hoofmann-Martius Rearrangement); Intramolecular aromatic rearrangement (Claisen Rearrangement, Benzidine Rearrangement); Mixed types of aromatic rearrangement, Fries Rearrangement.

6. Organometallic Compounds:

Organomagnesium Compounds, Organozinc Compounds, Organolead Compounds,
Organocadmium Compounds.

7. Amino acids, Peptides and Protenins:

Amino acids (Preparative Methods, dipolar Nature, Chemical reaction, Detection and
Configaration); Peptides (The Peptide Linkage, Peptide Synthesis, Structure of
Polypeptides); Proteins (General Characteristics, Classification, Structure).

8. Carbohydrate:

Introduction, occurrence, classification, constitution of glucose, osazone formation. Reaction of glucose and fructose, mutration, cyclic structure-pyranose and furanose
form. Epimerisation, Chain lengthening and shortening in aidoses.

9. Chemicals Kinetics:

Rate, order and molecularity of a reaction, rate constants of first and second order
reactions, half life period, influence of temperature on reaction rate, activation energy, determination of order of a reaction.

10. Homogeneous catalysis:

Criterion of catalysis, mechanism of catalytic action, enzyme catalysis, industrial
catalyst.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

MINING ENGINEERING (DEGREE)

PAPER-I

I. MINING GEOLOGY:

a. Minerals: Properties of minerals, origin and occurrences.
b. Rocks: Igneous rocks, sedimentary rocks and methamorphic rocks, textures, structures and classifications.
c. Physical Geology: Geological work of wind, running water underground and surface, geological work of lakes and swamps, geological work or organism, volcanoes, earthquakes.
d. Structural Geology: Dip and strike, folds, joints, faults, unconformity, overlap, mountains.
e. Stratigraphy of India: The Archalan Group, Cuddapah system, Vindhyan system, Palaeozoic group, Mesozoic group, Gondwana group and Tertiary group.
f. Engineering Geology: Dam sites and reservoirs, bridge sites, geology of tunnels sites, stability of hill slopes and cutting, building stones, road materials, geology of water supply.
g. Economic Geology: Process of formation of mineral deposits, classification of mineral deposits.

II. MINING: METHODS OF MINING COAL AND METAL:

a. Coal: Assess to a mineral deposits, Incline and Adit, pit and shaft, shaft sinking, layout of pit-top and pit-bottom, bord and pillar method of working coal, development and depillaring, local-wall and other methods of working.
b. Metal: Methods of raising, methods of storing metalliferous deposits, application of underground metal mining methods, room and pillar, open slopes, sub-level sloping, sub-level caving, shrinking, block caving and out and fill slope.
c. Open Cast Mining: Manual and mechanized open cast working.

III. MINE SURVEYING:

a. Plotting and maintenance of various types of plans.
b. Chain Surveying: Principle and types, ranging, offsets, obstacles and sources of errors in chaining.
c. Dial: Uses of miner’s dial, hoose-needle and fixed needle, sources of error.
d. Leveling: Uses of leveling in mining, dumpy level, different methods of leveling errors, precise leveling sensitivity and determination of spirit level sensitivity.

IV. SAFETY AND LEGISLATION:

The Mines Act. 1952.

a. The Coal Mines Regulation, 1957.
b. The Metallifetous Mines Regulation, 1961.

PAPER – ll.

I. MINING MACHINERY:

a. The units, mass, force, weigh and basic definitions, work, energy and power.
b. Simple machines, levers, pulleys, transmission or power, strength and properties of materials, engineering materials, principles and uses of compressed air, types of wire ropes and their attachments, simple numerical problems.
c. Types of winding, friction winders, cages, shaft pittings, safty devices, rope haulages and locomotives, belt conyors, cable ropeways, fans, mine pumps and face mechanisation.
d. Earth leakage protection system, flame proof equipments, intrincically safe equipments, type of motors-squirrel cage induction motor, slipring induction motor, circuit breaker, synchronone induction motor, transformer, electric drill.

II. ROCK MECHANICS AND ROOF SUPPORT:

Pressure arch theory, subsidence, properties of types of roof, testing of roofs, timber supports, materials used for supports, systematic tintasing, withdrawals of supports, friction and hydraulic props, shield support, roof bolting, roof stiching floor bolting, capsule and bamboo bolting, stowing practices.

III. MINE ENVIROMENT:

Gases and gas detectors, underground air and ventilation system, control of mine ventilation and types of instruments used for its control distribution of air and its control, mine fires, explosions, rescue apparatus and operations mine lighting system, miner's diseases and dust hazards, subsidence and inundations, simple numerical problems.

IV. EXPLOSIVES AND BLASTING PRACTISE:

a. Strength, velocity of detonation, densition, water resistance, sensitivity, fume characteristics.
b. Low explosives.
c. High explosives.
d. Permitted explosives.
e. Detonators and accessories.
f. Exploders transport and storage, magazine, slurry explosives.

V. DRILLING:

Drilling patterns for underground, drilling patterns for open cast, methods employes for drilling.

1. Precussive Drilling:

a. Drilling with rigid rods.
b. Drilling with flexible cables.

2. Rotary Drilling:

a. Drilling by saw toothes cutter.

b. Drilling by tricone rock roller bit.

c. Drilling by diamond drill bit.

d. Drilling by chilled shots, types of drill bits, types of drill rods, core recovery drilling.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

MINING ENGINEERING (DIPLOMA)

PAPER-I

1. ELEMENTS OF MINING TECHNOLOGY
   Modes of Entry, Sinking Operations, Drifting and Tunneling.

2. ELEMENTS OF MINING SURVEYING
   Introduction, Chain Surveying, Compass Surveying.

3. MINE ENVIROMENTAL ENGINEERING
   Mine Atmosphere, Mine Ventilation System, Mine Lighting.

4. STRATA CONTROL AND ROOF SUPPORT
   Supports, Powered Supports, Stowing.

5. OPENCAST MINING AND LAND RECLAMATION
   Open Cast Mining, Opening of O/C Mine, Removal of Strata, land Reclamation.

6. MINE MANAGEMENT LEGISLATION AND GENERAL SAFETY
   Management, Safety, Legislation.

PAPER-II

1. ADVANCE MINE SURVEYING
   Triangulation Survey, Open Cast Mine Surveying.

2. ADVANCE MINING GEOLOGY
   Indian Stratigraphy, Ground Water, Prospecting Methods, Remote Sensing.

3. MINE FIRES, EXPLOSION, INUNDATION, RESCUE AND RECOVERY
   Mine Fires, Gas Explosion, Inundation.

4. WINNING AND WORKING METALS
   Irregular Deposits, Mode of Entry, Preparatory Work.

5. MINE MACHINERY AND MAINTENANCE
   Wire Rope, Winding, Compressed Air Machines.

6. DRILLING AND BLASTING PRACTICES IN MINES
   Surface Blasting.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

PHYSICS

PAPER I

1. Mechanics:

Conservation Laws, Collision impact parameter, Scattering cross-section centre of mass and lab systems with transformation of physical quantities, Rutherford Scattering Motion of a rocket under constant force, field, Rotating frames of reference, Coriolis force, Motion of rigid bodies, Angular momentum, Torque and procession of a top Gyroscope. Central forces Motion under inverse square law, Kepler's laws. Motion of Satellites (including geostationary) Galilean Relativity, Special Theory of Relativity, Michelson-Morley Experiment, Lorentz Transformations-addition theorem of velocities. Variation of mass with Velocity, Mass-energy equivalence. Fluid dynamics, streamlines, turbulence, Bernoulli's Equation with simple applications.

2. Thermal Physics:

Laws of Thermodynamics, Entrophy, Carnot's cycle, isothermal and Adiabatic changes. Thermodynamcis Potentials, Maxewell's relations, the Clausius-Clapeyron equation, reversible cell, joule-Kelvin effect. Stefan-Boltzmann Law. Kinetic Theory of Gases. Maxwell's Distribution Law of Velocitites, Equipartition of energy, specific heats of gases, mean Free path, Brownian Motion, Black body radiation, specific heat of solids-Einstein & Debye theories, Wein's Law Planck's Law, Solar Constant. Thermalionization and Stellar spectra. Production of low temperatures using adiabatic demagnetization and dilution refrigeration, concept of negative temperature.

3. Waves and Oscillations:

Oscillations, Simple harmonic motion, stationary and traveling waves, Damped harmonic motion, Forced oscillation & Resonance wave equation, Harmonic solutions, plane and spherical waves, super position of waves, phase and group velocities, Beats Huygen's principle. Interference Diffraction Fresnel & Fraunhofer. Diffraction by straight edge, Single and multiple slits. Resolving power of grating and Optical Instruments, Rayleigh Criterion. Polarization; Production and Detection of Polarized light (linear, circular and elliptical) Laser sources (Helium-Neon, Ruby and semi conductor diode). Concepts of spatial

and temporal coherence. Diffraction as a Fourier Transformation. Fresnel and Fraunhofer diffraction by rectangular and circular apertures. Holography theory and applications.

PAPER II

1. Electricity & Magnetism :

Coulomb's Law Electric field. Gauss's Law, Electric potential. Poisson and Laplace equations for a homogeneous dietectric, unchanged conducting sphere in a uniform field. Point charge and infinite conduction plane. Magnetic shell. Magnetic induction and field strength. Blot-Savart law and applications. Electromagnetic Induction Faraday's and Lenz's laws, self and Mutual inductances. Alternating currents. L.C.R. circuits, series and parallel resonance circuits, quality factor. Kirchoff's laws with applications Maxwell's equations and electromagnetic waves. Transverse nature of electromagnetic waves, Pointing vector. Magnetic field in mater-dia, para, ferro antiferro and ferri magnetism (qualitative approach only).

2. Modern Physics:

Bohr's theory of hydrogen atom. Electron spin. Optical and X-ray Sepectra. Stern-Gerlach experiment and spatial quantization. Vector model of the atom, spectral terms, fine structure of spectral lines J-J and L-S coupling. Zeeman effect, Pauli's exclusion principles spectral terms of two equivalent non-equivalent electrons. Gross and fine structures of electronic band Spectra. Raman effect. Photoelectric effect, Compton effect. Debrogile waves. Wave Particle duality and uncertainty principle. Schrodinger wave equation with application to (i) particle in a box (ii) motion across a step potential. One dimensional harmonic oscillator. Eigen values and Eigen functions. Uncertainty Prinicples Radioactivity. Alpha, beta and gamma radiations. Elementary theory of the alpha decay. Nuclear binding energy. Mass spectroscopy, Semi empirical mass formula, Nuclear fission and fusion. Elementary Reactor Physics Elementary particles and their classification. Strong and Weak Electromagnetic interactions. Particle accelerator, cyclotron, Leniar accelerators. Elementary ideas of superconductivity.

3. Electronics :

Band theory of solids-conductors, insulators, and semi conductors, intrinsic and extrinsic semiconductors P.N. Junction. Thermister Zenner diodes reverse and forward biased P-N. junction, solar cell. Use of diodes and transistors for rectification, amplification oscillators, modulation and detection of r.f.waves. Transistor receivers, Television, Logic Gates.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

PHYSIOTHERAPY (DEGREE)

PAPER-I

I. ANATOMY

1. General Anatomy:
- Introduction to Anatomy, terms and terminology.
- Regions of Body, Cavities and systems.
- Surface anatomy – musculo-skeletal, vascular, cardiopulmonary system
- General Embryology.
- Applied anatomy.

2. Musculoskeletal system.
- Connective tissue & its modification, tendons, membranes, special connective tissue.
- Bone structure, blood supply, growth, ossification, and classification.
- Muscle classification, structure and functional aspect.
- Joints – classification, structures of joints, movements, range, limiting factors, stability, blood supply, nerve supply, dislocations and applied anatomy.

2(a). Upper extremity:
- Bony architecture
- Joints – structure, range of movement
- Muscles – origin, insertion, actions, nerve supply
- Major nerves – course, branches and implications of nerve injuries
- Development of limb bones, muscles and anomalies
- Radiographic identification of bone and joints
- Applied anatomy

2(b). Lower Extremity:
- Bony architecture
- Joints – structure, range of movement
- Muscles – origin, insertion, actions, nerve supply
- Major nerves – course, branches and implications of nerve injuries
- Development of limb bones, muscles and anomalies
- Radiographic identification of bone and joints
- Applied anatomy

2(c). Spine and thorax
- Back muscles - Superficial layer, Deep muscles of back, their origin, insertion, action and nerve supply.
- Vertebral column – Structure & Development, Structure & Joints of vertebra
- Thoracic cage
- Radiographic identification of bone and joints
- Applied anatomy

2(d). Head and neck:
- Cranium
- Facial Muscles – origin, insertion, actions, nerve supply
- Temporo mandibular Joints – structure, types of movement

3. Nervous system
- Classification of nervous system
- Nerve – structure, classification, microscopy with examples.

- Neurons, classification with examples. Simple reflex arc.
- Parts of a typical spinal nurve/Dermatome
- Central nervous system – disposition, parts and functions
- Cerebrum
- Cerebellum
- Midbrain & brain stem
- Blood supply & anatomy of brain
- Spinal cord- anatomy, blood supply, nerve pathways
- Pyramidal, extra pyramidal system
- Thalamus, hypothalamus
- Structure and features of meningies
- Ventricles of brain, CSF circulation
- Development of nervous system & defects
- Cranial nerves – (course, distribution, functions and palsy)
- Sympathetic nervous system, its parts and components
- Parasympathetic nervous system
- Applied anatomy

4. Sensory system
- Structure and function of
    - Visual system
    - Auditory system
    - Gustatory system
    - Olfactory system
    - Somato sensory system

5. Cardiovascular system
- Circulatory system – major arteries and veins of the body, structure of blood vessels
- Heart structure, positions, chambers, valves, internal & external features
- Blood supply to heart
- Conductive system of heart

6. Lymphatic system
- Circulation, structure & functions
- Lymph nodes

7. Respiratory system
- Structure of upper and lower respiratory tract

Thorax:
- Pleural cavities & pleura
- Lungs and respiratory tree
- Heart and great vessels
- Diaphragm

8. Digestive system
- Parts of digestive system
- Abdominal cavity – divisions
- Muscles of abdominal wall
- Liver
- Pancreas
- Spleen
- Alimentary canal
- Gall bladder
- Intestine (small & large)

9. Urinary and Reproductive system

- Urinary system
- Pelvic floor, innervations
  - Kidney, Ureter, bladder, urethra
- Genital system – male and female
  - Reproductive system of male
  - Reproductive system of female

10. Endocrine system
- Pituitary gland
- Thyroid
- Parathyroid

II. PHYSIOLOGY

1. General Physiology
- Cell: morphology, Structure and function of cell organelles
- Structure of cell membrane
- Transport across cell membrane
- Intercellular communication
- Homeostasis

2. Blood
- Introduction-composition & function of blood
- W.B.C., R.B.C., Platelets formation & functions, Immunity
- Plasma: composition, formation & functions, Plasma Proteins:-types & functions
- Blood Groups- types , significance, determination
- Hemoglobin
- Haemostasis
- Lymph-composition, formation, circulation &functions

3. Cardiovascular system
- Conducting system-components, impulse conduction
- Heart valves
- Cardiac cycle- definition, phases of cardiac cycle
- Cardiac output- definition, normal value, determinants. Stroke volume and its regulation
- Heart rate and its regulation
- Arterial pulse, Blood pressure-definition, normal values, factors affecting blood pressure
- Shock-definition, classification, causes and features
- Basic idea of ECG
- Cardiovascular changes during exercise

4. Respiratory System
- Mechanics of respiration
- Lung volumes and capacities
- Pulmonary circulation, transport of respiratory gases
- Factors affecting respiration
- Regulation of respiration-neural regulation, voluntary control and chemical regulation
- Hypoxia, Hypercapnoea, Hypocapnoea
- Artificial respiration
- Disorders of respiration- dyspnoea, orthopnoea, hyperpnoea, hyperventilation, apnoea, tachypnoea
- Respiratory changes during exercise.

5. Nerve Muscle Physiology

- Muscles- classification, structure, properties, Excitation contraction coupling
- Motor unit, EMG, factors affecting muscle tension,
- Muscle tone, fatigue, exercise
- Nerve –structure and function of neurons, classification, properties
- Resting membrane potential & Action potential their ionic basis
- All or None phenomenon
- Neuromuscular transmission
- Ionic basis of nerve conduction
- Concept of nerve injury & Wallerian degeneration
- Synapses
- Electrical events in postsynaptic neurons
- Inhibition & facilitation at synapses
- Chemical transmission of synaptic activity
- Principal neurotransmitters.

6. Nervous system

- Introduction, central and peripheral nervous system, functions of nervous system
- Reflexes- monosynaptic, polysynaptic, superficial, deep &withdrawal reflex
- Sense organ, receptors, electrical & chemical events in receptors
- Sensory pathways for touch, temperature, pain, proprioception & others
- Control of tone & posture: Integration at spinal, brain stem, cerebellar, basal ganglion levels, along with their functions
- Motor mechanism: motor cortex, motor pathway:the descending tracts- pyramidal & extra pyramidal tracts-origin, course, termination & functions. Upper motor neuron and lower motor neuron paralysis.
- Spinal cord lesions- complete transection & hemisection of the spinal cord
- Autonomic nervous system :features and actions of parasympathetic & sympathetic nervous system
- Hypothalamus
- Higher functions of nervous system
- Special senses- eye, ear, nose, mouth

7. Renal System

- Physiology of kidney and urine formation
- Glomerular filtration rate, clearance, Tubular function
- Water excretion, concentration of urine-regulation of Na^+, Cl^-, K^+ excretion
- Physiology of urinary bladder

8. Digestive System

- Digestion & absorption of nutrients
- Gastrointestinal secretions & their regulation
- Functions of Liver & Stomach.

10. Endocrinology

- Physiology of the endocrine glands – Pituitary, Pineal Body, Thyroid, Parathyroid, Adrenal, Gonads, Thymus, Pancreas. Hormones secreted by these glands, their classifications and functions.

11. Male & female reproductive system

- Male - Functions of testes, pubertal changes in males, testosterone - action & regulations of secretion.
- Female - Functions of ovaries and uterus, pubertal changes, menstrual cycle, estrogens and progestron - action and regulation.

III. CLINICAL BIOCHEMISTRY

1. Nutrition: RDA, BMR, SDA, caloric requirement and balanced diet.
2. Carbohydrates: Definition, classification and general functions. Carbohydrate Metabolism - Glycolysis, T.C.A cycle.
3. Lipids: Definition, classifications and general functions. Essential fatty acids and their importance, Cholesterol, Lipoproteins. Metabolism-β−Oxidation of fatty acids, fatty liver and ketosis.
4. Amino Acids : Definition, classification, essential and non essential aminoacids.
5. Proteins: Definition, classification, and Bio-medical Importance. Metabolism: Formation and fate of ammonia, Urea cycle and its significance.
6. Study of hemoglobin and myoglobin with their functions.
7. Enzymes: Definition, classification with examples, Factors affecting enzyme action, isoenzyme and co-enzyme, Clinical importance of enzymes.
8. Biochemistry of connective tissue - Introduction, various connective tissue proteins : collagen, elastin- structure and associated disorders.
9. Vitamins: Definition, classification and functions, dietary source, daily requirement and deficiency disorders.
10. Diabetes mellitus - definition, types & causes.

