

MANIPUR PUBLIC SERVICE COMMISSION

SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

AGRICULTURE

Paper-I

Ecology and its relevance to man, natural resources, their sustainable management and conservation. Physical and social environment as factors of crop distribution and production. Climatic elements as factors of crop growth, impact of changing environment on cropping pattern as indicators of environments. Environmental pollution and associated hazards to crops, animals, and humans.

Cropping pattern in different agro-climatic zones of the country. Impact of high-yielding and short-duration varieties on shifts in cropping pattern. Concepts of multiple cropping, multistorey, relay and inter-cropping, and their importance in relation to food production. Package of practices for production of important cereals, pulses, oil seeds, fibres, sugar, commercial and fodder crops grown during Kharif and Rabi seasons in different regions of the country.

Important features, scope and propagation of various types of forestry plantations such as extension, social forestry, agro-forestry, and natural forests.

Weeds, their characteristics, dissemination and association with various crops; their multiplication; cultural, biological and chemical control of weeds.

Soil-physical, chemical and biological properties. Processes and factors of soil formation. Modern classification of Indian soils, Mineral and organic constituents of soils and their role in maintaining soil productivity. Essential plant nutrients and other beneficial elements in soils and plants. Principles of soil fertility and its evaluation for judicious fertiliser use, integrated nutrient management. Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils. Fixation of phosphorus and potassium in soils and the scope for their efficient use. Problem soils and their reclamation methods.

Soil conservation planning on watershed basis. Erosion and run-off management in hilly, foot hills, and valley lands; processes and factors affecting them. Dry land agriculture and its problems. Technology of stabilising agriculture production in rainfed agriculture area.

Water-use efficiency in relation to crop production, criteria for scheduling irrigations, ways and means of reducing run-off losses of irrigation water. Drip and sprinkler irrigation. Drainage of water-logged soils, quality of irrigation water, effect of industrial effluents on soil and water pollution.

Farm management, scope, important and characteristics, farm planning. Optimum resources use and budgeting. Economics of different types of farming systems.

Marketing and pricing of agricultural inputs and outputs, price fluctuations and their cost; role of co-operatives in agricultural economy; types and systems of farming and factors affecting them.

Agricultural extension, its importance and role, methods of evaluation of extension programmes, socio-economic survey and status of big, small, and marginal farmers and landless agricultural labourers; farm mechanization and its role in agricultural production and rural employment. Training programmes for extension workers; lab-to-land programmes.

Paper-II

Cell Theory, cell structure, cell organelles and their function, cell division, nucleic acids-structure and function, gene structure and function. Laws of heredity, their significance in plant breeding. Chromosome structure, chromosomal aberrations, linkage and cross-over, and their significance in recombination breeding. Polyploidy, euploid and an euploids. Mutation-micro and macro-and their role in crop improvement. Variation, components of variation. Heritability, sterility and incompatibility, classification and their application in crop improvement. Cytoplasmic inheritance, sex-linked, sex-influenced and sex-limited characters.

History of plant breeding. Modes of reproduction, selfing and crossing techniques. Origin and evolution of crop plants, centre of origin, law of homologous series, crop genetic resources-conservation and utilization. Application of principles of plant breeding to the improvement of major field crops. Pure-line selection, pedigree, mass and recurrent selections, combining ability, its significance in plant breeding. Hybrid vigour and its exploitation, backcross method of breeding, breeding for disease and pest resistance, role of interspecific and intergeneric hybridization. Role of biotechnology in plant breeding. Improved varieties, hybrids, composites of various crop plants.

Seed technology, its importance. Different kinds of seeds and their seed production and processing techniques. Role of public and private sectors in seed production, processing and marketing in India.

Physiology and its significance in agriculture. Imbibition, surface tension, diffusion and osmosis. Absorption and translocation of water, transpiration and water economy.

Enzymes and plant pigments; photosynthesis-modern concepts and factors affecting the process, aerobic and nonaerobic respiration; C, C and CAM mechanisms. Carbohydrate, protein and fat metabolism.

Growth and development; photoperiodism and vernalization. Auxins, hormones, and other plant regulators and their mechanism of action and importance in agriculture. Physiology of seed development and germination; dormancy.

Climatic requirements and cultivation of major fruits, plants, vegetable crops and flower plants; the package of practices and their scientific basis. Handling and marketing problems of fruit and vegetables. Principal methods of preservation of important fruits and vegetable products, processing techniques and equipment. Role of fruits and vegetables in human nutrition. Raising of ornamental plants, and design and layout of lawns and gardens.

Diseases and pests of field vegetables, orchard and plantation crops of India. Causes and classification of plant pests and diseases. Principles of control of plant pests and diseases Biological control of pests and diseases. Integrated pest and disease management. Epidemiology and forecasting.

Pesticides, their formulations and modes of action. Compatibility with rhizobial inoculants. Microbial toxins.

Storage pests and diseases of cereals and pulses, and their control.

Food production and consumption trends in India. National and international food policies. Production, procurement, distribution and processing constraints. Relation of food production to national dietary pattern, major deficiencies of calorie and protein.

MANIPUR PUBLIC SERVICE COMMISSION

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OPTIONAL PAPER

Animal Husbandry and Veterinary Science

Paper-I

1. Animal Nutrition-Energy sources, energy, metabolism and requirements for maintenance and production of milk, meat, eggs and wool. Evaluation of feeds as sources of energy.

1.1. Trends in protein nutrition: sources of protein metabolism and synthesis, protein quantity and quality in relation to requirements. Energy protein ratios in ration.

1.2. Minerals in animal diet : Sources, functions, requirements and their relationship of the basic minerals nutrients including trace elements.

1.3. Vitamins, Hormones and Growth Stimulating, substances : Sources, functions, requirements and inter-relationship with minerals.

1.4. Advances in Ruminant Nutrition-Dairy Cattle: Nutrients and their metabolism with reference to milk production and its composition. Nutrient requirements for calves, heifers, dry and milking cows and buffaloes. Limitations of various feeding systems.

1.5 Advances in Non-Rumiant Nutrition-Poultry-Nutrients and their metabolism with reference to poultry, meat and egg production, Nutrients requirements and feed formulation and 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, Nutrient requirement and feed formulation for baby-growing and finishing pigs.

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. Nutrition requirements for growth, maintenance and production. Balanced rations.

2. Animal Physiology

2.1 Growth and Animal Production :-Prenatal and postnatal growth, maturation, growth curves, measures of growth, factors affecting growth, conformation, body composition, meat quality.

2.2 Milk Production and Reproduction and Digestion : Current status of hormonal control of mammary development, milk secretion and milk ejection. Male and Female reproduction organ, their components and function. Digestive organs and their functions.

2.3 Environmental Physiology : Physiological relations and their regulation; mechanisms of adaption, environmental factors and regulatory mechanism involved in animal behaviour, methods of controlling climatic stress.

2.4 Semen quality : Preservation and Artificial Insemination-Components of semen, composition of spermatozoe, chemical and physical properties of ejaculated semen, factors affecting semen **in vivo** and **in vitro**. Factors affecting semen production and quality preservation, composition of diluents, sperm concentration, transport of diluted semen. Deep Freezing techniques in cows, sheep and goats, swine and poultry.

Detection of oestrus and time of insemination for better conception.

3. Livestock Production and Management : 3.1 Commercial Dairy Farming-Comparison of dairy farming in India with advanced countries. Dairying under fixed farming and as a specialised farming, economic dairy farming, Starting of a dairy farm. Capital and land requirement, organisation of the dairy farm.

Procurement of goods; opportunities in dairy farming, factors determining the efficiency of dairy animal, Herd recording, budgeting, cost of milk production; pricing policy; Personnel Management. Developing Practical and Economic ration for dairy cattle; supply of greens throughout the year, field and fodder requirements of Dairy Farm, Feeding regimes for day and young stock and bulls, heifers and breeding animals, new trends in feeding young and adult stock; Feeding records.

3.2. Commercial meat, egg and wool production: Development of practical and economic rations for sheep, goats, pigs, rabbits and poultry. Supply of greens, fodder, feeding regimens for young and mature stock. New trends in enhancing production and management. Capital and land requirements and socio-economic concept.

3.3. Feeding and management of animals under drought, flood and other natural calamities.

4. Genetics and Animal Breeding : Mitosis and Meiosis; Mendelian inheritance; deviations to Mendelian genetics; Expression of genes; Linkage and crossing over; Sex determination, sex influenced and sex limited characters; Blood groups and polymorphism; Chromosome aberrations; Gene and its structure; DNA as a genetic

material; Genetic code and protein synthesis; Recombinant DNA technology, Mutations, types of mutations, methods for detecting mutations and mutation rate.

4.1 Population Genetics Applied to Animal Breeding: Quantitative Vs. qualitative traits; Hardy Weinberg Law; Population Vs. individual; Gene and genotypic frequency; Forces changing gene frequency; Random drift and small populations; Theory of path coefficient; Inbreeding, methods of estimating inbreeding coefficient, systems of 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 Systems : Heritability, repeatability and genetic 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; Progeny 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 threshold character.

Paper-II

1. Health and Hygiene

1.1. Histology and Histological Techniques : Stains-Chemical classification of stains used in biological work-principles of staining tissues-mordants-progressive & regressive stains-differential staining of cytoplasmic and connective tissue elements-Methods of preparation and processing of tissues-celloidin embedding-Freezing microtomy-Microscopy-Bright field microscope and electron microscope. Cytology-structure of cell, organells & inclusions; cell division-cell types-Tissues and their classification-embryonic and adult tissues-Comparative histology of organs:-vascular, Nervous, digestive, respiratory, musculo-skeletal and urogenital systems-Endocrine glands-Integuments-sense organs.

1.2. Embryology : Embryology of vertebrates with special reference to aves and domestic mammals-gametogenesis-fertilization-germ layers-foetal membranes & placentation-types of placenta in domestic mammals-Teratology-twin & 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 & coronal nerve block-Regional anatomy of paravertebral nerves, pudental nerve, median, ulnar & radial nerves-tibial, fibular and digital nerves-Cranial nerves-structures involved in epidural anaesthesia-superficial lymph nodes-surface anatomy of visceral organs of thoracic, abdominal and pelvic cavities-

comparative features of locomotor apparatus & their application in the biomechanics of mammalian body.

1.4 Anatomy of Fowls : 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 proteins production, classification and properties; coagulation of blood; Haemorrhagic disorders-anticoagulants-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, heartbeat, electrocardiograms, Work and efficiency of heart-effect of ions on heart function-metabolism of cardiac muscle, nervous and chemical regulation of heart, effect of temperature and stress on heart, blood pressure and hypertension, Osmotic regulation, arterial pulse, vasomotor regulation of circulation, shock. Coronary & pulmonary circulation, Blood-Brain barrier-Cerebrospinal fluid-circulation in birds.

1.5.3 Respiration : Mechanism of respiration, Transport and exchange of gases-neural control of respiration-chemoreceptors-hypoxia-respiration in birds.

1.5.4 Excretion: Structure and function 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 recreation in chicken-Sweat glands and their function. Biochemical tests for urinary dysfunction.