IV. GENERAL PSYCHOLOGY

1. Introduction to Psychology, Fields of application of Psychology, influence of heredity and environment on the individual.
2. Learning – theories and principles of learning, Learning disabilities.
3. Memory – types, theories of memory and forgetting, methods to improve memory.
4. Thinking – process of thinking, problem solving, decision making and creative thinking.
5. Motivation - theories and types of Motivation.
6. Emotions - theories of emotions and stress, Emotional and behavioural disorders of childhood and adolescence, Disorders of under and over controlled behaviour, Eating disorders.
7. Attitudes – theories, attitudes and behaviour, factors in attitude change.
8. Intelligence - theories of intelligence, I.Q., general intelligence and special intelligence, intelligence tests and their uses.
9. Personality, theories of personality, factors influencing personality, Personality Disorders.
10. Conflict and frustration - Common defensive mechanism: Identification, regression, repression, projection, sublimation and rationalization.
11. Attention and Perception: Nature of attention, factors determining attention, nature of perception, principle of perceptual grouping; illusions and Hallucination.
12. Counselling - Aims and principles.
13. Development and growth of behaviour in infancy and childhood, adolescence, adulthood and old age, normal and abnormal.
14. Psychotherapy – introduction to paradigms in psychopathology and therapy.
15. Mental deficiency -
    a) Mental retardation
    b) Autistic behaviour
    c) Learning disabilities.

V. BIOMECHANICS AND KINESIOLOGY

1. Mechanics - Definition of mechanics and Biomechanics
2. Motion: definition, types of motion, plane and axis of motion, factor determining the kind and modification of motion.
3. Force - Definition, diagrammatic representation of force, point of application, classification of forces, concurrent, coplanar and co-linear forces, composition and resolution of forces, angle of pulls of muscle
4. Friction
5. Gravity - Definition, line of gravity, Centre of gravity
6. Equilibrium - Supporting base, types, and equilibrium in static and dynamic state
7. Levers - Definition, function, classification and application of levers in physiotherapy & order of levers with example of lever in human body
8. Pulleys - system of pulleys, types and application
9. Elasticity - Definition, stress, strain, HOOKE'S Law
10. Springs - properties of springs, springs in series and parallel, elastic materials in use
11. Muscular system
12. Definition, properties of muscle, muscular contraction, structural classification, action of muscle in moving bone, direction of pull, angle of pull, functional classification, coordination of muscular system.
13. Joint structures and functions:
    i. Joint design, Structure of Connective Tissue, Properties of Connective Tissue, joint function, changes with disease, injury, immobilization, exercise, over use
    ii. Structure and functions of upper extremity joints – shoulder complex, elbow complex, wrist and hand complex
    iii. Structure and functions of lower extremity joints – hip joint, knee joint, ankle and foot complex
    iv. Structure and functions of axial skeletal joints – vertebral column – craniocervical, thorax, lumbar, lumbo pelvic region
    v. Structure and functions of tempromandibular joint
14. Posture – dynamic and static posture, kinetic and kinematics of posture, analysis of posture, effect of age, pregnancy, occupation on posture.
15. Gait – kinematics and kinetics of gait, gait in running and stair climbing.

VI. FUNDAMENTALS OF EXERCISE THERAPY

1. Introduction to exercise therapy
2. Mechanical principle applied in human body – gravity, centre of gravity, line of gravity, base of support, equilibrium, axis and planes
3. Disability models – ICIDH model of disability, Nagi model of disability, ICF model
4. Exercise physiology – effect of exercise in various systems – musculoskeletal, neuromuscular, cardiovascular, respiratory system
5. Movements
6. Passive movements – definition, classification, indications, contra indications, advantages, limitations, techniques - emphasize PROM to upper, lower, neck and trunk muscles
7. Active movements - definition, classification, indications, contra indications, advantages, limitations, techniques - emphasize active movements to upper, lower, and neck and trunk muscles
8. Starting positions – muscle work, effect and uses and derived positions
9. Relaxation – definition, types of relaxation, relaxation techniques

10. Suspension – definition, types, uses and therapeutic applications
11. Balance-static and dynamic balance, mechanism of balance control, balancing exercises
12. Neuromuscular coordination – causes of in coordination, exercises to improve coordination – Frenkle exercise
13. Joint range measurement – Goniometer, types and techniques of measuring joint ROM
14. Measurement of limb length, girth
15. Manual muscle testing – grading system, techniques- emphasize on skill to grade upper, lower, neck and trunk muscles.
16. Mobility aids – crutches, canes, walker
17. Soft tissue manipulation (massage) – history, types, techniques, physiological effects, therapeutic uses, contraindications

VII. FUNDAMENTALS OF ELECTRO THERAPY

1. Basic components of electric current-electrons, protons, neutrons, ions, matter, molecules
2. Current electricity – static electricity, electric charge, conductors, conduction of electricity, resistance, factors effecting resistance with example in human body, insulation, unit of electric current – ampere, coulomb, volt, ohms law
3. Magnetism, theories of magnetism, properties of magnet.
4. Electromagnetic induction, electromagnetic radiation, laws governing radiations – Grouth's law, cosine law, inverse square law, law of reflection, rarefaction.
5. Electrical components – transformer, capacitor, diode, valves
6. Types of electric current, wave forms, current modulation – continuous, burst, beat, surge. Electric circuit in parallel and series.
7. Safety issues while using electrical equipments – for patients and therapist
8. Muscle and nerve response to electrical stimulation – polarization, depolarization and propagation of impulse.
9. Pain – types of pain, pain pathway, theories of pain, Gate control theory of pain, pain modulation at various levels.
10. Low frequency currents:
    a. Neuromuscular electrical stimulation – physiological effects, therapeutic uses of electrical stimulation techniques – electrodes type, electrode size, electrode placement, stimulating points, methods of reducing skin electrode resistance, contraindications and precautions.
    b. High voltage pulsed stimulation. c. Russian stimulation.
    d. Trans cutaneous Electrical Nerve stimulation (TENS) – therapeutic uses of TENS, types, electrode placement in TENS, contraindications and precautions
    e. Iontophoresis – mechanism, biophysical effect, medication dosage, medicated ions used, techniques of application.
11. Electro diagnostic test – FG test, strength duration curve, chronaxie, reobase
12. Interferential therapy (IFT) – physiological effects, therapeutic indications, methods of application, sweep, base, contraindication and precautions.

VIII. MEDICAL MICROBIOLOGY

1. Introduction & History of Microbiology
2. Classification of microorganism : Bacterial Morphology, cells structure, difference between prokaryotes & eukaryotes, capsule, flagella, fimbrae, pilli, cell wall, plasma membrane, cytoplasm, ribosomes etc.
3. Bacteriology - Classification of Bacteria, Morphological characteristics of different bacteria.
4. Bacterial growth/Reproduction : Growth curve

5. Sterilization & disinfection :
   a) Physical Methods
   b) Chemical Methods
   c) Mechanism of Sterilizations
   d) Difference between sterilization and disinfection.
6. Modes of transmission of diseases
   a) Various routes of spread of infection.
   b) Hospital acquired infection.
   c) Bacterias responsible for nosocomial infectious
7. Bacterial diseases (in brief):
   - Mycobacterial diseases: Tuberculosis, Leprosy and Syphilis.
   - Bacterial disease: Pyogenic, Diphtheria, Gram negative infection, Bacillary dysentery.
8. Viral diseases (in brief) : Poliomyelitis, Herpes, Rabies, Measles, Rickttsia, Chlamydial infection, HIV infection.
9. Fungal diseases and opportunistic infections (in brief).
10. Food sanitation
    a) Hygiene in restaurants & kitchens.
    b) Health of food handlers & hygiene.
    c) Disease caused by infected food & water.
11. Immunity
    a) Active, passive
    b) Natural, acquired
    c) Antigen
    d) Antibody, type of antibodies
    e) Antigen antibody reactions.
    f) Mechanism of immunity
    g) Immunization.
12. AIDS - Aetiology, modes of transmission, diagnostic procedure.
13. Handling of infected material.

IX. PATHOLOGY

1. Introduction to Pathology
2. Cell injuries:
   - Aetiology and Pathogenesis with a brief recall of important aspects of normal cell structure.
   - Reversible cell injury: Types, Sequential changes, Cellular swellings, vacuolation, Hyaline changes, Mucoid changes.
   - Irreversible cell injury: Types of Necrosis & Gangrene, Autolysis.
   - Pathologic calcification: Dystrophic and Metastatic. Intracellular Accumulations.
3. Inflammation and Repair
   - Acute inflammation: features, causes, vascular and cellular events, Inflammatory cells and Mediators.
   - Chronic inflammation: Causes, Types, Classification nonspecific and granulomatous with examples.
   - Repair, Wound healing by primary and secondary union, factors promoting and delaying the process. Healing in specific site including bone healing.
4. Circulatory Distrurbances
   - Hyperemia/Ischemia and Haemorrhage
   - Edema: Pathogenesis and types.

- Chronic venous congestion: Lung, Liver, Spleen, Systemic Pathology
- Thrombosis and Embolism: Formation, Fate and Effects.
- Infarction: Types, Common sites.
- Shock: Pathogenesis, types, morphologic changes.

5. Growth Disturbances and Neoplasia
   - Atrophy, Hypertrophy, Hyperplasia, Aplasia, Hypoplasia, dysplasia. Precancerous lesions.
   - Neoplasia: Definition, classification, Biological behaviour: Benign and Malignant (brief idea), Carcinoma and Sarcoma.
6. Hematology
   - Constituents of blood and bone marrow, Regulation of hematopoiesis.
   - Anemia: Classification, clinical features & lab diagnosis (brief idea).
   - Hemostatic disorders, Vascular and Platelet disorders & lab diagnosis.
   - Coagulopathies - (i) Inherited (ii) Acquired with lab diagnosis.
   - Leukocytic disorders: Leukocytosis, Leukopenias, Leukemoid reaction.
   - Leukemia: Classification, clinical manifestation, pathology and Diagnosis (brief idea).
7. Respiratory System
   - Pneumonia, Bronchitis, Bronchiectasis, Asthma, Tuberculosis, Carcinoma of lungs, Occupational lung diseases
8. Cardiovascular Pathology
   - Congenital Heart diseases: Atrial septal defect, Ventricular septal defect, Fallot's tetralogy, Patent ductus arteriosu,. Endocarditis, Rheumatic Heart disease.
   - Vascular diseases: Atherosclerosis, Monckeberg's medial calcification.
   - Ischemic heart Disease: Myocardial infarction.
9. Hepato Biliary Pathology
   - Jaundice: Types, aetio-pathogenesis and diagnosis.
10. Musculoskeletal System
    - Osteomyelitis: acute, chronic, tuberculous, mycetoma
    - Metabolic diseases: Rickets/ Osteomalacia, osteoporosis, Hyperparathyroidism, Paget's disease.
    - Tumours Classification: Benign, Malignant, Metastatic and synovial sarcoma.
    - Arthritis: Suppurative, Rheumatoid. Osteoarthritis, Gout, Tuberculous.
11. Endocrine pathology
    - Non-neoplastic lesions of Thyroid: Thyrotoxicosis, myxedema,
12. Neuropathology
    - Inflammations and Infections: TB Meningitis, Pyogenic Meningitis, viral meningitis and Brain Abscess, Tuberculosis, Cysticercosis.
13. Dermatopathology:
    - Skin tumors: Squamos cell carcinoma, Basal cell carcinoma, Melanoma (brief idea)
14. Congenital Myopathy & mysthenia gravis

X. PHARMACOLOGY

1. General Pharmacology:
   - Introduction, Definitions, Classification of drugs, Sources of drugs, Routes of drug administration,
   - Distribution of drugs, Metabolism and Excretion of drugs, Pharmacokinetics, Pharmacodynamics,
   - Factors modifying drug response.

- Elementary knowledge of drug toxicity, drug allergy, drug resistance, drug potency, efficacy & drug antagonism.

2. Autonomic Nervous system
   - General considerations – The Sympathetic and Parasympathetic Systems, Receptors, Somatic Nervous System
   - Cholinergic and Anti-Cholinergic drugs, Adrenergic and Adrenergic blocking drugs, Peripheral muscle relaxants.
3. Cardiovascular Pharmacology (in brief) :
   - Drugs Used in the Treatment of Heart Failure: Digitalis, Diuretics, Vasodilators, ACE inhibitors
   - Antihypertensive Drugs: Diuretics, Beta Blockers, Calcium Channel Blockers, ACE Inhibitors, Central Acting Alpha Agonists, Peripheral Alpha Antagonists, Direct acting Vasodilators
   - Antiarrhythmic Drugs
   - Drugs Used in the Treatment of Vascular Disease and Tissue Ischemia: Vascular Disease, Hemostasis Lipid-Lowering agents, Antithrombotics, Anticoagulants and Thrombolytics
   - Ischemic Heart Disease – Nitrates, Beta-Blockers, Calcium Channel Blockers
   - Cerebral Ischemia
   - Peripheral Vascular Disease
4. Neuropharmacology (in brief) :
   - Sedative-Hypnotic Drugs: Barbiturates, Benzodiazepines
   - Antianxiety Drugs: Benzodiazepines, Other Anxiolytics
   - Drugs Used in Treatment of Mood Disorders: Monoamine Oxidase Inhibitors, Tricyclic Antidepressants, Atypical Antidepressants, Lithium
   - Antipsychotic drugs
5. Disorders of Movement (in brief) :
   - Drugs used in Treatment of Parkinson's Disease
   - Antiepileptic Drugs
   - Spasticity and Skeletal Muscle Relaxants
6. Inflammatory/Immune Diseases-
   - Non-narcotic Analgesics and Nonsteroidal Anti-Inflammatory Drugs: Acetaminophen, NSAIDs, Aspirin, Nonaspirin NSAIDs, drug Interactions with NSAIDs
   - Glucocorticoids: Pharmacological Uses of Glucocorticoids, adverse effects, Physiologic Use of Glucocorticoids
   - Drugs Used in Treatment of Arthritic Diseases: Rheumatoid Arthritis, Osteoarthritis, Gout
   - Drugs Used in the Treatment of Neuromuscular Immune/Inflammatory Diseases: Myasthenia gravis, Idiopathic Inflammatory Myopathies, systemic lupus Erythmatosus, Scleroderma, Demyelinating Disease
7. Respiratory Pharmacology (in brief) : Obstructive Airway Diseases, Drugs used in Treatment of Obstructive airway Diseases, Allergic Rhinitis
8. Digestion and Metabolism (in brief):
   - Gastrointestinal Pharmacology: Peptic Ulcer Disease, Constipation, Diarrhea
   - Drugs Used in Treatment of Diabetes Mellitus: Insulin, Oral Hypoglycemics
9. Geriatrics:
   - Pharmacology and the geriatric Population: Adverse effects of special concern in the Elderly, Dementia, Postural hypotension, urinary incontinence.

PAPER-II

I. ORTHOPAEDICS

1. Introduction to Orthopaedics:
   An Orthopaedic patient, history taking, clinical features, clinical examination, and investigation (X- ray, CT scans, MRI scan, Bone scan)
2. Injuries of muscle & tendons : etiology & management.
3. Bony & Soft tissue injuries :
   Injury & repair, Clinical presentation, evaluation & general principles of rehabilitation management, Tenosynovitis, Bursitis etc.
4. Fractures -
   a. Types, Healing, complications, general principles of treatment.
   b. Fracture of Spine, pelvis, hip joint, femur, patella, knee joint, cartilage and ligaments, tibia, fibula, ankle, calcaneum, metatarsals, calvicle, scapula, ribs, humerus, elbow joint, radius, ulna, scaphoid, metacarpals & phalanges.
   c. Fracture separation of epiphysis.
5. Inflammation of bones & joints (Clinical features, evaluation, conservative & surgical management) -
   a) Bones - Osteomyelitis- osteomyelitis - pyogenic & tubercular, osteoarthritis.
   b) Joints - Rheumatoid arthritis, Juvenile Arthritis, Reiter's disease, Polymyalgia rheumatica, Gout, Ankylosing spondylitis, Neuropathic- joints, haemophilic arthropathy, Avascular necrosis.
6. Nutritional & metabolic diseases of bones : Rickets, Osteomalacia & Osteoporosis.
7. Spine deformities:
   Clinical features, diagnosis, management of Scoliosis, Kyphosis, Lordosis, Spondylosis, prolapse of intervertebral disc, cord compression, sacralization and traumatic deformities (paraplegia & quadriplegia).
8. Infections of Musculoskeletal system –
   a. Bacterial infections
   b. Tubercular infections, Leprosy, Pott's paraplegia
9. Congenital malformations (in brief description with outline of treatment):
   a. Congenital Hip Displasia, Congenital Talipes Equinovarus / Calcaniovalgus, Arthrogryposis Multiplex Congenita, Congenital Torticolis, Acromelia, phocomelia, Amelia,
   b. Spina Bifida: all types, clinical presentation, sequel & management
10. Developmental diseases of skeleton:
    Osteogenesis imperfecta, heterotopic ossification, Osteochondritis, Perthes' disease.
11. Neuromuscular diseases:
    a) Volkmann's Ischaemic contracture, obstetrical paralysis, and peroneal muscular atrophy
    b) Poliomyelitis – orthopaedic aspects and treatment of deformities.
12. Upper Limbs:
    Clinical presentation, evaluation, conservative & surgical management of rotator cuff injuries, adhesive capsulitis, bursitis, biceps tendonitis, shoulder dislocation, snapping & winged scapula, tennis and golfer elbow, olecranon bursitis, soft tissue injuries, sprains and strains, Arthritic conditions, tenosynovitis, Carpal tunnel syndrome, wrist drop, claw hand, mallet finger, Duputyren's contracture, reflex sympathetic dystrophy, common fractures and dislocations.

13. Lower Limb:
Clinical presentation, evaluation, conservative & surgical management of Arthritic conditions, soft tissue injuries, sprains and strains, achillis tendonitis, bursitis, plantar fascitis, deformities, reflex sympathetic dystrophy, neuropathic Joints, common fractures and dislocations, prescavus, pesavaglus, hallus valgus footstrains, metatarasalgia, hallus rigidus, ingrowing toe nail.
14. Neuro-vascular Diseases :
Orthopaedic aspects and treatment of - Nerve injuries (major nerves), Plexus injuries
15. Amputations :
Justification, outline of surgical approaches, incisions, procedures, indications, contraindications, complications & management.
16. Bone tumors : benign & malignant (in brief)
17. Operations :
Reconstructive arthoplasty, arthodesis, bone grafting, osteotomy, tenden transplantation & transfer, nerve- neurolysis, suture, graft and decompression.
18. Othopaedic splints and appliances.
19. Tractions : Skin, skeleton (in brief).
20. Foot arches & their complications.
21. Rehabilitation of patients.