1.5.5 Endocrine glands : Functional disorders, their symptoms and diagnosis. Synthesis of hormones, mechanism and control of secretion-hormonal receptors-classification and function.

1.6. General knowledge of pharmacology and therapeutics of drugs : Cellular level of pharmacodynamics and pharmaco-kinetics-Drugs acting on fluids and electrolyte balance-drugs acting on Autonomic nervous system-Modern concepts of anaesthesia and dissociative anaesthetics-Autocoids-Antimicrobials and principles of chemotherapy in microbial infections-use of hormones in therapeutics-chemotherapy of parasitic infections-Drug and economic persons in the Edible tissues of animals-chemotherapy of Neoplastic diseases.

1.7. Veterinary Hygiene with reference to water, air and habitation : Assessment of pollution of water, air and soil-Importance of climate in animal health-effect of environment on animal function and performance-relationship between industrialisation and animal agriculture-animal housing requirements for specific categories of domestic animals viz. pregnant cows & sows, milking cows, broiler birds-stress, strain & productivity in relation to animal habitation.

2. Animal Diseases :

2.1 Pathogenesis, symptoms, postmortum lesions, diagnosis, and control of infection diseases of cattle, pigs and poultry, horses, sheep and goats.

2.2 Etiology, symptoms, diagnosis, treatment of production diseases of cattle, pig and poultry.

2.3 Deficiency diseases of domestic animals and birds.

2.4 Diagnosis and treatment of nonspecific condition like impaction, Bloat, Diarrhoea, Indigestion, dehydration, stroke, poisoning.

2.5 Diagnosis and treatment of neurological disorders.

2.6 Principles and methods of immunisation of animals against specific diseases-hard immunity-disease free zones-'zero' disease concept-chemoprophylaxis.

2.7 Anaesthesia-local, regional and general-preanaesthetic medication, Symptoms and surgical interference in fractures and dislocation, Hernia, choking, abomassal displacement-Caesarian operations, Rumenotomy-Castrations.

2.8 Disease investigation techniques-Materials for laboratory investigation-Establishment Animal Health Centres-Disease free zone.

3. Veterinary Public Health

3.1 **Zoonoses** : Classification, definition; role of animals and 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 disease control, Epidemiological features of air, water and food borne infections.

3.3 **Veterinary Jurisprudence** : Rules and Regulations for improvement of animal quality and prevention of animal diseases-state and control Rules for prevention of animal and animal product borne diseases-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, collection and transport of raw milk.

Quality, testing and grading raw milk, Quality storage grades of whole milk, Skimmed milk and cream.

Processing, packaging, storing, distributing, marketing defects and their control and nutritive properties of the following milks : Pasteurized, standardized, toned, double toned, sterilized, homogenized, reconstituted, recombined and flavoured milks. Preparation of cultured milks, cultures and their management, youghurt, Dahi, Lassi and Srikhand. Preparation of flavoured and sterlized milks. Legal standards, Sanitation requirement for clean and safe milk and for the milk plant equipment.

4.2 Milk Products Technology : Selection of raw materials, assembling, production, processing, storing, distributing 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, lactose and casein. Testing Grading, judging milk products-BIS and Agmark specifications, legal standards, quality control nutritive properties. Packaging, processing and operational control Costs.

5. Meat Hygiene and Technology :

5.1 Meat Hygiene :

5.1.1 Ante mortem care and management of food animals, stunning, slaughter and dressing operations; abattoir requirements and designs; Meat inspection procedures and judgement of carcass meat cuts-drading of carcass meat cuts-duties and functions of Veterinarians in Wholesome meat production.

5.1.2 Hygienic methods of handling production of meat-spoilage of meat and control measures-Post slaughter physicochemical changes in meat and factors that influence them-quality improvement methods-Adulteration of meat and defection-Regulatory provisions in Meat trade and Industry.

5.2. Meat Technology

5.2.1 Physical and chemical characteristics of meat-meat emulsions-methods of preservation of meat-curing, canning, irradiation, packaging of meat and meat products; meat products and formulations.

5.3. **Byproducts :** Slaughter house by products and their utilisation-Edible and inedible byproducts-social and economic implications of proper utilisation 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, preservation of poultry meat, and products. Legal and BIS standards.

Structure, composition and nutritive value of eggs. Microbial spoilage. Preservation and maintenance. Marketing of poultry meat, eggs and products.

5.5. **Rabbit/Fur Animal farming :** Care and management of rabbit meat production. Disposal and utilization of fur and wool and recycling of waste byproducts. Grading of wool.

6. **Extension** : Basic philosophy, objectives, concept and principles 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.

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OPTIONAL PAPER

Anthropology

Paper I

1.1 Meaning and scope Anthropology

1.2 Relationship with other disciplines: History, Economics, Sociology, Psychology, Political Science, Life Science, Medical Science.

1.3 Main branches of Anthropology, their scope and relevance

a) Social-cultural Anthropology

b) Physical and biological Anthropology

c) Archaeological Anthropology.

1.4 Human Evolution and emergence of Man.

Organic Evolution-Theories of evolution in historical perspective, pre-Darwinian, Darwinian and Post-Darwinian period. Modern synthetic theory of evolution; brief outline of terms and concepts of evolutionary biology (Doll's rule, Cope's rule, Gause's rule, parallelism, convergence, adaptive radiation, mosaic evolution); Principles of systematics and taxonomy, major primate taxa, tertiary and quaternary fossil primates, Systematics of Hominoidea and Hominidae, Origin and evolution of man-'*Homo erectus and Homo sapiens*'.

1.5 Phylogenetic status, characteristics and distribution of the following:

a) Prepleistocene fossil primates-*Oreopithecus*.

b) South and East African hominids-Plesianthropus/Australopithecus Africaus, Paranthropus, Australopithecus.

c) *Paranthropus-Homo erectus-Homo erectus javanicus, Homo erectus pekinensis*.

d) *Homo Heidelbergensis*.

e) Neanderthal man-La-chapelle-aus-saints (Classical type), Mt. Carmelites types (Progressive type).

f) Rhodesian man

g) Homo sapiens-Cromognon, Grimaldi, Chancelade.

Recent advances in understanding the evolution, distribution and multidisciplinary approach to understand a fossil type in relation to others.

1.6 Evolutionary trend and classification of the order Primates, Relationship with other mammals, molecular evolution of Primates, Comparative anatomy of man and apes, primate locomotion;-terrestrial and arboreal adaptation, skeletal changes due to erect posture and its implications.

1.7 Cultural Evolution-broad outlines of pre-historic cultures:

a) Paleolithic

b) Mesolithic

c) Neolithic

d) Chalcolithic

e) Copper-Bronze age

f) Iron age

2.1 Family-Definition and typology of family, household and domestic groups. Basic structure and functions; stability and changes in family. Typological and processual approaches to the study of family. Impact of urbanization, industrialization, education and feminist movements. Universality of family-a critique.

2.2 **Concept of kinship** : Definition of kin, incest prohibition exogamy and endogamy. Principles of descent-types and functions. Political and jurial aspects of kinship. Unilineal, bilateral and double descent. Descent, filiation and complementary filiation. Kinship terminology, typology and approaches to the study of terminology Alliance and descent.

2.3 Marriage -Definition, types and variation of marriage systems. Debates on the universal definition of marriage. Regulation of marriage-preferential, prescriptive, proscriptive and open systems. Types and form of marriage Dowry, bride-price, pestation and marriage stability.

3.1 Study of culture, patterns and processes. Concept of culture, patterns of culture, relationships between culture and civilization and society.

3.2 Concept of Social Change and Cultural Change:

3.3 Social structure and social organization, Role-analysis and social network. Institutions, groups community. Social stratification: principles and form, status, class and power, gender. Nature and types of mobility.

3.4 Concept of Society.

3.5 Approaches to the study of culture and society-classical evolutionism, neo-evolutionism, culture ecology, historical particularism and diffusionism, structural-functionalism, culture and personality, transaction-alism, symbolism, cognitive approach and new ethnography, post structuralism and post-modernism.

4.1 Definitions and functions of religion. Anthropological approaches to the study of religion-evolutionary, psychological and functional. Magic, witchcraft and sorcery; definitions and functions and functionaries: priest, saman, medicine man and sorcerers. Symbolism in religion and rituals. Ethnomedicine. Myths and rituals: definitions and approaches to their study-structural, functional and processual Relation with economic and political structures.

5.1 Meaning, scope and relevance, principles governing production, distribution and consumption in communities subsisting on hunting-gathering, fishing, pastoralism, horticulture and other economic pursuits. Fomalist and substantivist debate-Dalton, Karl-polyanny and Marx approach and New Economic Anthropology. Exchange: gifts, barter, trade, ceremonial exchange and market economy.

5.2 Theoretical foundations. Types of political organisations-band, tribe, chiefdom, state, concept of power, authority and legitimacy. Social control, law and justice in tribal and peasant societies.

6.1 Concepts of developmental Anthropological perspective. Models of development. Critiques of classical developmental theories. Concepts of planning and planned development. Concept of participatory development. Culture ecology and sustainable development. Displacement and rehabilitation.

7.1 Concept of research in anthropology, subjectivity and reflexivity in terms of gender class, ideology and ethics. Distinction between methodology, methods and techniques. Nature and explanation in anthropological research. Positivistics and non-positivistic approaches. Comparative methods; nature, purpose and methods of comparison in social and cultural anthropology. Basic techniques of data collection. Interview, participant and other forms of observation, schedules, questionnaire, case-study methods, extended casestudy methods, life histories and secondary sources, oral history, genealogical method, participatory, learning and assessment (PLA). Participatory rapid assessment (PRA). Analysis, interpretation and presentation of data.

8.1 Concept, scope and major branches of human genetics. Its relationship with other branches of science and medicine.

8.2 Method for study of genetic principles in man-family study (pedegree analysis, twin study, foster child, co-twin method, cytogenetic method, chromosomal and karyotype analysis), biochemical methods, immunological methods, D.N.A. technology and recombinant technologies.

8.3 Twin study method-zygosity, heritability estimates, present status of the twin study method and its applications.

8.4 Mendelian genetics in man-family study, single factor, multifactor, lethal, sub-lethal, and polygenic inheritance in man.

8.5 Concept of genetic polymorphism and selection, Mendelian population, Hardy-Weinberg law; causes and changes which bring down frequency-mutation, isolation, migration, selection, inbreeding and genetic drift. Consanguineous and non-consanguineous mating, genetic load, genetic effect of consanguineous and cousin marriages (statistical and probability methods for study of human genetics).

8.6 Chromosomes and chromosomal aberrations in man, methodology.

a) Numerical and structural aberrations (disorders)

b) Sex chromosomal aberrations-Klinefelter (XXY), Turner (XO), Super female (XXX), intersex, and other syndromic disorders.

c) Autosomal aberrations-Down syndrome, Patau, Edward and Cri-du-chat syndromes.

d) Genetic imprints in human disease, genetic screening, genetic counselling, human DNA profiling, gene mapping and genome study.

8.7 Concept of race in historical and biological perspective. Race and racism, biological basis of morphological variation of non-metric and metric characters. Racial criteria, racial traits in relation to heredity and environment; biological basis of racial classification, racial differentiation and race-crossing in man.