II. GENERAL MEDICINE INCLUDING PEDIATRICS & PSYCHIATRY

1. Introduction:
Brief outline of subject of medicine, a medical patient, common signs & symptoms of disease
2. Infectious Diseases:
Brief description of concept of infection, types, classification & common clinical manifestation of infection and general principle of management
3. Nutritional & Metabolic Diseases:
Brief description of following diseases along with outline of management: Diabetes Mellitus, Vitamins (A, B, C, D & K) and Minerals (iron, calcium phosphorus, iodine) deficiencies, and Obesity
4. Alimentary tract:
Brief description of manifestations of alimentary tract disease & general principle of diagnosis & outline of management of following diseases: Peptic ulcer disease, common infections of small & large intestine
5. Brief description of liver diseases along with outline of management:
Hepatitis, & Jaundice
6. Diseases of connective tissues:
Brief description of manifestations along with outline of management of - SLE, polymyositis
7. Diseases of skin:
Brief description of manifestations along with outline of management of common skin diseases - scabies, pediculosis, taeniasis, impetigo & psoriasis
8. Geriatrics-
Physiology of ageing, manifestations of diseases in old people and general principles of management. Implications of aging in physical therapy. lung disease, Pleurisy & Pulmonary embolism
9. First Aid in common Medical Emergencies
10. Cardio-vascular System:
Manifestations of heart & vascular disease & general principle of diagnosis. Brief

description of following diseases along with outline of management: Cardiac failure, Ischaemic heart disease, hypertension, atherosclerosis, Deep vein thrombosis

11. Respiratory System:
    Manifestations of respiratory disease & general principle of diagnosis. Brief description of following diseases along with outline of management:
    Obstructive Pulmonary diseases (Bronchial Asthma, COPD), pulmonary infections (Pneumonia, Bronchitis, Lung abscess, Tuberculosis), Respiratory failure, occupational lung diseases
12. Neurology:
    Brief Description of Headache, migraine, raised intra-cranial pressure. Inflammatory conditions – meningitis (bacterial, tubercular), rabies
    Disorders of cerebral circulation - ischaemia, haemorrhages (CVA), HT encephalopathy
    Demyelinating diseases- acute disseminated encephalomyelitis, multiple sclerosis
    Extra pyramidal syndromes - Parkinson's disease, Chorea, Athetosis, Dystonia, hemiballismus,
    Spasmodic Torticollis
    Convulsive disorders - epilepsy (GM, PM, Psychomotor), tetany
13. Developmental and degenerative syndromes –
    Cerebral palsy, kernicterus, hereditary ataxias, motor neuron disease, Peroneal muscular atrophy
14. Disorders of Spinal cord and Cauda Equina-
    Spinal cord injury, paraplegia, quadriplegia, spina-bifida, transverse myelitis, Neurogenic bladder and bowel
15. Peripheral nerve disorders –
    Traumatic / compression or entrapment neuropathy, polyneuritis, GB syndrome, diabetic polyneuropathy and spinal radiculopathies. Special emphasis on brachial and lumbo-sacral plexuses and major nerves – radial, ulnar, median, femoral, and sciatic nerve
16. Muscle disorders –
    Progressive muscular dystrophy, polymyositis, myasthenia gravis, floppy infant syndrome

PEDIATRICS

1. Normal Growth and development of child : Motor, mental, language and social
2. Common infectious diseases in children:
   Brief description of following infectious diseases along with outline of management:
   Tetanus, diphtheria, Mycobacterial, measles, chicken pox, gastroenteritis, HIV, and Malaria
3. Immunization programmes:
   WHO schedule, different vaccinations, rationale; special consideration to various disease eradication programmes like Pulse-Polio
4. Child and nutrition :
   Nutritional requirements, malnutrition syndrome, Vitamins (A, B, C, D & K) and Minerals (iron, calcium phosphorus, iodine) deficiencies in children and management in brief
5. Clinical presentation, management & prevention of the following : Cerebral palsy, Poliomyelitis, Muscular dystrophy
6. Childhood rheumatism :
   Types, clinical presentation, & management in brief

7. Acute CNS infections:
   Clinical presentation, complications and management of bacterial and tubercular infections in brief
8. Clinical presentation, management & prevention of the following respiratory conditions: URI, LRI, bronchiolitis, asthma, TB
9. Clinical presentation, management & prevention of the following cardiac conditions: Rheumatic heart disease, SABE, Congenital heart disease - ASD, VSD, PDA

PSYCHIATRY

1. Modalities of psychiatric treatment
2. Psychiatric illness and physical therapy link
3. Brief description of Etio-pathogenesis, manifestations, and management of psychiatric illnesses -
   a. Anxiety neurosis
   b. Depression
   c. Obsessive compulsive neurosis
   d. Psychosis- Définition & types
   e. Maniac-depressive psychosis
   f. Post-traumatic stress disorder
   g. Psychosomatic reactions: Stress and Health, theories of Stress – Illness Link
4. Brief description of Etio-pathogenesis, manifestations, and management of psychiatric illness
   a. Drug dependence and alcoholism
   b. Somatoform and Dissociate Disorders – conversion reactions, Somatization, Dissociate Amnesia, and Dissociate Fugue
   c. Personality disorders
5. Child psychiatry:
   Brief descriptions of manifestations, and management of childhood disorders - attention deficit syndrome, and behavioral disorders
6. Geriatric Psychiatry (in brief)

III. GENERAL SURGERY

1. Fluid, Electrolyte and Acid-Base disturbances –
   Diagnosis and management ; Nutrition in the surgical patient., Shock - Clinical feature, pathology & management.
2. Transfusion therapy in surgery – blood components, complications of transfusion .
3. Wounds :
   a) Classification, acute wounds, chronic wounds.
   b) Wound healing – Basic process involved in wound repair, basic phases in the healing process, clinical management of wounds, factors affecting wound healing, scars - type and treatment.
   c) Wound Infections, - physiology & manifestation, types of infections, treatment, principle of antimicrobial treatment.
4. Pre & postoperative complications of surgery and their management.
5. Hemostasis –
   Components, hemostatic disorders, factors affecting bleeding during surgery.
6. Types of anaesthesia and its affects on the patient, pain relief.
7. Types of Incisions; Clips Ligatures and Sutures; General Thoracic Procedures, Radiologic Diagnostic procedures, Endoscopy–types, Biopsy – uses and types. Overview and Drainage systems and tubes used in Surgery.

8. Burn:
   Definition, Classification, Causes, Prevention, Pathological changes, Complications, Clinical Features and Management.
9. Skin Grafts :
   Types, Grafting Procedures, Survival of Skin Graft ; Flaps – Types and uses of Flaps.
10. Infections and injuries of Hand :
    Hand infection, suppurativve infection, other infection, hand injuries, dupuytrens contracture.
11. Surgical Oncology – Cancer –
    Definition, types, clinical manifestations of cancer, Staging of Cancer, surgical procedures involved in the management of cancer.
12. Disorders of muscles, tendons and ligaments, sports related injuries. Periarticular inflammations acte muscle injury, chronic muscles injury, Tendon disorders, tendon sheath disorder, fascia, Ganglia, Bursae, Repeatative strain injury.
13. Neurological disorder affecting to musclo-skeletal system. , Motor dysfunction and treatment, cerebral palsy, acquired abnormalities, inherited disorder, neuromuscular disorder, sensory disorder.
14. The cranium :
    The scalp, the skull, head injuries.
15. Thoracic and cardiac surgery :
    Thoracotomy, lobectomy, pneumonectomy, thoracoplasty, mitral valvotomy, open heart surgery.
16. Various surgical heart diseases with respect to clinical presentation, complications and management -
    Valvular heart disease, congenital heart disease –e.g., ASD, VSD, PDA, Ischaemic heart disease. Outline of postoperative complications in cardiac surgery and their management.
17. Diseases of the Arteries and Veins :
    Definition, Etiology, Clinical features, signs and symptoms, complications, management and treatment of following diseases : Arteriosclerosis, Atherosclerosis, Aneurysm, Buerger's disease, Raynaud's Disease, Thrombophlebitis, Deep Vein Thrombosis, Pulmonary Embolism, Varicose Veins.
18. Definition, Indication, Incision, Physiological changes and Complications following Common operations like Cholecystectomy, Colostomy, Ileostomy, Gastrectomy, Hernias, Appendicectomy Mastectomy, Nephrectomy, Prostectomy.
19. Obstetrics & Gynecology :
    Surgical procedures involving child birth. Incontinence – Types, Causes, Assessment and Management, Common gynecology disorders - salpingitis, parameteritis, retroverted uterus prolapse of uterus, pelvic inflammation , Definition & indications of– Hysterosalphingography, Dilatation and Curettage, Laproscopy, Colposopy, & Hysterectomy,
20. ENT:
    Common problems of ear, otitis media, Otosclerosis, functional aphonia and deafness, facial palsy - classification, medical and surgical management of lower motor neuron type of facial palsy.
21. Ophthalmology:
    Common inflammation and other infections of eye, ptosis, defects of the external rectus, cataract, refractions, pleoptic exercises, physiologic defects of vision.

IV. COMMUNITY MEDICINE

1. Health and Disease: Definitions, Concepts, Dimensions and Indicators of Health, Concept of well-being, Spectrum and Determinants of Health, Concept and natural history of Disease, Concepts of disease control and prevention, Modes of Intervention, Population Medicine, The role of socio-economic and cultural environment in health and disease.
2. Epidemiology, definition and scope. Principles of Epidemiology and Epidemiological methods: Components and Aims, Basic measurements, Methods, Uses of epidemiology, Infectious disease epidemiology, Dynamics and modes of disease transmission, Host defenses and Immunizing agents, Hazards of Immunization, Disease prevention and control, Disinfection. Screening for Disease: Concept of screening, Aims and Objectives, Uses and types of screening.
3. Epidemiology of communicable disease: Respiratory infections, Intestinal infections, Arthropodborne infections, Zoonoses, Surface infections, Hospital acquired infections Epidemiology ochronic non-communicable diseases and conditions: Cardio vascular diseases: Coronary heart disease, Hypertension, Stroke, Rheumatic heart disease, Cancer, Diabetes, Obesity, Blindness Accidents and Injuries.
4. Public health administration- an overview of the health administration set up at Central and state levels. The national health program-highlighting the role of social, economic and cultural factors in the implementation of the national programs. Health problems of vulnerable groups- pregnant and lactating women, infants and pre-school children, occupational groups.
5. Health programs in India: Vector borne disease control program, National leprosy eradication program, National tuberculosis program, National AIDS control program, National program for control of blindness, Iodine deficiency disorders (IDD) program, Universal Immunisation program, Reproductive and child health program, National cancer control program, National mental health program. National diabetes control program, National family welfare program, National sanitation and water supply program, Minimum needs program.
6. Demography and Family Planning: Demographic cycle, Fertility, Family planning-objectives of national family planning program and family planning methods, A general idea of advantage and disadvantages of the methods.
7. Preventive Medicine in Obstetrics, Paediatrics and Geriatrics: MCH problems, Antenatal, Intranatal and post natal care, Care of children, Child health problems, Rights of child and National policy for children, MCH services and indicators of MCH care, Social welfare program for women and children, Preventive medicine and geriatrics.
8. Nutrition and Health: Classification of foods, Nutritional profiles of principal foods, Nutritional problems in public health, Community nutrition program.
9. Environment and Health: Components of environment, Water and air pollution and public health: Pollution control, Disposal of waste, Medical entomology.
10. Hospital waste management: Sources of hospital waste, Health hazards, Waste management.
11. Disaster Management: Natural and man made disasters, Disaster impact and response, Relief phase, Epidemiologic surveillance and disease control, Nutrition, Rehabilitation, Disaster preparedness.
12. Occupational Health: Occupational environment, Occupational hazards, Occupational diseases, Prevention of occupational diseases. Social security and other measures for the protection from occupational hazard accidents and diseases. Details of compensation acts.

13. Mental Health: Characteristics of a mentally healthy person, Types of mental illness, Causes of mental ill health, Prevention, Mental health services, Alcohol and drug dependence. Emphasis on community aspects of mental health.
14. Health Education: Concepts, aims and objectives, Approaches to health education, Models of health education, Contents of health education, Principles of health education, Practice of health education.

V. RESEARCH METHODOLOGY AND BIOSTATISTICS

RESEARCH METHODOLOGY

1. Introduction to Research methodology:
   Meaning of research, objectives of research,Motivation in research, Types of research & research approaches, Research methods vs methodology, Criteria for good research.
2. Research problem:
   Statement of research problem, Statement of purpose and objectives of research problem, Necessity of defining the problem
3. Research design:
   Meaning of research design, Need for research design, Features for good design, Different research designs, Basic principles of research design.
4. Measurement & scaling techniques: Measurement in research-
   Measurement scales, sources of error in measurement, Technique of developing measurement tools, Meaning of scaling, its classification, important scaling techniques.
5. Methods of data collection: collection of primary data, collection data through questionnaires & schedules, Difference between questionnaires & schedules.
6. Computer technology:
   Introduction to Computers, computer application in research computers & researcher.

BIOSTATISTICS

1. Introduction: Meaning, definition, characteristics of statistics. Importance of the study of statistics, Branches of statistics, Statistics and health science , Parameters and Estimates, Variables and their types, Measurement scales.
2. Tabulation of Data: Basic principles of graphical representation, Types of diagrams – histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, Normal probability curve.
3. Measures of Central Tendency: Need for measures of central Tendency, Definition and calculation of Mean – ungrouped and grouped, interpretation and calculation of Median-ungrouped and grouped, Meaning and calculation of Mode, Geometric mean & Hormonic mean, Guidelines for the use of various measures of central tendency.
4. Measures of Dispersion : Range, mean deviation, standard deviation & variance.
5. Probability and Standard Distributions: Meaning of probability of standard distribution, the binominal distribution, the normal distribution, Divergence from normality – skewness, kurtosis.
6. Correlation & regression : Significance, correlation coefficient, linear regression & regression equation.
7. Testing of Hypotheses , Level of significance, Degrees of freedom.
8. Chi-square test, test of Goodness of fit & student t-test.
9. Analysis of variance & covariance: Analysis of variance (ANOVA), what is

ANOVA? Basic principle of ANOVA, ANOVA technique, Analysis of Co variance (ANACOVA)

10. Sampling: Definition, Types- simple, random, stratified, cluster and double sampling. Need for sampling - Criteria for good samples, Application of sampling in community, Procedures of sampling and sampling designs errors.

VI. PHYSIOTHERAPY IN ORTHOPAEDIC CONDITIONS

1. PT assessment for Orthopedic conditions -
   SOAP format. Subjective - history taking, informed consent, personal, past, medical and socioeconomic history, chief complaints, history of present illness. Pain assessment- intensity, character, aggravating and relieving factors, site and location. Objective- on observation - body built swelling, muscle atrophy, deformities, posture and gait. On palpation- tenderness-grades, muscle spasm, swelling-methods of swelling assessment, bony prominences, soft tissue texture and integrity, warmth and vasomotor disturbances. On examination – ROM – active and passive, resisted isometric tests, limb length-apparent, true and segmental, girth measurement, muscle length testing-tightness, Contracture and flexibility, manual muscle testing, peripheral neurological examination dermatomes, myotomes and reflexes, special tests and functional tests. Prescription of home program. Documentation of case records, and follows up.
2. Fractures -
   types, classification, signs and symptoms, complications. Fracture healing – factors affecting fracture healing. Principles of fracture management - reduction - open and closed, immobilization - sling, cast, brace, slab, traction - manual, mechanical, skin, skeletal, lumbar and Cervical traction, external fixation, functional cast bracing. PT management in complications - early and late - shock, compartmental syndrome, VIC, fat embolism, delayed and mal union, RSD, myositis ossificans, AVN, pressure sores etc. Physiotherapy assessment in fracture cases. Aims of PT management in fracture cases - short and long term goals. Principles of PT management in fractures - Guidelines for fracture treatment during period of immobilization and guidelines for treatment after immobilization period.
3. Specific fractures and dislocations:
   PT assessment and management of upper limb fractures and dislocations. PT assessment and management of lower limb fractures and dislocations including pelvis. PT assessment and management spinal fractures.
4. Principles of various schools of thought in manual therapy-Maitland, Mackenzie, Mulligan
5. Degenerative and inflammatory conditions:
   Definition, signs and symptoms, clinical features, path physiology, radiological features, deformities, medical, surgical management. Describe the PT assessment and management and home program for the following conditions – Osteoarthritis - emphasis mainly on knee, hip and hand, Rheumatoid Arthritis, Ankylosing spondylitis, Gout, Perthes disease, Periarthritic shoulder.
6. Infective conditions:
   Definition, signs and symptoms, clinical features, pathophysiology, radiological features, medical, surgical management. Describe PT assessment and management for following conditions – Osteomyelitis – acute and chronic, Septic arthritis, Pyogenic arthritis, TB spine and major joints - knee and hip.
7. Define; review the postural abnormalities of spinal column, clinical features, deformities, medical and surgical management. Describe PT assessment and management and home program.

8. Deformities:
Review in detail the causes, signs and symptoms, radiological features, medical and surgical management. Describe the PT. assessment and management of the following conditions : Congenital : CTEV, CDH, Torticollis, pes planus, pes cavus and other common deformities. Acquired: scoliosis, kyphosis, coxa vera, genu varum, valgum and recurvatum.

9. Poliomyelitis:
Definition, etiology, types, pathophysiology, clinical features, deformities, medical and surgical management. PT. assessment and management after surgical corrections and reconstructive surgeries - emphasis on tendon transfer and home program.

10. Leprosy:
Definition, cause, clinical features, medical and surgical management. PT assessment, aims, and management after surgical procedures such as tendon transfer both pre and post operatively.

11. Amputations:
Definition, levels, indications, types, PT assessment, aims, management pre and post operatively. PT management with emphasis on stump care and bandaging. Pre and post prosthetic training, checking out prosthesis, complications of amputations and its management.

12. Spinal conditions:
Review the causes, signs and symptoms, investigations, radiological features, neurological signs. PT assessment, aims, and management and home program of the following conditions: Cervical spondylosis, Lumbar spondylosis, Spondylolisthesis, Spinal canal stenosis, Spondylolysis, Sacro-iliac joint dysfunction, Sacralisation, Lumbarisation, Intervertebral disc prolapse, Coccydynia, Spina bifida occulta.

13. Osteoporosis : Causes, predisposing factors, investigations and treatment.

14. Orthopedic surgeries:
Pre and post operative PT assessment, goals, precautions and PT management of following surgeries such as: Arthrodesis, Osteotomy, Arthroplasty-partial and total- Excision arthroplasty, excision arthroplasty with implant, interpositional arthroplasty and total replacement; Tendon transplant, Soft tissue release-tenotomy, myotomy, lengthening; Arthroscopy, Spinal stabilization, Re-attachment of limbs, External fixators, Synovectomy.

15. Shoulder joint:
Shoulder instabilities, TOS, RSD, Impingement syndrome – conservative and Post operative PT management. Total shoulder replacement and Hemi replacement. - Post operative PT management. AC joint injuries - rehabilitation. Rotator cuff tears-conservative and surgical repair. Subacromial decompression - Post operative PT management.

16. Elbow and forearm:
Excision of radial head - Post operative PT management. Total elbow arthroplasty-Post operative PT management.

18. Wrist and Hand:
Total wrist arthroplasty. Repair of ruptured extensor tendons. Carpal tunnel syndrome. Flexor and extensor tendon lacerations - Post operative PT management.