8.8 Ethnic groups of mankind-characteristics and distribution in world, racial classification of human groups. Principal living peoples of world. Their distribution and characteristics.

8.9 Age, sex and population variation in genetic marker-ABO, Rh blood groups, HLA, Hp, transferrin, Gm, blood enzymes. Physiological characteristics-Hb level, body fat, pulse rate, respiratory functions and sensory perceptions in different cultural and socio-economic groups. Impact of smoking air pollutions, alcoholism, drugs and occupational hazards on health.

9.1 Concepts and Methods of Ecological Anthropology. Adaptation-social and cultural Deterministic theories-a critique. Resources-biological, non-biological and sustainable development. Biological adaptation-climatic, environmental, nutritional and genetic.

10.1 Relevance in understanding of contemporary society. Dynamics of ethnicity at rural, tribal, urban and international levels. Ethnic conflicts and political developments. Concept of ethnic boundaries. Ethnicity and concept of nation state.

11.1 Concept of human growth and development-stages of growth-prenatal, natal, infant, childhood, adolescence, maturity, senescence.

Factors affecting growth and development genetic, environmental, biochemical, nutritional, cultural and socio-economic.

- Ageing and senescence. Theories and observations-biological and chronological longevity. Human physique and somatotypes. Methodologies for growth studies.

12.1 Reproductive biology, demography and population study. Reproductive physiology of male and female. Biological aspects of human fertility. Relevance of menarche, menopause and other bioevents to fertility. Fertily patterns and differentials.

12.2 Demographic theories-biological, social and cultural.

12.3 Demographic methods-census, registration system, sample methods, dual reporting system.

12.4 Population structures and population dynamics.

12.5 Demographic rates and ratios, life table-structure and utility.

12.6 Biological and socio-ecological factors influencing fecundity, fertility natality and mortality.

12.7 Methods of studying population growth.

12.8 Biological consequences of population control and family welfare.

13.1 Anthropology of sports

13.2 Nutritional Anthropology.

13.3 Anthropology in designing of defence and other equipments.

13.4 Forensic Anthropology.

13.5 Methods and principles of personal identification and reconstruction.

13.6 Applied human genetics-Paternity diagnosis genetic counselling and eugenics.

13.7 DNA technology-prevention and cure of diseases.

13.8 Anthro-po-genetics in medicine

13.9 Serogenetics and cytogenetics in reproductive biology.

13.10 Application of statistical principles in human genetics and Physical Anthropology.

PAPER II

1. Evolution of the Indian Culture and Civilization-Pre historic (Paleolithic, Mesolithic and Neolithic), Protohistoric (Indus Civilization). Vedic and post-Vedic beginnings. Contributions of the tribal cultures.

2. Demographic profile of India-Ethnic and linguistic elements in the Indian population and their distribution. Indian population, factors influencing its structure and growth.

3. The basic structure and nature of traditional Indian social system-a critique. Varnasharam, Purushartha, Karma, Rina and Rebirth. Theories on the origin of caste system, Jajmani system. Structural basis of inequality in traditional Indian society. Impact of Buddhism, Jainism, Islam and Christianity on Indian society.

4. Emergence, growth and development of anthropology in India-contributions of the 19th Century and early 20th Century scholar-administrators. Contributions of Indian anthropologists to tribal and caste studies. Contemporary nature of anthropological studies in India.

5. Approaches to the study of Indian society and culture-traditional and contemporary.

5.1 Aspects of Indian village-Social organisations of agriculture, impact of market economy on Indian villages.

5.2 Linguistic and religious minorities-social, political and economic status.

6. Tribal situation in India-biogenetic variability, linguistic and socio-economic characteristics of the tribal populations and their distribution. Problems of the tribal Communities-land alienation, poverty indebtedness, low literacy, poor educational facilities, unemployment, underemployment, health and nutrition. Developmental projects-tribal displacement and problems of rehabilitation:

Development of forest policy and tribals, Impact of urbanisation and industrialization on tribal and rural populations.

7. Problems of exploitation and deprivation of Scheduled Castes/Scheduled Tribes and Other Backward Classes. Constitutional safeguards for Scheduled Tribes and Scheduled Castes. Social change and contemporary tribal societies: Impact of modern democratic institutions, development programmes and welfare measures on tribals and weaker sections. Emergence of ethnicity, tribal movements and quest for identity. Pseudo-tribalism.

8. Social change among the tribes during colonial and post-Independent India.

8.1 Impact of Hinduism, Christianity, Islam and other religious on tribal societies.

8.2 Tribe and nation state-a comparative study of tribal communities in India and other countries.

9. History of administration of tribal areas, tribal policies, plans, programmes of tribal development and their implementation. Role of N.G.Os.

9.1 Role of anthropology in tribal and rural development.

9.2 Contributions of anthropology to the understanding of regionalism, communalism and ethnic and political movements.

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BOTANY

PAPER-I

1. Microbiology and Plant Pathology: Viruses, bacteria, and plasmids-structure and reproduction. General account of infection, Phytoimmunology. Applications of microbiology in agriculture, industry, medicine and pollution control in air, soil and water.

Important plant diseases caused by viruses, bacteria, mycoplasma, fungi and nematodes. Mode of infection and dissemination. Molecular basis of infection and disease resistance/defence. Physiology of parasitism and control measures. Fungal toxins.

2. Cryptogams: Algae, Fungi, Bryophytes, Pteridophytes-structure and reproduction from evolutionary viewpoint. Distribution of Cryptogams in India and their economic potential.