19. Hip:
Joint surgeries- hemi and total hip replacement - Post operative PT management Tendonitis and bursitis. - Management.

20. Knee:
Lateral retinacular release, chondroplasty- Post operative management. Realignment of extensor mechanism. ACL and PCL reconstruction surgeries - Post operative rehabilitation. Meniscectomy and meniscal repair - Post operative management. Plica syndrome, patellar dysfunction and Hoffa's syndrome - conservative management. TKR- rehabilitation protocol. Patellar tendon ruptures and Patellectomy- rehabilitation.

21. Ankle and foot: Ankle instability. Ligamentous tears- Post operative management.

VII. PHYSIOTHERAPY IN NEUROLOGICAL CONDITIONS

1) Review of basic Neuro - Anatomy and Physiology
2) Physiotherapy evaluation of a neurological patient, electro diagnostic procedures, interpretations and prognosis in different neurological conditions, Upper and Lower motor neuron lesions.
3) Principles of physiotherapy programs, reeducation and retraining techniques in neurological conditions, approaches like: Bobath's / neuro developmental therapy, Rood's approach, PNF, Vojta techniques, biofeedback, Brunnstorm movement therapy, Motor Relearning programming, sensory integration therapy.
4) Disturbance of speech and aphasia
5) Spinal cord injury:
review of anatomy and physiology, Physiotherapy Assessment of Spinal cord injury, Principles of Physiotherapy at various stages of Spinal cord injury Rehabilitation goals and ADL training
6) Assessment and principles of therapeutic management of following neurological conditions:
   - Stroke, meningitis, encephalitis, Parkinson's disease, Cerebral palsy, cerebellar lesions, Brain tumors, Multiple Sclerosis, facial palsy.
   - Motor neuron disease, Disseminated sclerosis, transverse myelitis, polio, syringomyelia, spina bifida,
   - Neuropathies, neuromuscular junction disorders and myopathies
7) Peripheral nerve injuries, surgical resection & repair:
   - Classification & types
   - Functional assessment, investigation, diagnosis & prognosis
   - Physiotherapeutic management
   - Poly neuropathy
8) Traumatic brain injury:
   - Types and Mechanisms of head injury
   - Clinical features, potential complications
   - Physiotherapy principles of immediate and postoperative therapeutic management
9) Neurosurgery:
Post surgical Physical therapy in neurosurgical procedures – craniotomy, shunts, SOL resection, surgical treatment of spasticity, cervical cord decompression.

VIII. PHYSIOTHERAPY IN CARDIO-RESPIRATORY & GENERAL CONDITIONS

1. Anatomical and Physiological differences between the Adult and Pediatric lung.
2. Bedside assessment of the patient-Adult & Pediatric.
3. Investigations and tests – Exercise tolerance Testing – Cardiac & Pulmonary, Radiography, PFT, ABG, ECG, Hematological and Biochemical Tests

4. Physiotherapy techniques to increase lung volume – controlled mobilization, positioning, breathing exercises, Neurophysiological Facilitation of Respiration, Mechanical aids - Incentive Spirometry, CPAP,IPPB
5. Physiotherapy techniques to decrease the work of breathing – Measures to optimize the balance between energy supply and demand, positioning, Breathing re-education – Breathing control techniques, mechanical aids – IPPB, CPAP, BiPAP
6. Physiotherapy techniques to clear secretions – Hydration, Humidification & Nebulisation, Mobilisation and Breathing exercises, Postural Drainage, Manual techniques – Percussion, Vibration and Shaking, Rib Springing, ACBT, Autogenic Drainage, Mechanical Aids – PEP, Flutter, IPPB, Facilitation of Cough and Huff, Nasopharyngeal Suctioning
7. Drug therapy – Drugs to prevent and treat inflammation, Drugs to treat Bronchospasm, Drugs to treat Breathlessness, Drugs to help sputum clearance, Drugs to inhibit coughing, Drugs to improve ventilation, Drugs to reduce pulmonary hypertension, Drug delivery doses, Inhaled Nebulisers.
8. Management of wound ulcers- Care of ulcers and wounds - Care of surgical scars- U.V.R and other electro therapeutics for healing of wounds, prevention of Hypergranulated Scars Keoloids, Electrotherapeutics measures for relief of pain during mobilization of scars tissues
9. Physiotherapy in dermatology -Documentation of assessment, treatment and follow up skin conditions. U.V.R therapy in various skin conditions; Vitiligo; Hair loss; Pigmentation; Infected wounds ulcers. Faradic foot bath for Hyperhydrosis. Care of anesthetic hand and foot; Evaluation, planning and management of leprosy- prescription, fitting and training with prosthetic and orthotic devices.
10. Neonatal and Pediatric Physiotherapy – Chest physiotherapy for children, The neonatal unit, Modifications of chest physiotherapy for specific neonatal disorders, Emergencies in the neonatal unit.
11. Physiotherapy in Obstructive lung conditions
12. Physiotherapy in Restrictive lung conditions.
13. Management of breathlessness.
14. Pulmonary Rehabilitation.
15. Physiotherapy following Lung surgeries.
16. Respiratory failure – Oxygen Therapy and Mechanical Ventilation.
    Introduction to ICU : ICU monitoring –Apparatus, Airways and Tubes used in the ICU -Physiotherapy in the ICU – Common conditions in the ICU – Tetanus, Head Injury, Lung Disease, Pulmonary Oedema, Multiple Organ Failure, Neuromuscular Disease, Smoke Inhalation, Poisoning, Aspiration, Near Drowning, ARDS, Shock; Dealing with an Emergency Situation in the ICU.
17. Burns management - Role of physiotherapy in the management of burns, post grafted cases- Mobilization and Musculo-skeletal restorative exercises following burns.
18. Physiotherapy management following cardiac surgeries.
19. Cardiac Rehabilitation.
20. Physiotherapy management following Peripheral Vascular Disease (PVD).
21. Abdominal Surgeries - Management of Pulmonary Restorative Dysfunction following surgical procedures on Abdomen and Thorax.
22. Management of Amputations following Diabetes, PVD - Prosthesis in amputations of lower limbs following ulcers and gangrenes
23. Physiotherapy intervention in the management of Medical, Surgical and Radiation Oncology Cases

24. Home program and education of family members in patient care.
25. Physiotherapy in Obstetrics – Antenatal Care, Antenatal Education, Postnatal Care. Electrotherapy and Exercise Therapy measures for the re-education of Ano-Urethral sphincter.
26. Treatment, Response to exercise and Implications of Physiotherapy in the following disease conditions: Hypertension, Diabetes, Renal Failure and Obesity.
27. Geriatrics: Problems in old age, role of physiotherapy in elderly

IX. PHYSIOTHERAPY IN SPORTS

1. Pre-exercise evaluation
2. Diet and nutrition
   Measurement of fitness components and sports skills - Measurement of muscular strength, Measurement of muscular endurance, Measurement of flexibility, Determination exercise endurance,
3. Physiological effects of exercise on body systems - Muscular system, Endocrine system, Cardio-respiratory system, Nervous system
4. Sports injuries - Spine – PIVD, Kissing spine, cervical whiplash injuries, facet joint syndrome, SI joint dysfunction, Hip – muscle strain, piriformis syndrome, ITB syndrome, osteitis pubis, Knee – menisci, cruciate, collateral, osteochondritis, chondromalacia patellae, biceps femoris tendonitis, swimmers knee, patello-femoral pain syndrome, Leg & ankle – shin splint, achillis tendonitis & rupture, TA bursitis, ankle sprain, plantar fascitis, turf toe syndrome, Head & face – maxillo-facial injuries, helmet compression syndrome.
5. Sports injuries
   Shoulder – instability, rotator cuff injury, biceps tendonitis and rupture, pectoralis major rupture, scapular dyskinesis and acromio-clavicular joint injuries, Elbow – tennis elbow, golfer's elbow, Wrist and hand – carpal tunnel syndrome, gamekeeper's thumb.
6. Principles of injury prevention.
7. Principles of training & Rehabilitation in sports injuries.
8. Sports in Special age groups: Female athletic triad, Younger athlete- Musculo-skeletal problems, management, children with chronic illness and nutrition. Older athlete- Physiological changes with aging, benefits, risks of exercise in elderly, exercise prescription guidelines for elderly.

X. REHABILITATION ON MEDICINE

1. Introduction of Rehabilitation & History
2. Epidemiology of disability (Impairment, disability, phases of disability process, etc.).
3. Principles of Rehabilitation & concept of team approach with rolls of each individual participant.
4. Organization of Rehabilitation unit.
5. Disability prevention evaluation & principles of Rehabilitation Management.
6. Role of Physiotherapy in Rehabilitation (Preventive, treatment & restoration)
7. Brief outline of Communication disorder & its implications on Rehabilitation process.
8. Brief outline of psychosocial & vocational aspects of Rehabilitation.
9. Introduction to Occupational therapy.
10. Activities of daily living, functional assessment & training for functional independence.
11. Brief outline of basic community medicine with special reference to community based

Rehabilitation, infrastructure and role of CBR

12. Assessment of disability in rural & urban setups. Health care delivery system & preventive measures with specific reference to disabling conditions. Community education program.
13. Application of Physiotherapy skills at community level with special reference to the need at rural level.
14. Role of voluntary Organizations in CBR: Charitable Organizations, Voluntary health agencies – National level and International NGO's, Multilateral and Bilateral agencies. International Health Organizations: WHO, UNICEF, UNDP, UNFPA, FAO, ILO, World bank, USAID, SIDA, DANIDA, Rockfeller, Ford foundation, CARE, RED CROSS.
15. National District Level Rehabilitation Program: Primary rehabilitation unit, Regional training center, District rehabilitation center, Primary Health center, Village rehabilitation worker, Anganwadi worker.
16. Role of Physiotherapy in CBR: Screening for disabilities, Prescribing exercise program, Prescribing and devising low cost locally available assistive aids, Modifications physical and architectural barriers for disabled, Disability prevention, Strategies to improve ADL, Rehabilitation program for various neuro-musculoskeletal and cardiothoracic disabilities.

ORTHOTICS AND PROSTHOTICS

1. Introduction to surgical anatomy and various pathological deviations with respect to brace fitting.
2. Rationale of prescribing Prosthetic and Orthotic devices.
3. Types of Prosthetic and Orthotic devices: Spinal, Lower limb, and Upper limb.
4. Checkout, usage advice, precautions, and follow-up.
5. Walking aids and wheel chairs: prescription, usage advice, and follow-up.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

PLANNING

PAPER-I

I.City Planning: Historical development of city planning, principles of city planning, new towns, survey methods, site planning, and planning regulations and building bye-laws.

II.Housing: concept of shelter, housing design and policies, role of Government agencies, finance and management.

III.Planning Theory: Planning process, comprehensive planning, land use and density in residential and non-residential areas, central place theory, rank-size rule, settlement pattern, land utilization, and district level planning.

IV.Techniques of Planning: Application of remote sensing techniques in urban and regional planning, planning surveys, methods of preparation of urban and regional development plans, structure plans, strategy plans etc.; and site planning principles and design.

PAPER-II

I. ***Traffic and Transportation Planning:***

Principles of traffic engineering and transportation planning, method of conducting traffic and parking surveys, design of roads, intersections and parking areas; hierarchy of roads and levels of services, traffic and transport management in urban areas, traffic safety and traffic laws.

II. ***Urban Administration and Management:*** Concept and meaning of planning laws, development control and zoning regulations, laws relating to land acquisition, land ceilings, regional and urban plan preparations.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

SERICULTURE

PAPER-I

GROUP A –

Mulberry cultivation.

1. Soil, physical & chemical properties, organic matters.
2. Plant nutrients, their classification, sources, deficiency & toxicants.
3. Underground water & its sources, soil moisture concept, water management & water conservation.
4. Selection of land, preparation of land for establishment of mulberry plantation.
5. Mulberry cultivation technology in hilly slopes and its management

   Mulberry cultivation in plains under irrigated and rain fed condition.
6. Mulberry varieties, selection of variety, spacing, system of plantation, planting material, sapling production – different methods, transport of cuttings and saplings, planting techniques, establishment of plantation. Post planting care – cultural & intercultural operation, common weeds & their control, use of weedicides.
7. Nutrient management in mulberry/Integrated nutrient management.
8. Pruning in mulberry.
9. Leaf preservation & moisture preservation – harvesting methods.
10. Chawki garden – importance, harvesting and training, different systems of cultivation.
11. Package of practices for maximization of leaf yield in mulberry for different agro-climatic condition. Different agro-climatic zones of India, West Bengal & East India.

Mulberry crop protection.

1. Improtance and scope of plant pathology in sericulture including pathological terms and terminologies. Classification of mulberry disease.
2. Mulberry disease and their management covering symptoms causal organism and disease cycle, predisposing factors and various control measures.

   Fungal disease: Powdery mildew, Acedium leaf rust, peridiopsora leaf rust, Cercospora leaf spot, Pseudocercospora leaf spot, Myothecium leaf rust.
3. Bacterial diseases, bacterial leaf blight, bacterial leaf spot and bacterial wilt.

4. Minor diseases and their management, cercospora leaf spot, alternaria leaf blight, Fursarium leaf spot, sooty mould, stem canker, white root rot, sclerotium wilt, dwarf disease, mosaic disease.

5. Non-infectiuous disease and their management, Mineral deficiency, moisture & temperature extremes and air pollution.

6. Nematode disease: Root Knot.

7. Role of environment in mulberry disease development, disease prediction, mulberry disease forewarning calendar.

8. Plant protectants, equipment, their use and care and precautions.

9. Integrated disease management.

Mulberry pest and their management.

10. Major pests: Trips, Mealy bugs, Whitefly & Bihar hairy caterpillar, their distribution, taxonomic position, occurrence, biology, nature of damage, symptoms & their integrated management measures.

11. Minor pests: brief account of minor pests viz. Cut worm, Leaf roller, Scale insect, Jassid stem girdler beetle, Mulberry weevil, Termites, Mites including their occurrence, symptoms and control measures.

12. Definition and determination of Economic Threshold levels and estimation of crop loss due to mulberry pests.

13. Forewarning of mulberry pests.

14. Management: Essential components, forms & formation of insecticides, modes of action, determination & requirement of insecticides per unit area, application techniques & safe period integrated pest management.

GROUP B –
General sericulture rearing and technology-
General sericulture.

1. History and importance of sericulture in India.

2. Systematic position and distribution of mulberry & non-mulberry silkworm including salient features.

3. Production and productivity of mulberry and non-mulberry silk in India and other countries, import and export of Indian silk.

4. Review of Sericulture in China and Japan.

5. Sreiculture organisation in India- Administrative set up, research & training set up, seed production, cocoon production, marketing, Reeling & weaving sector, export import tariff protection.

6. Sericulture progress through five year plans- targets & achievements- future projection.

7. Sericulture- an important rural cottage industry in India, its development, problems and prospects.

8. By-products of silk industry, their economic importance and utilization.

9. Role of NGOs, quality clubs, self help groups and private enterprise in Sreiculture.

10. Comparative crop economics.

11. Sericulture research in India and its impact.

Rearing technology.

12. Model rearing house – basic plan, site selection, size of rearing houses, orientation, advantages & disadvantages.

13. Rearing equipment/appliances, types & uses.

14. Disinfection: different types of disinfections, different methods of disinfectio.

15. Incubation: Environment conditions required for incubation, incubation methods & incubation devices.

16. Brushing: selection of leaf for brushing – loose eggs & sheet eggs – cellular* mass brushing.

17. Chawki rearing: significance of Chawki rearing - salient features of Chawki rearing – leaf quality – quantum and frequency of feeding. Selection and estimation of Chawki leaf – preservation of Chawki leaf – environment management.

18. Concept of Chawki rearing centre- co-operative and community Chawki rearing.

19. Moulting- symptoms, care during pre-moulting, moulting and post moulting periods.

20. Late age rearing: different methods, rational utilization of mulberry leaves, bed spacing and feeding- environment management, leaf quality- leaf preservation.

21. Spinning and mounting- symptoms of spinning larvae, care to be taken during spinning, etc. methods of mounting, different types of mountages, effects of mountages on the quality of cocoons- density of population an the mountage – environment management.

22. Harvestng of cocoons- tie of harvest for seed cocoons and commercial cocoons, sorting of cocoons, preservation & transportation of cocoons, cocoon assessment-significance, leaf cocoon ratio, maintenance of rearing records.

23. Package of practice for silkworm rearing: crop schedule- seed as well as commercial crop.

24. General anatomy and morphology of silkworm.

25. Silkworm nutrition factors influencing silkworm growth & development.

26. Endocrine system in silkworm, types of hormones and their function, application of hormones in silkworm rearing.

27. Integument, moulting of silkworm, physiology of moulting, factors influencing moulting.

28. Structure of silk glands and biosynthesis of silk protein.

GROUP C –
Silkworm breeding and genetics.
Silkworm breeding

1. Classification of mulberry silkworm races: Geographical (Chinese, Japanese, European & tropical) Voltinism (Uni, Bi, Poly) moulting (Tri, Tetra, Penta) and characteristics.

2. Objectives, techniques and methods of silkworm breeding, inbreeding & back cross, pre-requisite, creation of variation, line breeding and mutation breeding.

3. Maintenance of silkworm breeds: Techniques of maintenance of mulberry silkworm breeds at breeding station.

4. Hybrid vigour (Heterosis) and its determination, types of hybrids (single & double hybrids) and their utility in Sericulture for productivity & quality improvement.

5. Special features of multivoltine breeding.

6. Indigenous & evolved silkworm breeds and hydrids in India, their characteristics and present status.

7. Special purpose of breeds, breeding for stress tolerance disease resistance, thin denier, reliability, etc.

Silkworm Genetics.

8. Mulberry silkworm: origin of Bombyx Mori, Morphology of silkworm eggs, larvae, pupa and moth.

9. Hereditary traits in silkworm egg, larvae pupa and cocoons, Mendelian inheritance, Inheritance in silkworm, test cross.

10. Voltinism, Diapause, Moulting and environment influence in silkworm, maternal inheritance.

11. Mutation – types of mutations, induced mutation and mutagens.

GROUP D-
Cocoon crop protection.
Silkworm diseases and their control.

1. Insect pathology classification of silkworm diseases: Etiology of silkworm diseases.

2. Protozoan diseases of silkworm (Pebine): Causative agent & its classification, mode of infection, identification of pebine spores, life cycle, symptoms, prevention & control.

3. Bacterial diseases of silkworm: Bacterial septicemia, bacterial gastro enteric diseases and bacterial toxicosis – causative agents pathogenesis, symptoms, diagnosis, prevention and control.

4. Viral disease of silkworm, Nuclear polyhedrosis, Cytolasmic, Polyhedrosis, Infectious Flacherie, Densonucleosis, Etiological agents, symptoms, diagnosis, prevention and control.

5. Fungal diseases of silkworm; white muscardine, green muscardine, other muscardine diseases, Aspergillosis- Etiology, epidemiology, symptoms, prevention & control.

6. Disinfecttions: Disinfectants – characteristics of ideal disinfectants, room and bed disinfectants, methods of disinfection, physical and chemical disinfection.

7. Symbiology: Host parasiotoid – pathogen interaction. Alternate host as source of spreading various silkworm diseases and immunity.

Silkworm pests and their control.

8. Uzi fly: Distribution, taxonomic position, occurrence and spread, crop loss.

9. Uzi fly: biology.

10. Uzi fly: Integrated pest management.

11. Dermestid beetle: Distribution, occurrence, biology & control measures.

GROUP E-
Silkworm's seed production.

1. Present status of silkworm seed, grainages, production and demand trends, government & private sector.

2. Seed organisation – organisational set up, multiplication and basic seed farm establishment, basic seed maintenance hygiene & multiplication norm. seed legislation act & regulation.

3. Monitoring of seed crops, disinfection and maintenance of hygiene during rearing, planning for seed cocoon production, programme of brushing.

4. Seed cocoon market, certification of seed lots, price fixations of seed cocoons.

5. Establishment of commercial grainage, location of grainage, design of model grainage, infrastructural facilities for a grainage, equipments and their utilization, cold storage facilities, disinfection & hygiene.

6. Commercial egg production- seed cocoon production, procurement, transportation, sorting, pupal gut examination test and forced eclosion test - preservation - sex – separation – synchronisation – emergence – coupling – decoupling – oviposition – mother moth examination, surface sterilization of eggs.

7. Preservation of eggs: Preservation of multi & bivoltine eggs, hot and cold acid treatment – long term and short term chilling – different hibernation schedule of preservation of bivoltine eggs.

8. Loose egg preparation.

9. Transportation of eggs.

10. Grainage preservation and economic of seed production.

PAPER-II

GROUP A-
Mulberry breeding, Genetics & Physiology.
Mulberry & Genetics.

1. General introduction to mulberry breeding: history of mulberry breeding in India, morphological and cytological features of mulberry plants. Genetic variability and sources of genetic variability in mulberry.

2. Germplasm resources: Exploration, collection, introduction, quarantine, conservation, evaluation and its breeding.

3. Mulberry breeding: Objectives, parameters associated with growth, yield & quantity.

4. Hybridisation techniques: Objectives, single cross, double cross and polycross procedure in mulberry, heterosis, genetic basis and manifestation, advantages & limitations.

5. Selection techniques; Mass selection, pure line selection and clonal selection.

6. Polyploids breedings: Induction and identification, characteristic features of polyploids, importance of triploids in mulberry improvement. Varieties evolved by polyploidy breeding.

7. Mutation breeding: Types of mutations, mutagens, induction, identification and evaluation of mutants, varieties evolved my mutation breeding.

8. Breeding techniques for stress conditions: Droughts, salinity, alkalinity.

9. Breeding for disease and pest resistance.

10. Tissue culture techniques in mulberry: preparation of media, micro-propagation, Encapsulation, Somaclonal variation, induction of haploids, somatic hybridisation and Cryo preservation.

Mulberry physiology.

11. Physiological factors determining crop growth and yield.

12. Role of nutrients in mulberry growth, deficiency symptoms & reclamation.

13. Use of growth regulators in mulberry propagation.

GROUP B-

Post cocoon technology.

1. Textile fibre- Natural and man made fibres – different varieties of commercial silk – chemical and physical properties of silk – importance of silk.

2. Physical and commercial characteristics of cocoon on raw silk quality.

3. Different types of defective cocoons – cocoon sorting method – effect of defective cocoon on reeling.

4. Cocoon testing and grading – cocoon marketing.

5. Cocoon stifling – Objectives and different methods. Storage and preservation of cocoon.

6. Cocoon cooking including brushing. Reeling and re-reeling.

7. Twisting and weaving of silk.

8. Wet processing of silk and finishing: Degumming, bleaching, dyeing, printing and finishing.

9. Silk testing and grading – silk exchange.

GROUP C-

Extension management.

1. Extension education – definition, objective, need, importance, scope and principles of education, fundamentals of adult learning and adult learning situation, major functions in extension management and role of extension workers.

2. Motivation – concept and definition, intrinsic motivation and extrinsic motivation.

3. Programme planning: definition, objectives, principles, steps and monitoring evaluation.

4. Extension communication: Concept, elements and process, methods of communication, individual, group and mass contact method, their merits and demerits, different teaching aids, fidelity in communication & communication gap.

5. Adoption and diffusion of innovation: Adoption process, innovation, decision process, percieved attributes of innovation, adoptor, categories and adoption, constraints, change agent- opinion leader, facilitator, inhibitor, extension strategies.

6. Training: Definition, types of training, training of farmers and trainers, evaluation.

7. Transfer of technology: Concept and meaning of transfer and technology, linkage with research system and client system, characteristics of client system, constraints percieved by the client system, constraints percieved by the change system, support system, technology generation and validation.

8. Case study: Meaning and importance, methods of conducting case study and report writing.

9. Organisation: Definition, types of organisations, profit making organisation (Bank, Insurance, Commercial establishment, etc.), non-profit making organisation (Panchayat, Youth club, Mahila mandal, Voluntary organisation, KVK, Quality clubs, self help groups).

10. System of extension in India: Major organisational stream of extension in India, frontline extension programme, some emerging thoughts in extension (TAR, IVLP), Sericulture extension system in India, role and function of different research and extension units.

11. Group dynamics, theory of leadership, concept of leader, type and leader identification and training of local leader.

GROUP D-
Computer, Economic and Statistics.

1. Introduction to computers: Meaning, characteristics of computer hardware, software, operating system and peripherals.

2. Introduction to windows, operating system, desktop components of windows, task bar, files and folders.

3. Microsoft word, introduction to word processing, creating and saving documents, text handling, entering and editing data, selecting, cut, copy and paste data, drag and drop, formatting text and numbers.

4. Microsoft excel, introduction to worksheet, enterin/editing data, entering/copying formula, formatting text and numbers.

5. Production and cost: elementary concepts of different costs (marginal cost, average cost, total fixed cost, average fixed cost, total variable cost, average variable cost, average total cost/average cost, etc.) product, production and production function, gross and net returns.

6. Tools of farm management analysis: farm, farm management, farm planning – advantages, characteristics of a good farm and farm budgeting.

7. Market and marketing: Concept of different types of markets and their characteristics, relation among demand, supply and price, regulated cocoon market – advantages and disadvantages, price stabilisation.

8. Farm financial management: Need for farm finance/credit- its types, agencies, role of cooperatives, bank, NABARD, etc.

9. Project: Objective, formulation and implementation of project, tools of appraising project (benefit-cost ratio, internal rate of return, net present value, etc.)

10. Survey: objectives, population survey vs sample survey, stages and steps in sample survey, structured questionaire, pilot survey, biases, sampling techniques (simple random, stratified random, multistage, systematic), sample size, survey on socio-economic condition, crop profitability, land under different crops and cropping pattern, disease and pest incidence, etc.

11. Data processing: Data – collection, scrutiny and presentation (tabular and diagrammatic line, horizontal and vertical bars, multiple and divided bars, pie, pictorial, statistical map) attribute and variable (discrete and continuous), frequency distribution, graphical representation (column, frequency polygon, histogram, ogive).

12. Simple parametric representation: Measures of central tendency (mean, arithmetic, geometric, harmonic, median, mode), measures of dispersion (range, standard deviation, coefficient of variation, standard error).

13. Bivariate data: Scatter diagram, regression equation and line, simple correlation coefficient.

14. Test os significance: Hypotheseis, decision making, level of significance, degrees of freedom, test of significance in small sample, student's t-test for comparision of means, X2 test for goodness of fit.

15. Analysis of variance: Replication, randomization, experimental error, one-way classification of data, ANOVA and F-test, LSD, multifactor experiments.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

SOCIOLOGY (DEGREE)

PAPER-I

1. **Sociology as the Scientific Study of Social Phenomena**: the emergence of Sociology; relationship of Sociology with other disciplines, especially with Psychology and Anthropology; the sociological perspectives: functionalist, conflict and interactionist perspectives; the scientific method in Sociology; and design of sociological research; techniques of data collection and measurement including participant and non-participant observation, interview schedule and questionnaires.

2. **Pioneering Contributions to Sociology**: seminal ideas of Durkheim, Marx and Weber. Durkheim's ideas on society, social facts, division of labour, suicide and religion; Marx's ideas on historical materialism, alienation, class and class struggle; Weber's ideas on social action, ideal types, bureaucracy, rationality, the Protestant ethic and the spirit of capitalism.

3. **The individual and Society**: individual behaviour; social interaction, society and social group; social system, status and role; culture, personality and socialization; deviance and social control. Types of society and their characteristics: tribal, agrarian, industrial and post-industrial.

4. **Social stratification and mobility**: open and closed systems of stratification; types of mobility; determinants and consequences of stratification into social classes; social mobility in class society; caste system in India as a form of stratification; cultural and structural views about caste; mobility in the caste system; issues of equality and social justice; untouchability and its eradication; Scheduled Castes, Other Backward Classes, stratification in tribal societies in India; the Scheduled Tribes.

5. **Family, marriage and kinship**: Structure and functions of family; structural principles of kinship; family descent and kinship; marriage and divorce; the joint family in India : its structural and functional aspects; changes in the joint family; kinship system in India : regional variations; marriage and divorce among the Hindus, Muslims, Christians and tribals in India; changes in family and marriage in India : impact of legislation , socio-economic developments and other factors; changing status of women among Hindus, Muslims, Christians and tribals; intergeneration gap.

6. **Economic System**: social dimensions of division of labour and types of exchange: social aspects of pre-industrial and industrial economic systems; industrialization and change in the political, educational, religious, familial and stratificational spheres; social determinants and consequences of economic development. The Jajmani and its bearings on the traditional Indian society; market economy in India and its social consequences; occupational diversification and social structure; trade unions in India; economic development in India; economic inequalities, exploitation, forced labour and child labour.

PAPER-II

1. **Political system**: The nature of social power; power, authority and legitimacy; power of the elite, class power, organizational power, power of unorganized masses; power in democracy and in totalitarian society; political parties and voting; the functioning of the democratic political system in a traditional society like India; political parties in India and their social composition; caste and politics in India; social structural origins of political elites in India and their social orientation; decentralization of power and political participation in Panchayati Raj local institutions; Autonomous Districts in the North East; village councils and village development boards in tribal areas; Article 371A of the Constitution of India and its implications in Nagaland.

2. **Educational Systems**: education as medium of cultural reproduction, indoctrination, social stratification and mobility; education and modernization. Origin and development of modern education in India; educational inequality and change; education and social mobility; educational problems of women, Backward Classes, the Scheduled Castes and Scheduled Tribes; development of modern education in Nagaland.

3. **Religion:** The religious phenomenon; the sacred and the profane; social functions and social dysfunctions of religion; magic religion and science; changes in society and changes in religion secularization. Major religious categories in India: Hindus, Muslims, Christians, Sikhs, Buddhists and Jains; traditional tribal religion in India; inter-religious interaction and its manifestation in the problems of conversion, minority status and communalism, secularism in India; Christianisation of the tribals of North East India, especially in Nagaland.

4. **Tribal, rural and urban segments:** tribal societies and their integration in Indian society: Rural social system: Socio-cultural dimensions of rural society; the village community in India: traditional power structure; social consequences of land reforms; Community Development Programme; the Green Revolution; new strategies for rural development such as NREGS. Urban social organization: meaning of urbanization and urbanism; urbanization in India; urban slums in India; problems of ethnic diversity and community integration; rural-urban differences in demographic and socio-cultural characteristics and their social consequences.

5. **Social change, development and progress**: social structure and social change, continuity and change as fact and value; process of change; theories of social change; major sources of change in India; spontaneous social change: Sanskritisation, westernisation, modernisation, globalisation; directed and planned social change in India: Five Year Plans and legislative measures.

6. **Social problems**: difficulties in defining social problems; current global problem: terrorism; illegal activities like smuggling, drugs and arms trade; major social problems in India: corruption, nepotism, youth unrests, casteism, tribalism; insurgency, separatism and problems related to national integration.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

STATISTICS (DEGREE)

PAPER-I

UNIT-1: Descriptive Statistics and Numerical Analysis-
Measures of Central Tendency: Measures of Variation: Moments. Skewness and Kurtosis: Principle of Least squares: Correlation and Regression: correlation Ratio. Intraclass Correlation and Spearman's Rank correlation:

Δ ∇ and E operators-their main relationships and problems: Interpolation and Extrapolation: Newton's forward, backward and divided difference formulae:
Lagrange's interpolation formula. Central difference formula due to Gauss. Bessel and Stirling and Everett's: Numerical Integration. General quadrature formula. Simpson's ⅓rd. Simpson's ⅜th rule and Weddle's Rules of Numerical Integration: Inversion formula. Roots of transcendental equation. Iteration method. Regular Falsi method and Newton's Raphson's method.

UNIT-II: Probability Theory: Random experiment. sample points. sample space. events etc.: Definitions of probability and related problems: Theorems of total. compound and conditional probability: Baye's theorem: Discrete and continuous random variables: Probability mass function(pmf). probability density function(pdf). marginal and conditional distribution functions: mathematical expectations-Addition and multiplication theorem of expectations. conditional expectation and variance: Convergence in probability: Probability generating. moment generating and cumulant generating functions: Markov's and Chebysheff's Inequality. central limit theorem. Weak and Strong law of large numbers: Standard distributions-bernoulli. Binomial. Poisson and Normal distributions their interrelations including limiting cases: Cauchy. Exponential. Beta and Gamma distributions:

UNIT-III: Statistical Inference and Testing of Hypothesis:
Estimate and estimators: Problems of point and interval estimations: Criterion of a good estimator-Unbiasedness. consistency. efficiency and sufficiency with simple illustrations: Problems of unbiased estimators related to standard distributions: Concepts of statistical hypothesis. Null and Alternative hypothesis: Simple and Composite hypothesis: Type-l and Type-ll errors: Critical region. one and two tailed tests. level of significance and power of a test: Most powerful (MP) and Uniformly MP tests with illustrations (binomial. Poisson. normal). Confidence interval and confidence limits: Maximum likelihood (ML) estimation and its properties. Non-parametric tests-Chi-square and Kolmogorov test for goodness of fit. Run test for randomness. Sign test for location. Wilcoxon-Mann-Whitney test and Kolmogorov-Smirnov test for the two sample problems.

UNIT-IV: Sampling Distribution:
Random sample. parameter and statistic: sampling distribution of a statistic. standard errors of sample mean. sample proportion and moments: Sampling distribution of sample mean and variance for normal population: Sampling distributions of χ^2 (chi-square). t and F-statistic and their properties and applications: Test of significance based on χ^2. t and F statistics: Large sample test for proportions. fisher's Z-test for correlation coefficient.
Notions of a sequential test. Wald's SPRT. its OC and ASN functions.

UNIT-V: Linear Inference and Multivariate Analysis:

Theory of Least squares and Analysis of Variance. Gauss-markoff theory. normal equations. least square estimates and their precision. Tests of significance based on least square theory in one-way. two-way classified data: Partial and Multiple Correlation involving three variables: Tests about correlation and regression coefficients. Teat for linearity of regression: Bivariate normal distribution and its properties: Multivariate normal distribution.

PAPER-II

UNIT-I: Sample Surveys and Official Statistics:

Complete census and sample survey and their advantages and disadvantages. need for sampling. Pilot survey. sources of sampling and non-sampling errors: Different types of sampling.: simple random sampling (WR and WOR). Stratified random sampling and Systematic sampling-their unbiased estimate of mean: Sampling for proportion: Proportional. Neyman and Optimum allocations: Cluster sampling. Double sampling and Multistage sampling: Ratio and Regression method of estimation under SRS. their biases and mean square error. Planning and organization of sample with special reference to recent large scale surveys conducted in India. Central Statistical Organization (CEO).National Sample Survey (NSS) Organization. Directorate of Economic & Statistics.

UNIT-II: Design of Experiment (DOE):

Basic principles of Design of Experiments (DoE): CRD. RBD and LSD-their analysis and advantages and disadvantages: Factorial Experiments-its advantages over single factor experiments: Total and partial confounding in 2" (n=2.3.4&5): Missing plot technique in RBD and LSD. Analysis of Split Plot.

UNIT-III: Demography and Statistical Quality Control (SQC):

Meaning and scope of Demography: Sources of demographic data: limitation and uses of demographic data. different types of mortality and fertility rates: Gross and net reproduction rates: complete life table and Abridged life table-its main features and method of construction: Logistic and other population growth curves: Population projection and its importance in National planning. Population projection by fitting a logistic curves: Demographic profile of Indian Census(latest).

Morbidity and its measurement. Standard classification by cause of death: health surveys and use of Hospital Statistics.

Concepts and importance of SQC: Assignable and Chance causes of variations: Control charts for variables and attributes: meant (*X).* Range (R). p and c-charts: Sampling inspection versus 100% inspection: Single sampling. Double sampling and Sequential sampling plans for attributes inspection: OC.ASN and ATI curves: Concepts of Producer's risk and Consumer's risk: AQL.AOQL and LTPD etc.

UNIT-IV: Economic Statistics and Psychometry:

Concepts. definition and different components of time series: Additive and Multiplicative models: Determination of trends by different methods: Computation of seasonal indices by different methods.

Index number-its definition. construction and applications: Price and Quantity index numbers: Simple aggregate and weighted average methods: Laspayre's. Paache's and Fisher's index numbers: Time and Factor reversal tests: Cost of living index number-construction and uses.

Theory and analysis of consumer demand specification and estimation of demand function. Price and income elasticity of demand and nature of commodities. Laws of supply and demand. Construction of demand functions based on family budget data by using different forms of Engel curve and time series data: Income distribution-Pareto and log-normal. Gini's curve of concentration. Utility function and maximization of utility. Production functions-Homogeneous production functions. Cobb-Douglas and CES production functions and their properties: General linear model-assumption. Least square estimation. BLUE. meaning and problems of multicollinearity. hateroscedasticity. autocorrelation and errors in variables in general linear model.

Educational and psychological Statistics- Scaling individual test items in terms of difficulties: Percentile scaling. Z-scaling. Standard scores. Normalized scores and T-scores. Scalings of rankings and ratings in terms of normal probability: Reliability and methods for determining test reliability: Validity of test scores and its determination: Intelligent quotient (IQ)-its measurement and uses.

UNIT-V: Operation Research (OR) and Computer Application:

History and scope definition of Operations Research (OR): Problems of OR.
Formulation of linear programming problems. Graphical and Simplex methods of solution of linear programming problems: Transportation problem. North-West corner rules. Unit penalty method. Method of matrix minimum (the least cost rule).
Assignment problem and its solution.:

Introduction to computers. Computer systems. Different Components and their functions. Number systems-Decimal. Binary. Octal and Hexadecimal: conversion from one number system to another. Programming languages. machine language. Assembly language and higher level language: Algorithm and Flowcharts: Elements of BASIC Programming language. Character sets. Constants and Variables. Operations. Expressions. Syntax rules: Basic Statements-REM.INPUT.READ-DATA.PRINT.RESTORE.TAB.SPC.IF-THEN GOTO: Subscripted variables DO LOOP.SUB-PROGRAM.STOP.END (Simple program using these statements and calculation of mean. Variance. construction of frequency table. t-values. chi-square values and simple correlation coefficient).