3. Phanerogams: Gymnosperms: Concept of Progymnosperms. Classification and distribution of Gymnosperms. Salient features of Cycadales, Coniferales and Gnetales, their structures and reproduction. General account of Cycadofilicales, Bennettitales and Cordaitales.

Angiosperms: Systematics, anatomy, embryology, palynology and phylogeny.

Comparative account of various systems of Angiosperm Classification. Study of angiospermic families—Magnoliaceae, Ranunculaceae, Brassicaceae (Cruciferae), Rosaceae, Leguminosae, Euphorbiaceae, Malvaceae, Dipterocarpaceae, Apiaceae (Umbelliferae), Asclepiadaceae, Verbenaceae, Solanaceae, Rubiaceae, Cucurbitaceae, Asteraceae (Composite), Poaceae (Gramineae), Arecaceae (Palmae), Liliaceae, Musaceae, Orchidaceae.

Stomata and their types. Anomalous secondary growth, Anatomy of C₃ and C₄ plants.

Development of male and female gametophytes, pollination, fertilization. Endosperm—its development and function. Patterns of embryo development. Polymbryony, apomixis, Applications of palynology.

4. Plant Utility and Exploitation:

Origin of cultivated plants, Vavilov's centres of origin. Plants as sources for food, fodder, fibres, spices, beverages, drugs, narcotics, insecticides, timber, gums, resins and dyes.

Latex, cellulose Starch and their products. Perfumery. Importance of Ethnobotany in Indian context. Energy plantation. Botanical Gardens and Herbaria.

5. Morphogenesis: Totipotency, polarity, symmetry and differentiation. Cell, tissue, organ and protoplast culture. Somatic hybrids and Cybrids.

PAPER-II

1. Cell Biology: Techniques of Cell Biology. Prokaryotic and eukaryotic cells - structural and ultrastructural details. Structure and function of extracellular matrix or ECM (cell wall) and membranes-cell adhesion, membrane transport and vesicular transport. Structure and function of cell organelles (chloroplasts, mitochondria, ER, ribosomes, endosomes, lysosomes, peroxisomes, hydrogenosome). Nucleus, nucleolus, nuclear pore complex. Chromatin and nucleosome. Cell signalling and cell receptors. Signal transduction (G-1 proteins, etc.). Mitosis and meiosis; molecular basis of cell cycle. Numerical and structural variations in chromosomes and their significance. Study of polytene, lampbrush and B-chromosomes—structure, behaviour and significance.

2. Genetics, Molecular Biology and Evolution: Development of genetics, and gene versus allele concepts (Pseudoalleles). Quantitative genetics and multiple factors. Linkage and crossing over—methods of gene mapping including molecular maps (idea of mapping function). Sex chromosomes and sexlinked inheritance, sex determination and molecular basis of sex differentiation. Mutation (biochemical and molecular basis). Cytoplasmic inheritance and cytoplasmic genes (including genetics of male sterility). Prions and prion hypothesis.

Structure and synthesis of nucleic acids and proteins. Genetic code and regulation of gene expression. Multigene families.

Organic evolution-evidences, mechanism and theories. Role of RNA in origin and evolution.

3. Plant Breeding, Biotechnology and Biostatistics: Methods of plant breeding -- introduction, selection and hybridization (pedigree, backcross, mass selection, bulk method). Male sterility and heterosis breeding. Use of apomixis in plant breeding. Micropropagation and genetic engineering—methods of transfer of genes and transgenic crops; development and use of molecular markers in plant breeding.

Standard deviation and coefficient of variation (CV). Tests of significance (Z-test, t-test and chi-square tests). Probability and distributions (normal, binomial and Poisson distributions). Correlation and regression.

4. Physiology and Biochemistry: Water relations, Mineral nutrition and ion transport, mineral deficiencies. Photosynthesis—photochemical reactions, photophosphorylation and carbon pathways including C₃ pathway (photorespiration), C₃, C₄ and CAM pathways. Respiration (anaerobic and aerobic, including fermentation—electron transport chain and oxidative phosphorylation. Chemiosmotic theory and ATP synthesis. Nitrogen fixation and nitrogen metabolism. Enzymes, coenzymes, energy transfer and energy conservation. Importance of secondary metabolites. Pigments as photoreceptors (plastidial pigments and phytochrome). Photoperiodism and flowering, vernalization, senescence. Growth substances—their chemical nature, role and applications in agri-horticulture, growth indices, growth movements. Stress physiology (heat, water, salinity, metal). Fruit and seed physiology. Dormancy, storage and germination of seed. Fruit ripening -- its molecular basis and manipulation.

5. Ecology and Plant Geography: Ecological factors. Concepts and dynamics of community. Plant succession. Concepts of biosphere. Ecosystems and their conservation. Pollution and its control (including phytoremediation).

Forest types of India -- afforestation, deforestation and social forestry. Endangered plants, endemism and Red Data Books. Biodiversity. Convention of Biological Diversity, Sovereign Rights and Intellectual Property Rights. Biogeochemical cells. Global warming.

MANIPUR PUBLIC SERVICE COMMISSION

SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

CHEMISTRY

PAPER-I

1. Atomic structure

Quantum theory, Heisenberg's uncertainty principle, Schrodinger wave equation (time independent). Interpretation of wave function, particle in one-dimensional box, quantum numbers, hydrogen atom wave functions. Shapes of s, p and d orbitals.

2. Chemical bonding

Ionic bond, characteristics of ionic compounds, factors affecting stability of ionic compounds, lattice energy, Born-Haber cycle; covalent bond and its general characteristics, polarities of bonds in molecules and their dipole moments. Valence bond theory, concept of resonance and resonance energy. Molecular orbital theory (LCAO method); bonding in homonuclear molecules: H_2^+ , H_2 to Ne_2 , NO, CO, HF, CN, CN^- , BeH_2 and CO_2 . Comparison of valence bond and molecular orbital theories, bond order, bond strength and bond length.