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SYLLABUS FOR COMBINED TECHNICAL SERVICES EXAMINATION

ZOOLOGY

PAPER-I

Non Chordata and chordata. Ecology, Ethology, Bio Statistic and Economic Zoology

Section 'A'
Non Chordata and Chordata

1. A general survey, classification and relationship of the various phyla.
2. Protozoa; Study of the structure, bionomica and life history of Paramaecium, Monocyotis, malaria parasite, Trypanosoma and Leishmania.

   Locomotion, nutrition and reproduction in Protozoa.
3. Porifera: Canal system, skeleton and reproduction.
4. Coelenterta: Structure and life history of Oblia and Aurelia, polymorphism in Hydrozoa, coral formation, metagenesis, phylogenetic relationship of Cinidaria and Acnidaria.
5. Helminths: Structure and life history of Planaria, Fasciola, Taenia and Ascaris. Parastic adaption,. Helminths in relation to man.
6. Annelida: Neries, earthworm and leech; coelem and metamerism; modes of life in polychaetes.
7. Arthropoda: Palemon, Scorpion, Cockroach, Larval forms and parasitism in Crustacea mouth part vision and respiration in arthropods, social life and metamorphosis in insects. Importance of Peripatus.
8. Mollusca: Unio Pila, oyster culture and pearl formation, cephalopodes.
9. Echinodermata-General organization, larval forms and affinities of Echinodermata.
10. General organisation and characters, outline classification and inter-relationship of protochordata, Pisces, Amphibia, Reptiluja. Aves and mammalia.
11. Noteny and retrogressive metamorphosis.
12. A general study of comparative account of the various systems of vertebrates.
13. Locomotion, migration and respiration in fishes; structure and affinities of dipnoi.

14. Origin of Amphibia; distribution, anatomical peculiarities and affinities of Urodela and Apoda.
15. Origin of Reptiles; adaptive radiation in reptiles fossil reptiles; poisonous and non poisonous snakes of India; poison apparatus of snake.
16. Origin of birds; flightless birds; aerial adaption and migration of birds.
17. Origin of mammals; homologies of ear ossicles in mammals; dentition and skin derivatives in mammals; distribution, structural peculiarities and phylogenetic relations of Prothotheria and Methatheria.

Section –B

Ecology, Ethology, Biostatistics and Economics Zoology.

Ecology

1. Environment: Abiotic factors and their role; Biotic factors-Inter and Inter-specific relations.
2. Animal: Organisation at population and community levels, ecological successions.
3. Ecosystems: concept, components, fundamental operation, energy flow, biogeo-chemical, cycles, food chain and tropic levels.
4. Adaption in fresh water, marine and terrestrial habitats.
5. Pollution in air, water and land.
6. Wild life in India and its conservation.

Ethology

7. General survey of various types of animal behaviour.
8. Role of hormones and phermones in behaviour.
9. Chronobiology: Biological clock, seasonal rhythms, tidal rhythms.
10. Neuro-endocrine control of behaviour.
11. Methods of studying animals behaviour.

Biostatistics

12. Methods of sampling, frequency distribution and measures of central tendency, standard deviation, standard error and standard devaiance, correlation and regression and Chiswuare and t-test.

Economic Zoology

13. Parasitism, Commensalism & host parasite relationship.
14. Parasite protozoans, helminthsis and insect of man and domestic animals.
15. Inspect pests of crops and stores products.
16. Beneficial insects.
17. Pisciculture and induced breeding.

PAPER- II

Cell Biology, Genetics, Evolution and Systematic, Bio-chemistry, Physiology and Embryology.

Section-A

Cell Biology, Genetics, Evolution and Systematic.

1. Cell Biology- Structure and function of cell and cytoplasmic constituents; structure of nucleus, plasma membrane, mitochondria, golgibodies, endo-plastic reticulum and ribosomes, cell-division; mitotic spindle and chromosome movements and meiosis.

Gene structure and function: Watson Crick model of DNA, replication of DNA Genetic model protein synthesis cell differentiation, sex-chromosomes and sex determination.

2. Genetics-Mendelian laws of inheritance re-combination linkage and linkage maps, multiple, alleys: mutation(natural and induced), mutation and evolution meiosis, chromosome number and form, structural rearrangements polyploidy; cytoplasmic inheritance, regulation of gene expression in prokaryotes and eukaroyotes; biochemical genetic, elements of human genetic; normal and abnormal karyotypes; genes and diseases, Eugenics.

3. Evolution and systematic-Origin of life, history of evolutionary through, Lamarck and his works. Darwin and his works, source and nature of organic variation.

Natural selection, Hardy-Weinberg law, cryptic and warning coloration mimicry; isolating mechanisms and their role , Insular fana, concept of species and sub-species, principles of classification, zoological nomenclature and international code. Fossils, outline of geological eras phylogeny of horse, elephant, camel, origin and evolution of man, principles and theories of continental distribution of animal zoogeographical realms of the world.

SECTION-B

Biochemistry, Physiology and Embryology

1. Biochemistry: Structure of carbohydrates, lipids, amino acids, proteins and nucleic acids, glycolysis and Krebs cycle, oxidation and reduction, oxidative phosphorylation, energy conservation and releases, ATP, Cycling AMP, Saturated and unsaturated fatty acids, cholesterol, steroid hormones; Types of enzymes, mechanism of enzyme action, immunoglobulin and immunity, vitamins and coenzymes; Hormones, their classification, biosynthesis and functions.

2. Physiology with special reference to mammals; composition of blood., blood groups in man, coagulation, oxygen and carbon dioxide transport, hemoglobin, breathing and its regulation, nephron and urine formation, acid-base balance and homeostasis; temperature regulation in man, mechanism of conduction along axon and across synapses, neurotransmitters, vision, hearing and other receptors; types of muscles, ultrastructees and mechanism of contraction of skeletal muscle; role of salivary gland, liver, pancreas and intestinal glands in digestion, absorption of digested food, nutrition and balanced diet of man, mechanism of action of steroid and peptize hormones, role of hypothalamus, pituitary thyroid, parathyroid, pancreases, adrenal testis, ovary and linear organs and their inter-relationship. Physiology of reproduction in humans, hormonal control of development in man and insects, pheromones in insects and mammals.

3. Embryology: Gametogenesis, fertilization, types of eggs, cleavage, development upto gastruction in branchostoma, frog and chick; Fate maps of frog and chick; metamorphosis in frog. Formation and fate of extra embryonic membrane in chick; formation of amnion allantoises and types of placenta in mammals, function or placenta in mammals: Organisers, Regeneration, genetic control of development. Organogenesis of central nervous system sense of organs heart and kidney of vertebrate embryos. Aging and its implication in relation to man.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

CHEMICAL ENGINEERING (DEGREE)

PAPER-I

a) FLUID AND PARTICLE DYNAMICS

Viscosity of Fluids.Laminar and turbulent flows. Equation of continuity and Navier-Stokes equation-Bernoulli's theorem. Flow meters. Fluid drag and pressure drop due to friction, Renold's Number and friction factor- effect of pipe roughness. Economic pipe diameter. Pumps, water, air/steam jet ejectors, compressors, blowers and fans. Agitation and mixing of solids and pastes. Crushing and grinding- principles and equipment. Rittenger's and Bond's laws. Filtration and filtration equipment. Fluid-particulars mechanics-free and hindered setting. Fluidisation and minimum fluidization velocity, concepts of compressible and incompressible flow. Transport of Solids.

b) MASS TRANSFER

Molecular diffusion coefficients, First and second law and diffusion, mass transfer coefficients, film and penetration theories of mass transfer. Distillation, simple distillation, relative volatility, fractional distillation, plate and packed columns for distillation. Calculation of theoretical number of plates. Liquid-liquid equilibria. Extraction- theory and practice: Design of gas-absorption columns. Drying. Humidification dehumidification. Cryatallisation. Design of equipment.

c) HEAT TRANSFER

Conduction, thermal conductivity, extended surface heat transfer. Convection-free and forced. Heat transfer coefficients – Nusselt Number. LMTD and effectiveness. NTU methods for the design of Double Pipe and Shell & Tube Heat Exchange. Analogy between heat and momentum transfer. Boiling and condensation heat transfer. Single and multiple-effect evaporators. Radiation- Stefan-Boltzman Law, emissivity and absorptivity. Calculation of heat load of a furnace Solar heaters.

d) NOVAL SEPARATION PROCESSES

Equilibrium separation processes-ion-exchange, osmosis, electro-dialysis, reverse osmosis, ultra-filtration and other membrane processes. Molecular distillation. Super critical fluid extraction.

e) PROCESS EQUIPMENT DESIGN

Factors affecting vessel design of storage vessels-vertical, horizontal spherical, underground tanks for atmospheric and high pressure. Design of closures flat and elliptical head. Design of supports. Materials of construction-characteristics and selction.

f) PROCESS DYNAMICS AND CONTROL

Measuring instruments for process variables like level, pressure, flow, temperature pH and concentration with indication in visual/ pneumatic/ analog/digital signal forms. Control variable, manipulative variable and load variables. Linear control theory- Laplace, transforms. PID controllers. Block diagram representation transient and frequency response, stability of closed loop system. Advance control strategies.

PAPER-II

a) MATERIAL AND ENERGY BALANCES

Material and energy balance calculations in processes with recycle/ bypass/purge. Combustion of solid/liquid gaseous fuels, stoichiometric relationships and excess air requirements. Adiabatic flame temperature.

b) CHEMICAL ENGINEERING THERMODYNAMICS

Laws of thermodynamics. PVT relationships for pure components and mixtures. Energy functions and inter-relationships – Maxwell's relations. Fugacity, activity and chemical potential. Vapour-liquid equilibria, for idea/non-ideal, single and multi component equilibrium, equilibrium constant and equilibrium conversions. Thermodynamic cycles – refrigeration and power.

c) CHEMICAL REACTING ENGINEERING

Batch reactors – Kinetics of homogeneous reactions and interpretation of kinetic data. Ideal flow reactors – CSTR, plug flow reactors and their performance equations. Temperature effects and run-away reactions. Heterogeneous reactions – catalytic and non-catalytic and gas-solid and gas liquid reactions. Intrinsic kinetics and global rate concept. Importance of inter-phase and intraparticle mass transfer on performance. Effectiveness factor Isothermal and non-isothermal reactors and reactor stability.

d) CHEMICAL TECHNOLOGY

Natural organic products-Wood and wood-base chemicals, pulp and paper. Agro industries – sugar, Edible oils extraction(including tree based seeds), Soaps and detergents. Essential oils – Biomass gasification (including biogas). Coal and coal chemical. Petroleum and Natural gas- Petroleum refining(Atmospheric distillation/cracking/reforming) Petrochemical industries-Polyethylenes(LDPE/HDPE/LLDPE), Polyvinyl Chloride, Polystyrene and lime industries. Paints and varnishes. Glass and ceremics. Fermantation – alcohol and antibiotics.

e) ENVIRONMENT ENGINEERING AND SAFETY

Ecology and environment. Sources of pollutants in the air and water. Green house effect, ozone layer depletion, acid rain. Micrometeorology and dispersion of pollutants in environment. Measurement techniques of pollutant levels and their control strategies. Solid wastes, their hazards and their disposal techniques. Design and performance analysis of pollution control equipment. Fire and explosion hazards rating –HAZOP and HAZAN. Emergency planning, disaster management. Environmental legislations – water, air environment protection Acts, Forest(Conservation)Act.

f) PROCESS ENGINEERING ECONOMICS

Fixed and working capital requirement for a process industry and estimation methods. Cost estimation and comparison of alternatives. Net present value by discounted cash flow. Pay back analysis. IRR, Depreciation, taxes and insurance. Break-even point analysis. Project scheduling- PERT and CPM. Profit and loss account, balance sheet and financial statement. Plant location and plant layout including piping.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

MEDICAL/RADIOLOGICAL IMAGING TECHNOLOGY

(1) BMIT (Bachelor of Medical Imaging Technology)/ BRIT (Bachelor of Radiological Imaging Technology)

PAPER – I

A. Anatomy, Physiology and Pathology
   (1) General Anatomy (Bones)
   (2) Systemic Anatomy and Physiology (GIT, RS, CNS. ETC)
   (3) Surface Anatomy in relation to Radiology
   (4) Applied Pathology (Radiology)
B. General Physics and Radiological Physics and Physics of Radio diagnosis Equipments.
C. Radiographic Photography, Radiographic techniques, Darkroom techniques and Film Processing.

PAPER-II

A. Special Diagnostic Procedures and Advances in Radiology
   (1) Contrast Studies
   (2) USG, CT, DR, MRI
B. Patient Care and Ethics
   (1) Radiation Hazards and Protection (Radiation Safety)
   (2) First Aid
   (3) AERB Safety Code
   (4) Technicians' Role and Responsibility
C. Foundation Course
   (1) Communication skill in English
   (2) Computer skill
   (3) General Knowledge

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

AGRICULTURAL ENGINEERING (DIPLOMA)

PAPER-I

1. ***Survey and Levelling:*** Survey & Levelling Instruments. Different methods of Survey & levelling. Mensuration of various section – Circular, Trapezoidal, Triangular, Rectangular, Parabola, Ellipse. Computation of Areas & Volumes from Field Notes, Drawings. Estimation & Costing of various Civil Works - Earthen Dams, Bench Terracing, Irrigation Canal, Retaining Wall.

2. ***Building materials:*** Types & their uses.

PAPER-II

1. ***Soil & Water Conservation:*** Definition, Classification & Type of Soils. Types of Soil Erosion and their causes. Erosion Control Measures- Biological & Engineering Measures. Computation of Bench Terracing, Farm Bund & Embankment.

2. ***Irrigation and Drainage:*** Types and Methods of Irrigation. Crop Water Requirement. Irrigation Water Measuring Devices. Computation of Irrigation Structures-Field Canal (Lined /Unlined), Drop Structure.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

INFORMATION TECHNOLOGY (DEGREE)

PAPER-I

1. **Theory of Computation**: Regular languages and finite automata, context free languages and Push-down automata, Turing machines.
2. **Digital Logic** : Logic Functions, Minimization, Design and synthesis of Combinatorial and Sequential Circuits, Number Representation and Computer Arithmetic (Fixed and Floating Point).
3. **Computer Organization**: Machine Instructions and Addressing Modes, ALU and Data path, Hardwired and Microprogrammed Control, Memory Interface, I/O Interface (Interrupt and DMA Mode), Serial Communication Interface, Instruction Pipelining, Cache, Main and Secondary Storage.
4. **Data Structures and Algorithms**: The Notion of Abstract Data Types, Stacks, Queues, Linked Lists, Trees, Binary Search Trees, Heap, Graph, Tree and Graph Traversals, Connected Components, Spanning Trees, Shortest Paths, Hashing, Sorting, Searching, Design Techniques (Greedy, Dynamic, Divide and Conquer), Asymptotic Analysis (Best, Worst, Average Cases) on Times and Space, Upper And Lower Bounds, Interactability.
5. **Programming Methodology:** C Programming, Program Control (Iteration, Recursion, Functions), Scope, Binding, Parameter Passing, Elementary Concepts of Object Oriented Programming.
6. **Operating Systems:** Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory Management and Virtual Memory, File systems, I/O systems. Protection and security.

PAPER-II

1. **Information Systems and Software Engineering**: Information Gathering, Requirement and Feasibility Analysis, Data Flow Diagrams, Process Specifications, Input/Output Design, Process Life Cycle, Planning and Managing the Project, Design, Coding, Testing, Implementation, Maintenance.
2. **Database**: Relational Mode, Database Design, Integrity Constraints, Normal Forms, Query Languages (SQL), File Structures (Sequential, Indexed), B-trees, Transaction and Concurrency Control.
3. **Data Communication:** Data Encoding and Transmission, Data Link Control, Multiplexing, Packet Switching, LAN Architecture, LAN Systems (Ethernet, Token Ring), Network Devices Switches, Gateways, Routers.
4. **Networks:** ISO/OSI Stack, sliding Window Protocols, Routing Protocols, TCP/UDP, Application Layer Protocols and Systems (HTTP, SMTP, DNS, FTP), Network Security.
5. **Web Technologies**: Three Tier Web Based Architecture; JSP, ASP, J2EE, NET Systems; HTML, XML.

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SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

Physical Education

Paper-I

A) History of Physical Education & Sports Sociology

- Development of Physical Education in India
  - Indus Valley Civilization Period
  - Vedic Period
  - Early Hindu Period (600BC-320AD) and later Hindu period (320AD-1000AD)
  - British Period
  - YMCA and its contributions
  - Sports Associations and Schemes in India
  - Physical Education in India post Independence
- Physical education in world (Sparta, Athens, Ancient Rome, USSR, Germany)
- Olympic, commonwealth and Asian games
  - Ancient Olympic Games-historical background, significances of ancient games
  - Modern Olympic Games, international Olympic committee (IOC) and Indian Olympic association IOA.
  - Commonwealth Games & Asian Games
- Meaning of sports sociology
  - Sports as social occurrence
  - Socialization through games and sports
  - Relationship between politics and sports
  - Relationship between family and sports participation
- Women and sports
  - History of women in sports
  - Empowerment of women through sports

B) Sports Training & Fitness Management

- Definitions: sports training, coaching, condition and adaptation
- Training load: types of training load, factors of training load
- Phases and means of recovery
- Overload: causes and symptoms of overload, means of tackling overload
- Strength training: concept and types of strength, methods of strength training
- Endurance training: concept and types of endurance, methods of endurance training
- Speed training: concept and types of speed, methods of speed training
- Technical training: techniques and skills, process of skill learning

- Training plan
- Periodization: aim and content of periods, types of periodization and its significances
- Super compensation in sports training
- Exercises for fitness & designing of the programme
    - Means of fitness development: aerobic & anaerobic exercises, callisthenic exercises and Swiss Ball exercise, free weight and machine
    - Calculation of various target heart rates
    - Concept of designing different fitness training program
- Nutrition and weight management
    - Nutrition- daily calorie requirements and daily energy expenditures
    - BMI. Obesity and its hazards
    - Dieting vs exercise for weight control
- Establishment and management of fitness centre
    - Principles of starting a fitness center- environment, location, policy, offer of program, record keeping, public relation
    - Fitness centre membership and its types
    - Safety aspects in a fitness centre
    - Qualification and qualities for a fitness trainer

C) Management of physical education & sports

- Management and organizational structure
    - Administration and management
    - Phases of management
    - Principles of management
    - Schemes of organizations: procedures to carry out effective scheme
    - Organizational structure of physical education in schools, sports in departments.
- Facilities and equipments
    - The need for outdoor facilities
    - Selection/types of surfaces
    - Guidelines/principles for layout of outdoor facilities
    - Care and maintenance of outdoor facilities
    - Gymnasium: need, location, dimension, sample floor plans and construction
    - Swimming pool: need, construction, maintenance, and supervision
    - Need for sports equipment and their types
    - Procedure & principles for the purchase of sports equipment
- Intramurals & Extramural
    - Meaning and educational outcomes of Intramural & extramural
    - Evil practices and limitation in participation
    - Sports tour management

- Staff management, class management and office management
    - Head of the institution/department and his role in imbibing the spirit of discipline among his employees & trainees/students
    - Staff cooperation and its significances
    - Need for office, its location and set up
    - Office functions and practices

D) Methods in physical education

- Presentation technique
    - Personal and technical presentation
    - Commands- their types and uses
    - Formation- types and situation for using different formation
- Tournaments: meaning, types, merits & demerits
    - Knock out or elimination
    - League or round-robin tournaments
    - Combination tournaments
    - Challenge tournament-ladder, pyramid, and cob-web
- Track marking:
    - Marking of 400 meters
    - Stagger marking for 200 mts and 400 mts
    - Curve marking- 800mts
- Field marking: sector markings for throwing events (shot put, javelin, discuss)
- Marking of jumping events
- Marking of play field: football, hockey, volleyball, basketball, badminton, kabaddi, kho-kho, handball, tennis, and cricket.