3. Solid State

Forms of solids, law of constancy of interfacial angles, crystal systems and crystal classes (crystallographic groups). Designation of crystal faces, lattice structures and unit cell. Laws of rational indices. Bragg's law. X-ray diffraction by crystals. Close packing, radius ratio rules, calculation of some limiting radius ratio values. Structures of NaCl, ZnS, CsCl, CaF_2 , CdI_2 and rutile. Imperfections in crystals, stoichiometric and nonstoichiometric defects, impurity defects, semi-conductors. Elementary study of liquid crystals.

4. The gaseous state

Equation of state for real gases, intermolecular interactions, liquefaction of gases and critical phenomena, Maxwell's distribution of speeds, intermolecular collisions, collisions on the wall and effusion.

5. Thermodynamics and statistical thermodynamics

Thermodynamic systems, states and processes, work, heat and internal energy; first law of thermodynamics, work done on the systems and heat absorbed in different

types of processes; calorimetry, energy and enthalpy changes in various processes and their temperature dependence.

Second law of thermodynamics; entropy as a state function, entropy changes in various process, entropy–reversibility and irreversibility, Free energy functions; criteria for equilibrium, relation between equilibrium constant and thermodynamic quantities; Nernst heat theorem and third law of thermodynamics.

Micro and macro states; canonical ensemble and canonical partition function; electronic, rotational and vibrational partition functions and thermodynamic quantities; chemical equilibrium in ideal gas reactions.

6. Phase equilibria and solutions

Phase equilibria in pure substances; Clausius-Clapeyron equation; phase diagram for a pure substance; phase equilibria in binary systems, partially miscible liquids– upper and lower critical solution temperatures; partial molar quantities, their significance and determination; excess thermodynamic functions and their determination.

7. Electrochemistry

Debye-Huckel theory of strong electrolytes and Debye-Huckel limiting Law for various equilibrium and transport properties.

Galvanic cells, concentration cells; electrochemical series, measurement of e.m.f. of cells and its applications fuel cells and batteries.

Processes at electrodes; double layer at the interface; rate of charge transfer, current density; overpotential; electroanalytical techniques–voltmeter, polarography, ampero-metry, cyclic-voltametry, ion selective electrodes and their use.

8. Chemical kinetics

Concentration dependence of rate of reaction; differential and integral rate equations for zeroth, first, second and fractional order reactions. Rate equations involving reverse, parallel, consecutive and chain reactions; effect of temperature and pressure on rate constant. Study of fast reactions by stop-flow and relaxation methods. Collisions and transition state theories.

9. Photochemistry

Absorption of light; decay of excited state by different routes; photochemical reactions between hydrogen and halogens and their quantum yields.

10. Surface phenomena and catalysis

Absorption from gases and solutions on solid adsorbents, adsorption isotherms,– Langmuir and B.E.T. isotherms; determination of surface area, characteristics and mechanism of reaction on heterogeneous catalysis.

11. Bio-inorganic chemistry

Metal ions in biological systems and their role in ion-transport across the membranes (molecular mechanism), ionophores, photosynthesis–PSI, PSII; nitrogen fixation, oxygen-uptake proteins, cytochromes and ferredoxins.

12. Coordination chemistry

(a) Electronic configurations; introduction to theories of bonding in transition metal complexes. Valence bond theory, crystal field theory and its modifications; applications of theories in the explanation of magnetism and electronic spectra of metal complexes.

(b) Isomerism in coordination compounds. IUPAC nomenclature of coordination compounds; stereochemistry of complexes with 4 and 6 coordination numbers; chelate effect and polynuclear complexes; trans effect and its theories; kinetics of substitution reactions in square-planer complexes; thermodynamic and kinetic stability of complexes.

(c) Synthesis and structures of metal carbonyls; carboxylate anions, carbonyl hydrides and metal nitrosyl compounds.

(d) Complexes with aromatic systems, synthesis, structure and bonding in metal olefin complexes, alkyne complexes and cyclopentadienyl complexes; coordinative unsaturation, oxidative addition reactions, insertion reactions, fluxional molecules and their characterization. Compounds with metal-metal bonds and metal atom clusters.

13. General chemistry of 'f' block elements

Lanthanides and actinides; separation, oxidation states, magnetic and spectral properties; lanthanide contraction.

14. Non-Aqueous Solvents

Reactions in liquid NH₃, HF, SO₂ and H₂ SO₄. Failure of solvent system concept, coordination model of non-aqueous solvents. Some highly acidic media, fluorosulphuric acid and super acids.

Paper-II

1. **Delocalised covalent bonding** : Aromaticity, anti-aromaticity; annulenes, azulenes, tropolones, kekulene, fulvenes, sydnones.

2(a) **Reaction mechanisms** : General methods (both kinetic and non-kinetic) of study of mechanism or organic reactions illustrated by examples–use of isotopes, cross-over experiment, intermediate trapping, stereochemistry; energy diagrams of

simple organic reactions—transition states and intermediates; energy of activation; thermodynamic control and kinetic control of reactions.

(b) **Reactive intermediates** : Generation, geometry, stability and reactions of carbonium and carbonium ions, carbanions, free radicals, carbenes, benzyne and nitrenes.

(c) **Substitution reactions** : S_N1 , S_N2 , S_{Ni} , $SN1/$, $SN2/$, $SNi/$ and $SRN1$ mechanisms; neighbouring group participation; electrophilic and nucleophilic reactions of aromatic compound including simple heterocyclic compounds—pyrrole, furan thiophene, indole.