E) Measurement & Evaluation

- Meaning of test, measurement and evaluation
- Needs and importance of test, measurement and evaluation in physical education and sports
- Frequency table: importance of F.T. and construction
- Measure of central tendency (Sports & physical education)
    - Mean (group & ungroup data)
    - Median (group & ungroup data)
    - Mode (group & ungroup data)
- Measure of variability
    - Quartile deviation (group & ungroup data)
    - Standard deviation (group & ungroup data)
- Knowledge test
- Criteria of test selection
- Administration of testing program: duties before, during and after testing

- Strength test
- Cardio respiratory endurance test
- Fitness test
- Balance test
- Flexibility test
- Sports skills test
- Social efficiency

Paper-II

F) Movement education

- History of movement education: traditional approach in movement education, process of skills acquisition
- Understanding movement
  - Relationship of body awareness & spatial awareness
  - Locomotor & non locomotor acidities and manipulative activities
  - General space and personal space
  - Using different speed in self space
- Motor skill learning
  - Concept of motor skill learning
  - Level of motor skill learning
  - Exploration
  - Discovery
- Motor learning principles
  - Facilitating exploration
  - Facilitating discovery
  - Facilitating combination
- Fundamental locomotion skill themes
- Fundamental manipulative skill themes
- Fundamental stability skill theme
- Movement education program for nursery school child

G) Sports psychology

- Definition of sports psychology and its history as a discipline
- Personality and sports performance
- Attention in sports: information processing, memory systems, measuring information
- Anxiety and arousal in sports

- ❖ Neurophysiology of arousal
- ❖ Autonomic nervous system, brain mechanics, preferred state of arousal

- Defining Anxiety and stress
- Measure of anxiety
- Multidimensional nature of anxiety
- Arousal adjustment strategies in sports
  - ❖ Relaxation procedures
  - ❖ Arousal energizing strategies
- Cognitive behavioral intervention in sport
  - ❖ Coping strategies in sports
  - ❖ Imagery in sports
  - ❖ Cognitive behavioral intervention programs using imagery and relaxation
  - ❖ Goal setting in sport
  - ❖ Psychological skills training for sport
- Motivation and self confidence in sport
- Aggression in sports
- Audience effects in sports
- Team cohesion
- Leadership in sports

H) Anatomy & exercise Physiology

- Skeletal system and Joints
  - ❖ Human skeleton and types of bone
  - ❖ Structure and functions of all bones
- Joints
  - ❖ Joints nomenclature and classification
  - ❖ Name of the movements around the joint
  - ❖ Structures of typical synovial joint
- Human Body Systems
  - ❖ Muscular System: classification and scientific names of muscles, structure and functions of different types of muscles (Skeletal muscle, smooth muscles, and cardiac muscles)
  - ❖ Digestive systems: organs of digestion, its structures and function, steps of digestion, digestive glands- structure and functions
- Excretory System
  - ❖ Various routes of excretion from human body
  - ❖ Organs of urinary system, structure and functions of kidney
- Circulatory system
  - ❖ Anatomical position and gross structure and function of heart
  - ❖ Blood vessels and its functions
  - ❖ Systemic and pulmonary circulation

- Respiratory system
  - Process of external & internal respiration
  - Structure and functions of lungs and air passage
  - Mechanism of respiration
- Nervous system
  - Structural and functional division of nervous system- CNS, PNS, and sensory motor nervous system
  - Structure and function of brain & spinal cord
- Long and short term effects of Exercises on Var ious human body systems: (Circulatory system, Respiratory system, muscular system, excretory system, endocrine system and nervous system)

I) Correctives & Rehabilitation

- Posture
  - Definition of posture, types of posture
  - Individual variations in posture
  - Curves in a normal spine
  - Good and bad posture, values of good posture, causes of bad posture and its drawbacks
- Common postural defects, causes and their corrective measures and its rehabilitation
  - Kyphosis
  - Lordosis
  - Flat foot
  - Kypho-lordosis
  - Knock knee, bow leg
  - Scoliosis
- Sports injuries
  - General factors causing sports injuries
  - Role of trained personnel in sports injury management
  - Complications of incomplete treatment
- Most common sports injuries: immediate and long term treatment
  - Sprain, strain, contusion, dislocation, fracture
- Introduction to therapeutic modalities & rehabilitation: effects & uses, techniques of application of therapeutic modalities
  - Ice, Infrared Radiation, Hot-moist therapy, wax bath, contrast bath
  - Classification and therapeutic application of: active exercise (free, assisted, resisted exercise) Passive exercise (relaxed, forced passive exercise)
  - Muscle strengthening: causes of muscle weakness and its principles of muscle strengthening

- ❖ Mobilizations of joints: factors causing limitation of joint mobility, methods for mobilizing joint stiffness
- ➢ Sports Massage
  - ❖ Effects of massage: physical, physiological and psychological
  - ❖ General approach to massage application
  - ❖ Role of massage in sports competition
  - ❖ Effects and uses of m assage techniques: superficial stroking, effleurage, kneading, petrissage, friction, percussion, vibratory techniques.

J) Kinesiology

- ➢ Definition of kinesiology, its objectives
- ➢ Role of kinesiology in physical education
- ➢ Fundamental concepts of the following terms with their application in sports
  - ❖ Axes and planes
  - ❖ Center of gravity
  - ❖ Line of gravity
- ➢ Neuromuscular concepts:
  - ❖ All and none law
  - ❖ Reciprocal innervations or inhibition
  - ❖ Angle of pull
- ➢ Applications of mechanical concept
- ➢ Motion: types of motion, Newton's law of motion and its application in sports
- ➢ Force: magnitude and direction of application of force
- ➢ Centripetal and centrifugal force and its application to sports activities
- ➢ Equilibrium: factors affecting equilibrium, role of equilibrium in sports
- ➢ Lever: types of lever, significance of lever in sport
- ➢ Analysis of locomotion: walking, jogging, running, lifting, catching, throwing.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

LIBRARY SCIENCE

PAPER-I

Unit: I: Laws of Library Science

Ranganathan's Five laws of Library Science are a set of norm s. precepts and guides to good practices in librarianship. These Laws are also v alid guides to practices in the wider area of documentation and information systems and services. After reading this unit. you will he able to: explain your activity in library, documentation and information work and services in tune with these guiding principles governed by the Fi ve Laws; and m ake use of the Five Laws a set of logical principles to initia te any ne w activity in library, docum entation information work and services.

Unit: II: Circulation work

Lending documents for hom e reading is a norm al. regular and on-goi ng activity of m ost modern service libraries. W hen hundreds and thousands of docum ents are on circulation among readers it is necessary to design a syst em to operate and control the m ovements of documents in a library. The work o f circulation has therefore, to he planned and m anaged with efficiency. This unit discu sses all these aspects. After reading this unit you will be able to identity the f actors with ref erence to wh ich circulation work can be planned; design a circulation system suitable for a library : describe policy guidelines with reference to all aspects of circu lation work: an d organize and m anage the vari ous functions of circulation work.

Unit: III: Indexing and abstracting periodicals

In this unit we discuss indexing and abstracting periodicals as information access tools. After reading this unit you w ill be able to: define in dexing and abstracting period icals: describe their scope and utility; enumerate different types of indexing and abstracting periodicals with examples; and explain the importance and uses of indexing and abstracting periodicals.

UNIT: IV: Current Awareness periodicals

In this unit we introduce you to tw o important information services offered by libraries and information centers: Current Awareness Services and Selective
Dissemination of Information service. After read ing this unit you will be able to: explain the need and purpose of current awaren ess services (CAS); describe the different types of CAS explain the concept and objectives of Selective Dissemination
of Information (SDI)service; list the components of SDI and de scribe them: and explain the functional aspects of SDI.

Unit: V: Human Resource Development

Human resource developm ent concept and c ontours; Personal planning; participative management and total quality management.

PAPER-II

Unit: I: Fundamental categories, Facet Analysis and Facet Sequence
This unit explains the importance of terminology for a scientific subject like classification. It also familiarizes you with the fundamental concepts/terms associated with the discipline of classification.

Unit: II: Kinds of entries
You have learnt about a library catalogue, the purpose of it serves and the functions it performs. The preparation of various types of entries constitutes the basic &work of cataloguing. This unit introduces you to the different types of entries and their relative functions. After reading this unit you will be able to describe a catalogue entry; explain the need for different kinds of entries; distinguish their functional characteristics:and identity the composition of entries in a dictionary and a classified catalogue.

Unit: III: Library and Information Networks
In this unit let us try to understand the concept of not works especially library and information networks. What they are how they function and their role in the provision of information service to the users has also in the resource sharing activities. After reading this unit you will be able to: understand the concept of computer networking in all its major forms; explain the role of networking in the public domain; know the meaning of library and bibliographic networking; the role of networking in resource sharing the information services; and explain some of the current developments in networking taking place in the developed countries of the world.

Unit: IV: Approaches to library classification
Postulation and systems approaches; Fundamental categories, facet an alysis and facet sequence; Phase relation and common isolates.

Unit: V: Dewey decimal classification (DDC); universal decimal classification (UDC); Colon classification (CC); Current trends in library classification.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

PRINTING TECHNOLOGY (DIPLOMA)

PAPER-I

1. Different Types and Process of Printing.
2. Printing machineries and equipment maintenance, responsibility of the operator, printing machine problems and its remedies etc.
3. Development in Printing technique, machineries & equipment, types of printing materials.
4. Prepress fundamentals, Computer fundamentals, DTP, importance of designing, fonts, graphics, methods of composing & imposing, page make up, proof reading, printers measurement system etc.
5. Reproduction photography, types of camera use in printing, Studio accommodation and planning, Camera room equipment and accessories, photographic principle, retouching and correction in printing.
6. Binding and finishing, types of binding, Packaging.
7. Post press machineries and equipments, Binding materials etc.

PAPER-II

1. Fundamentals of plate making, types of plate, exposure, coating, finishing, colour separation, scanning, tone and half tone etc.
2. Plate making machineries and equipments.
3. Use of chemicals in printing, types of ink, ink consumption, value and use of colour etc.
4. Understanding paper weight (gsm), paper size, paper calculation, conversion, opacity of paper, PH value and types of paper etc.
5. Costing and estimating, Quality and production control, material management in printing, suitability of the different printing process.
6. Simple algebra, calculus, geometry, addition, multiplication and subtraction etc.
7. Communication skills.

SYLLABUS FOR ELECTRONICS & TELE COMMUNICATION (DIPLOMA)

PAPER-I

1. ***Materials and Components:*** Structure and properties of Electrical Engineering materials; Conductors, Semiconductors and Insulations, Magnetic, Ferroelectric, Piezoelectric, Ceramic, Optical and Super-conducting materials. Passive components and characteristics Resistors, Capacitors and Inductors; Ferrities, Quartz crystal Ceramic resonators, Electromagnetic an Electromechanical components.

2. ***Physical Electronics, Electron Devices and ICs:*** Electrons and holes in semiconductors, Carrier Statistics, mechanism of current flow in a semiconductor, Hall effect; Junction theory; Different types of diodes and their characteristics; Bipolar Junction transistor; Field effect transistors; Power switching devices like SCRs, GTOs, Power MOSFETS; Basics of ICs-bipolar, MOS and CMOS types; basic of Opto Electronics.

3. ***Network Theory:*** Network analysis techniques; Network theorems, transient response, steady state sinusoidal response; Network graphs and their applications in network analysis; Tellegen's theorem. Two port networks; Z, Y, H and transmission parameters. Combination of two ports, analysis of common two ports. Network functions: Parts of network functions, obtaining a network function from a given part. Transmission criteria: delay and rise time, Elmore's and other definitions effect of cascading. Elements of network synthesis.

PAPER-II

1. ***Analog Electronic Circuits:*** Transistor biasing and stabilization, Small signal analysis; Power amplifiers. Frequency response. Wide banding techniques. Feedback amplifiers. Tuned amplifiers. Oscillators. Rectifiers and power supplies. Op Amp, PLL, other linear integrated circuits and applications. Pulse shaping circuits and waveform generators.

2. ***Digital Electronic Circuits:*** Transistor as a switching element; Boolean algebra, simplification of Boolean functions, Karnaguh map and applicators; IC logic gates and their characteristics IC logic families: DTL, TTL, ECL, NMOS, PMOS and CMOS gates and their comparison; Combinational logic Circuits; Half adder, Full adder; Digital comparator; Multiplexer, Demultiplexer; ROM and their applications. Flip flops. R-S, J-K, D and T flip-flops; Different types of counters and registers Waveform generators. A/D and D/A converters. Semiconductor memories.

3. ***Communication Systems:*** Basic information theory; Modulation and detection in analogue and digital systems; Sampling and data reconstruction; Quantization; and coding; time division and frequency division, multiplexing; Equalization; Optical communication: in free space & fiber optic; Propagation of signals oat HF. VHF, UHF and microwave frequency; Satellite Communication.

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

COMPUTER SCIENCE/COMPUTER ENGINEERING (DIPLOMA)

PAPER l

1.0 INTRODUCTION TO COMPUTERS

1.1 Generations of Computers:

- First generation
- Second Generation
- Third generation
- Fourth generation

1.2 Classification of Computers:

- Super-computers
- Mainframe computers
- Mini computers
- Workstations
- Micro computers

1.3 Data representation and Number systems:

- Binary digit-Bit, Byte, Nibble, Word
- Binary Coded Decimal (BCD)
- ASCII
- Number systems-Binary, Octal, Decimal, hexadecimal
- Conversions of Binary to Decimal system and vice versa
- Binary operations-addition, subtr action, 1's com plement and 2's compliment

1.4 Basic organization of a Computer system:

- Functional Block diagram
- Input unit
- Output unit
- Central Processing Unit-Main memory, ALU and CU
- Mass Storage unit

2.0 INPUT AND OUTPUT DEVICES

2.1 Input devices:

- Keyboard
- Mouse- Scroll mouse, optical mouse
- Scanners- Optical character reader, bar-code reader

2.2 Output devices:

- Monitors/VDU-Cathode ray tube, Liquid Crystal display
- Printers- Dot Matrix printer, Laser printer, Inkjet printer, Plotters

3.0 STORAGE DEVICES

3.1 Non-Volatile memory

- ROM, PROM and EPROM

3.2 Volatile memory

- Registers, Cache memory, Main memory RAM

3.3 Comparative study of Cache m emory, Primary storage and Secondary storage w.r.t. storage capacity and speed.

3.4 Different between SDRAM and DDR RAM

3.5 Magnetic storage device

- Floppy disk drives
- Hard disk drive-different com ponents and their functions, organization of data and drive interface.

3.6 Optical storage device

- CD/DVD drives-organization of data read/write mechanism.

4.0 COMPONENTS OF MOTHERBOARD

4.1 Memory controller hub

- System bus
- Processor socket
- DIMM slot
- Advanced Graphic Port

4.2 Input/Output controller hub

- Primary/Secondary IDE channel
- Peripheral Component Interconnect
- Serial and Parallel post
- PS/2 ports
- USB ports

4.3 BIOS ROM

4.4 CMOS battery

4.5 Real time clock

4.6 SMPS connector

5.0 COMPUTER NETWORKS

5.1 concept of computer network

- Local Area Networks
- Metropolitan Area Networks
- Wide Area Networks

5.2 Transmission modes:

- Simplex mode
- Half-duplex mode
- Full-duplex mode

5.3 Transmission Media:

- Co-axial cable
- Twisted pair-UTP and STP
- Optical Fiber

5.4 Network Topologies:

- Bus topology
- Star topology
- Ring topology
- Mesh topology

5.5 Network Architectures:

- Peer to Peer Networks
- Client Server networks

5.6 Network connectivity devices:

- MODEM
- Repeater
- Routers
- Bridge
- Gateway

5.7 OSI reference model of data communication:

- Physical layer
- Data Link layer
- Network layer
- Transport layer
- Session layer
- Presentation layer
- Application layer

5.8 Standards and Protocols:

- TCP/IP Protocols
- NetBEUI Protocols
- IPX/SPX Protocols
- IEEE Standards

6.0 INTERNET TECHNOLOGY

6.1 Basics of Intranet and Internet

6.2 Services provided by the Internet

- Email
- Chatting (textual/voice)
- Bulletin Boards
- Video conferencing
- FTP (uploading and downloading files)
- Telnet

6.3 World Wide Web:

- Web-Site Access and Information Search
- Browsers and search engines

6.4 Internet Connectivity:

- Internet Service Provider (ISP)
- Internet accounts and its features – Dial-up, Leased line, ISDN, VSAT

7.0 COMPUTER LANGUAGES:

7.1 Analogy with natural languages

7.2 Characteristics of a good Language

7.3 Classification of languages

- Machine language
- Assembly language
- High-level language

8.0 COMPUTER SOFTWARE:

8.1 Relationship between hardware and software

8.2 Classification of Software

8.3 System software – Operating system, Compiler & Interpreter

8.4 Application software-MS Office, Adobe PageMaker, PhotoShop etc.

8.5 MS Office

- MS WORD (Word Processing software)
- MS EXCEL (Spreadsheet/Data analysis software)
- MS POWERPOINT (Presentation software)
- MS ACCESS (Database software)

8.6 MS WORD

- About MS Word
- Starting MS WORD
- Components of MS Word window
- Creating and Editing document
- Formatting text
- Inserting Symbols, Picture and Word Art
- Tab settings, Borders and Shading
- Header and Footer-Footnote and Endnote
- Drawing basic shapes
- Inserting Text Box, Callouts, Captions
- Drawing with Tables
- Advanced WORD features
  - Auto correcting, Spelling and Grammar check
  - DropCap
  - Creating Multiple Columns
  - Mail Merge

8.7 MS EXCEL

- Features of MS EXCEL
- Components of EXCEL window
- Creating and naming Worksheets
- Formatting and Editing
- Using Formulas
- Types of Functions
- Sharing and Managing Data

- Working with Chart-Chart components, Chart types, 3d Chart

8.8 MS POWERPOINT

- About Powerpoint
- Different components in PowerPoint window
- Different views
- Using Design Templates
- Creating a new presentation
- Creating a Title Slide
- Formatting a Slide
- Applying Transition effects
- Using action button
- Animating and customizing animation

8.9 MS ACCESS

- About Access and Access database
- Planning database structure
- Creating a database
- Adding records to a database
- Querying a database
- Creating forms
- Creating Reports

9.0 COMPUTER VIRUSES

9.1 Introduction

9.2 Types of viruses

- Command processor infection
- Boot sector infection
- Executable file infection
- File-specific infection
- Memory resident infection
- Macro viruses

9.3 Protecting the PC from viruses

9.4 Recognizing an infection

9.5 Dealing with an infection

PAPER ll

1.0 Operating system

- Definition
- Function of OS
- Evolution of operating systems
  - Sequental processing
  - Batch processing

    - Multi programming
    - Multi processing
    - Real time
    - Multi tasking
- Process concept
    - CPU scheduling-First come first served, Shortest job first, Priority, Round Robin, Multiprocessor scheduling
- memory management
- I/O Systems and mass Storage Structure
- Disk Operating system
    - Features & characteristics of MS DOS
    - Booting, system files, BIOS
    - Files and directory
    - Internal commands
    - External commands
    - Meaning of BAT, EXE and COM files
- Windows Operating System
    - Concept of Windows- Arranging, Moving, Resizing, Opening and Closing of windows
    - Folder/File management-Search, copy, delete and rename files and folders Restore
    - Windows Accessories-Notepad, Word Pad, Paint
    - Overview of different versions of MS Windows OS

2.0 UNIX-OPERATING SYSTEM

- History and development of UNIX OS
    - Features, Structures of UNIX OS
    - Kernel, Shell, Applications Utilities
    - Hardware requirements for Installation
- Essential UNIX Commands
    - Startup & Shutdown Process
    - Booting Procedure with different stages, Login process, password concept, who, who am I, tty, date and cal commands, system shutdown.
    - File concept
        - File types in UNIX, Hierarchical directory structure, File system structure.
    - File creating, displaying, concatenating and copying
    - Creating and changing directories, removing files and directories
        - CD, CP, MD, RM, MKDIR, CAT
    - File processing commands
        - Wc, head, tail, cut, paste join, split, sort, grep, egrep, tr, comm., cmp, diff, more, less commands
    - File formatting and printing commands-pr with options, lp commands

- Online help facilities in UNIX- Use of man and help command
- Mathematical commands-bc, expr, factor, units
- Communication commands
  - User to user comm unication using write, m ailing using m ail, broadcasting messages using wall.

3.0 DATABASE MANAGEMENT SYSTEM

- Basic concepts of Data and Information
  - Database
  - Database management System
  - Database Administrator
  - Functions of DBMS
- Relational Databases
  - Relational system, the relational mode l, optimization, base tables and views, the SQL language
- Relational Data Objects
  - Domains and relations: dom ains, relations. And kinds of relations, relations and predicates, relational database
- The Entity/Relationship Model
  - Introduction, the overall approach, an overview of the E/R m odel, E/R diagrams, database with the E/R model
- SQL Language
  - Introduction, data definition, data-mani pulation, retrieval operation, data manipulation-update operation, table expressions, conditional expressions, scalar expressions, embedded SQL
- Database security
  - Introduction, authentication, authorization, and access control, enforcement

4.0 SYSTEM ANALYSIS AND DESIGN

4.1 Introduction

- System concept: Definition
- Characteristics of a system
- Elements of a system
- Types of system: Physical system, Abstract systems, Open system, Closed systems
- Information system

4.2 System Development Life Cycle

- Introduction
- Different phrases/stages in system development Life Cycle
- Role of the system Analyst
- Factors affecting failure in SDLC

5.0 PROGRAMMING IN 'C' LANGUAGE

5.1 Introduction

- History and features of C
- Algorithms
- Flowcharts
- Structural programming Concepts

5.2 Operations & Expression

- Character set of C
- Operators and Expressions-Arithm etic, Relational, Logical assignment operators, variables, constants, data types, expressions, data types conversion, key words, hierarchy of operators

5.3 Input & Output Statements

- 'C' Programme structure, Type declar ation, Input and Output, (printf, scanf, getchar, putchar, getch, putch), Conversion specifiers in format control string, Library functions (Math functions)

5.4 Control Statements

- Unconditional branching, goto statement
- Conditional branching statements: if statement, if-else, Nested 'if'
- Multiple branching statements: switch case statement

5.5 Control Loop Statements

- Loop Statements: 'for' statement, while statement, 'do-while' statement, 'break-continue' statement

5.6 Arrays & Strings

- Arrays:

- Concept of one dimensional, two dimensional and Multi-dimensional array, array declaration, Array and initialization, operations on one and two-dimensional arrays.

String Manipulations

- Strings, get, puts, string operations, string function (concatenation, comparison, length of a string).

5.7 Functions

- Library and User- Defined functions

- Concepts of library functions, user-defined Functions, local and global variables, storage class, parameter passing mechanisms

6.0 OBJECT ORIENTED PROGRAMMING

6.1 Introduction

- Procedure-oriented programming versus Object-Oriented programming concept
- Basic concepts of OOPs
- Object oriented languages
- Beginning with C++

- Concept and structure of C++ programming
- Introduction to structures & Union of C

6.2 Objects and Classes

- Classes
  - Specifying a class and types of class
  - Defining and nesting member functions
  - Arrays within a class
- Objects
  - Creating objects
  - Memory allocation for objects
  - Static data and member function
  - Array of objects
  - Objects as function arguments

6.3 Constructions and destructors

- Constructors
  - Parameterized
  - Multiple
  - Constructor with detail argument
  - Dynamic
- Destructor
  - Operator overloading and type conversion
  - Inline functions overloading
  - Overloading unary and binary operators
  - Rules for overloading operators

6.4 Inheritance

- Introduction
- Derived classes
- Member declaration: protected
- Types of inheritance
  - Single
  - Multilevel
  - Hierarchical
  - Hybrid inheritance
- Virtual base classes
- Abstract classes
- Constructors in derived classes
- Member classes

6.5 Polymorphism

- Introduction
  - Polymorphism in programming languages
  - Types of polymorphism
  - Polymorphic variables
- Overloading and overriding
- Virtual functions
- Static and dynamic binging

6.6 Pointers in C++

- Concept of Pointers
  - Pointer declaration
  - Pointer operator
  - Address operator
  - Pointer expressions
  - Pointer Arithmetic
- Pointers and Functions
  - Call by value
  - Call by reference
  - Pointer to functions
  - Passing function to another function
- Pointers in Arrays-Searching, Insertion and Deletion
- Pointers To String
  - Searching, Insertion and Deletion
  - Finding length and comparison
- Pointers and objects
  - Pointers to objects
  - This pointer
  - Pointers to derived classes

6.7 Internet Technology

- I/O system basics
  - The stream classes
  - Templates classes
  - Character based classes
  - Using manipulator to format I/O
- File handling
- File system Basics
- Opening and closing a file, Reading and writing a character from a file using fputs, fgets, rewind(), ferror, erasing file

6.8 Graphics in C++

- Text mode graphics functions-Window function, cputs(), clrscr()
- Graphics mode graphics functions:- initgraph, circle, closegraph
- Shapes

- Set colours, set lines styles, set fill style, flood fill Colours
- Line and Rectangle: Line(), Rectangle()

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COMPUTER OPERATOR & PROGRAMMING ASST. (C.O.P.A)

MODULE – I (Paper I)

Unit – I: - History of Computer & Fundamentals.

History of Computer

- Abacus of ENIAC, Computer Generation, Languages, Software and application, Computer in India.

Computer – An Introduction

- Function of Computer: Input, processing, Output, Functions of ALU, control, storage, input and output devices.
- Application of Computer: Viz. Railway reservation, Electricity / Telephone billing etc.

Types / Classification

- Classification of Computer: Home, Micro, Mini, Mini, Mainframe, Super Computers.
- Centralized Decentralized distributed systems.
- Network of Computers – Homogenous, Heterogeneous Characteristics.
- Clock Speed, Accuracy.
- Bits, bytes, characters, field, record, file.
- Binary, binary addition and subtraction, octal, hexadecimal, ASCII, EBCDIC, Positive versus Negative integers, floating point number.
- Higher level and Lower level Languages.

Unit – II: - Hardware and Software Concepts.

- Computer Hardware; Electronics Digital Computers.
- Input devices: On line data input devices &their importance, Dumb terminals, Intelligent terminal, voice recognition devices, Touch tone terminals, Mouse.
- Offline data input: Key to disk system, Key to tape system, Key to punched card.
- Sources data input: Point of sale terminals, Laser beam scanners, Optical sense readers, Optical Character readers (OCR), Magnetic ink character reader (MICR).
- Output Devices: Hard copy devices – Dot Matrix printer, Ink Jet printers, Laser Printers, Plotter output.
- Soft copy Devices: Hardware – VDU (Monochrome & Colours), LCD (Liquid Crystal Display), Audio response unit; Micro films.
- CPU Architecture: ALU: Instruction Execution, Fetch and Execution cycles, Control unit Micro – programming concepts, Speed mismatch between CPU and memory.

- Memory Devices: RAM, ROM, PROM. EPROM, ECC RAM, EDO RAM and their specifications, memory storage locations, use of memory addressing in programming.
- Secondary memory Devices: Floppy disk, hard disk (removable/fixed), Concepts of cylinders, tracks, and sectors, Advantage and Limitations of secondary, access time, access methods (Sequential, Direct, Index) & CD – ROM.
- Application vs. system software, compiler, interpreter, Multiuser, Multitasking operating systems.
- Virus protection diagnostic tools.

Unit – III: - Introduction to PC's/Micro computers Operating Systems. WINDOWS – 98/2000, MS DOS, NETWARE

DOS/WINDOWS commands –

- Profiling an Operating System.
- Booting Sequence: Operating System files and Command Processor file.
- Definition of a file; File names.
- Booting from floppy and HDD.
- Warm and Cold reboot.

Using Desk Top ICONS

- My Computer
- Network Neighborhood
- Control Panel
- Add Printer
- Create/Delete/Rename Folder

Basic Shell Commands of Unix:

- Date, echo, who, is, cp, rm, mv, cd,
- Mkdir, rmdir, chmod, sort, grep, passwd etc.

Communication & Network Concepts:

- Concepts of batch vs. on line environment.
- Single user vs. Multiuser environment, Multi tasking and Multi processing.
- Network management concept.
- Concept of batch files in MS DOS.

Concept of Information & Data – Processing

- Information concept and processing: Evolution of information processing, data, information, language and communication.

- Definition of Information: difference between Data and Information (analogous to raw material / finished product)
- Value of Information: relevance to receiver, decision – making potential.
- Data concepts: symbols which describe record reality logical and physical concepts.
- Logical concepts of data: Entities, Attributes and Relationships.
- Physical concepts: Storage and retrieval and processing of data; comparison of manual and computer storage and organization of data as files.
- Data processing: storage, retrieval and processing of data as files.
- Data processing: storage retrieval and processing of data, provision of information of relevance.
- Techniques/ Method of Data processing.

Unit – IV: - Programming practice and Techniques.

- Data capture and validation, Data entry package (Software & Practice)
- Input from design, data editing, key to disk system, validation & control.
- Laboratory exercise on data – entry (speed 8000 character hrs.) Tele – typewriter, video display terminal, dot matrix printers.
- Exercise on data collection, data validation and data validation and data verification.
- Exercise on transferring data from one medium to another / including back – up Restore.

Unit – V: - Language

Introduction to C

- Overview of C.
- Constant, Variable and Data types.
- Operators and expression.
- Managing Formatted/ Unformatted Input and Output.
- Decision making and Branching.
- Decision Making looping
- Arrays
- Handling of character strings
- User defined functions
- Structure and Unions
- Pointers
- File management in C

Module – II (Paper II)

Unit – I: - Program design & Logic

- Problem analysis, evolution using step wise refinement Algorithm. Data Flow Diagrams, structure charts, decisions tables, pseudocoding. More emphasis on flow charts and its symbols.
- Illustration with summing series, sorting, searching merging Analysis of algorithms – space and time trade offs. Programme documentation, style in programming, program testing. Flow charts and Data Flow Diagrams.
- Program testing and debugging efficient programming techniques structured programming.

Unit – II: - Programming and problem solving through C++

- Over view of programming: Introduction to Computer based problem solving and strategies for the same, programs design and implementation issue, Algorithm, Data organization, Data structure, use of procedures for modular design, documentation of programs and program testing.
- Fundamental of C++ programming; Structure of C++ programming Data Type, Data structure, constants and variables.
- Operators: Arithmetic, relation and logical, control if-then, for-while.
- Arrays: Array declaration, one and two dimensional array – Function; General, function arguments, return value.
- Basic I/O: Formatted and unformatted I/O
- Advance Programming Techniques
- Dynamic Data structure in C++
- Miscellaneous features: File handling.

Unit – III: - Introduction to Business Organization.

- Introduction to Business Organization and their need.
- Introduction to data processing: Records and Files; Data collection, prepration, verification, editing and checking.
- Business files-master, processing sorting searching, merging, summarizing, Business files – Master and Transactional Files: file generation back – ups files recovery procedures.
- Introduction to Accounting and Financial management Types of accounts, books of accounts, simples accounting entries etc.

Computer Application:

- Financial Accounting
- Pay Roll and invoicing application
- Budgeting and planning

- Cost Accounting
- Inventory and State Control
- Sales Accounting and Sales Analysis etc.

Unit – IV: - Xbase package

- Concept of data base Management system
- Difference between data file and database files
- Creating Data Base Files and Structures
- Editing Data base Files.
- Record pointer positioning features
- Specific record location features
- Information display commands
- Indexed files
- Create, delete, save and recall memory variables.
- Using in-built report and label facility
- Using table facility
- Format files
- Using various functions and set Commands available
- Handling of multiple database files.
- Developing Programmes for Commercial Application using Windows based, X-base package.

Unit – V: - An Overview of Selected packages.

- Desktop publishing
- Popular packages on Communication like CCMAIL, PRUCOMPLUS etc.
- Presentation Graphic features, coreldraw, Powerpoint etc,
- Multimedia / Animation packages.

Unit – VI: - Basic concept of Networking/ Communication.

- Concept of Networking, LAN, WAN & E-mail
- Internet connection setup & sharing.
- Protocol TCP/IP, FTP, ISP, NSP etc.
- Concept of Proxy server, Web server, Client server etc.
- Concept of Sites & pages.
- Introduction to BIML, DHTML, XML.
- Designing Web-pages: Static & Dynamic.

Unit – VII: - Data entry in Hindi/ Recognized Regional Language

- Data Entry.

Unit – VIII: - Awareness of IT – Act 2000

- Provisional of Act
- Types of offences, Fines, Imprisonment.

Unit – IX: - Office Automation packages.

- Word Processing Packages
- Spreadsheet Packages

SYLLABUS FOR COMBINED TECHNICAL EXAMINATION

PRODUCTION AND INDUSTRIAL ENGINEERING

PAPER-I

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, Strokes, 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.

PRODUCTION ENGINEERING

Metal Casting: Casting processes –types and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

Metal Forming: Stress- strain relations in elastic and plastic deformations; concept of flow stress, deformation mechanisms; hot and cold working – forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire/ rod drawing; metal working defects.

Metal Joining Processes: Welding processes – manual metal arc, MIG, TIG, plasma arc, submerged arc, electroslag, thermit, resistance, forge, friction, and explosive welding; other joining processes – soldering, brazing, braze welding; inspection of welded joints, defects and

remedies; introduction to advanced welding processes – ultrasonic, election beam, laser beam; thermal cutting.

Machining and Machine Tool Operations: Basic machine tools; machining processes- turning, drilling, boring, milling, shaping, planning, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining – geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; principles and applications of nontraditional machining processes – USM,AJM,WJM,EDM and Wire cut EDM, LBM, EBM,PAM, CHM,ECM.

Tool Engineering: Jigs and fixtures- principles, applications, and design; press tools – configuration, design of die and punch; principles of forging die design.

Metrology and Inspection: Limits, fits, and tolerances, interchangeability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools.

Powder Metallurgy: Production of metal powders, compaction and sintering.

Polymers and Composites: Introduction to polymers and composites; plastic processing – injection, compression and blow molding, extrusion, calendaring and thermoforming; molding of composites.

Manufacturing Analysis: Sources of errors in manufacturing; process capability; tolerance analysis in manufacturing and assembly; process planning; parameter selection and comparison of production alternatives; time and cost analysis; manufacturing technologies – strategies and selection.

Computer Integrated Manufacturing: Basic concepts of CAD, CAM, CAPP, cellular manufacturing, NC, CNC, DNC, Robotics, FMS, and CIM.

PAPER- II

GENERAL ENGINEERING

Engineering Materials: Structure and properties of engineering materials and their applications, effect of strain, strain rate and temperature on mechanical properties of metals and alloys, heat treatment of metals and alloys, its influence on mechanical properties.

Applied Mechanics: Engineering mechanics- equivalent force systems, free body concepts, equations of equilibrium; strength of materials- stress, strain and their relationship, Mohr's circle, deflection of beams, bending and shear stress, Euler's theory of columns.

Theory of Mechanics and Design: Analysis of planar mechanisms, cams and followers; governors and fly wheels; designs of elements- failure theories; design of bolted, riveted and welded joints; design of shafts, keys, spur gears, belt drives, brakes and clutches.

Thermal Engineering: Fluid mechanics- fluid statics, Bernoulli's equation, flow through pipes, equations of continuity and momentum; thermodynamics- zeroth, first and second law of thermodynamics, thermodynamic system and processes, calculation of work and heat for systems and control volumes; air standard cycles; basics of internal combustion engines and steam turbines; heat transfer- fundamentals of conduction, convection and radiation, heat exchangers.

INDUSTRIAL ENGINEERING

Product Design and Development: Principles of good product design, tolerance design; quality and cost considerations; product life cycle; standardization, simplification, diversification, value engineering and analysis, concurrent engineering.

Engineering Economy and Costing: Elementary cost accounting and methods of depreciation; break- even analysis, techniques for evaluation of capital investments, financial statements.

Work System Design: Taylor's scientific management, Gilbreths's contributions; productivity – concepts and measurements; method study, micro- motion study, principles of motion economy; work measurement- stop watch time study, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration; business process reengineering.

Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.

Production Planning and Inventory Control: Forecasting techniques – casual and time series models, moving average, exponential smoothing, trend and seasonality; aggregate production planning; master production scheduling; MRP and MRP- II; order control and flow control; routing; scheduling and priority dispatching; push and pull production systems, concepts of JIT manufacturing system; logistics, distribution, and supply chain management; Inventory –

functions, costs, classifications, deterministic and probabilistic inventory models, quantity discount; perpetual and periodic inventory control systems.

Operation Research: Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models: network flow models, constrained optimization and Lagrange multipliers; simple queuing models; dynamic programming; simulation – manufacturing applications; PERT and CPM, time- cost trade-off, resource leveling.

Quality Management: Quality- concept and costs, quality circles, quality assurance; statistical quality control, acceptance sampling, zero defects, six sigma; total quality management; ISO 9000; design of experiments- Taguchi method.

Reliability and Maintenance: Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; systems reliability determination; preventive maintenance and replacement, total productive maintenance – concept and applications.

Management Information System: Value of Information, information storage and retrieval system – database and data structures, knowledge based systems.

Intellectual Property System: Definition of intellectual property, importance of IPR; TRIPS and its implications, patent, copyright, industrial design and trademark.

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