(d) **Elimination reactions** : $E1$, $E2$ and $E1cb$ mechanism; orientation in $E2$ reactions—Saytzeff and Hoffmann; pyrolytic **syn** elimination—acetate pyrolysis, Chugaev and Cope eliminations.

(e) **Addition reactions** : - Electrophilic addition to $C=C$ and $C\equiv C$; nucleophilic addition to $C=O$, $C\equiv N$, conjugated olefins and carbonyls.

(f) **Rearrangements** : Pinacol-pinacolone, Hoffmann, Beckmann, Baeyer–Villiger, Favorskii, Fries, Claisen, Cope, Stevens and Wagner-Meerwein rearrangements.

3. **Pericyclic reactions** : Classification and examples; Woodward-Hoffmann rules—electrocyclic reactions, cycloaddition reactions [2+2 and 4+2] and sigmatropic shifts [1, 3; 3, 3 and 1, 5] FMO approach.

4. **Chemistry and mechanism of reactions** : Aldol condensation (including directed aldol condensation), Claisen condensation, Dieckmann, Perkin, Knoevenagel, Wittig, Clemmensen, Wolff-Kishner, Cannizzaro and von Richter reactions; Stobbe, benzoin and acyloin condensations; Fischer indole synthesis, Skraup synthesis, Bischler-Napieralski, Sandmeyer, Reimer-Tiemann and Reformatsky reactions.

5. Polymeric Systems

(a) **Physical chemistry of polymers** : Polymer solutions and their thermodynamic properties; number and weight average molecular weights of polymers. Determination of molecular weights by sedimentation, light scattering, osmotic pressure, viscosity, end group analysis methods.

(b) **Preparation and properties of polymers** : Organic polymers—polyethylene, polystyrene, polyvinyl chloride, Teflon, nylon, terylene, synthetic and natural rubber. Inorganic polymers—phosphonitrilic halides, borazines, silicones and silicates.

(c) **Biopolymers** : Basic bonding in proteins, DNA and RNA.

6. **Synthetic uses of reagents** : OsO_4 , HIO_4 , CrO_3 , $Pb(OAc)_4$, SeO_2 , NBS, B_2H_6 , Na-Liquid NH_3 , $LiAlH_4$, $NaBH_4$, $n-BuLi$, MCPBA.

7. **Photochemist** : Photochemical reactions of simple organic compounds, excited and ground states, singlet and triplet states, Norrish-Type I and Type II reactions.

8. Principles of spectroscopy and applications in structure elucidation

- (a) **Rotational spectra**—diatomic molecules; isotopic substitution and rotational constants.
- (b) **Vibrational spectra**—diatomic molecules, linear triatomic molecules, specific frequencies of functional groups in polyatomic molecules.
- (c) **Electronic spectra** : Singlet and triplet states. $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ transitions; application to conjugated double bonds and conjugated carbonyls—Woodward-Fieser rules.
- (d) **Nuclear magnetic resonance** : Isochronous and anisochronous protons; chemical shift and coupling constants; Application of ^1H NMR to simple organic molecules.
- (e) **Mass spectra** : Parent peak, base peak, daughter peak, metastable peak, fragmentation of simple organic cleavage, McLafferty rearrangement.molecules;
- (f) **Electron spin resonance** : Inorganic complexes and free radicals.

MANIPUR PUBLIC SERVICE COMMISSION

SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

CIVIL ENGINEERING

Paper-I

Part-A

Engineering Mechanics, Strength of Materials and Structural Analysis.

Engineering Mechanics :

Units and Dimensions, SI Units, Vectors, Concept of Force, Concept of particle and rigid body. Concurrent, Non Concurrent and parallel forces in a plane, moment of force and Varignon's theorem, free body diagram, conditions of equilibrium, Principle of virtual work, equivalent force system.

First and Second Moment of area, Mass moment of Inertia.

Static Friction, Inclined Plane and bearings.

Kinematics and Kinetics :

Kinematics in Cartesian and Polar Co-ordinates, motion under uniform and nonuniform acceleration, motion under gravity. Kinetics of particle : Momentum and Energy principles, D' Alembert's Principle, Collision of elastic bodies, rotation of rigid bodies, simple harmonic motion, Flywheel.

Strength of Materials :

Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, Shear Stress distribution across cross sections, Beams of uniform strength, Leaf spring. Strain Energy in direct stress, bending & shear.

Deflection of beams : Mecaulay's method, Mohr's Moment area method, Conjugate beam method, unit load method. Torsion of Shafts, Transmission of power, close coiled helical springs, Elastic stability of columns, Euler's Rankine's and Secant formulae. Principal Stresses and Strains in two dimensions, Mohr's Circle, Theories of Elastic Failure, Thin and Thick cylinder : Stresses due to internal and external pressure–Lame's equations.

Structural Analysis :

Castigliano's theorems I and II, unit load method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection, moment distribution, Kani's method of analysis and column Analogy method applied to indeterminate beams and rigid frames.

Rolling loads and Influences lines : Influences lines for Shear Force and Bending moment at a section of beam. Criteria for maximum shear force and bending Moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses.

Arches : Three hinged, two hinged and fixed arches, rib shortening and temperature effects, influence lines in arches.

Matrix methods of analysis : Force method and displacement method of analysis of indeterminate beams and rigid frames.

Plastic Analysis of beams and frames : Theory of plastic bending, plastic analysis, statical method, Mechanism method.

Unsymmetrical bending : Moment of inertia, product of inertia, position of Neutral Axis and Principle axes, calculation of bending stresses.

Part-B

Design of Structures : Steel, Concrete and Masonry Structures.

Structural Steel Design :

Structural Steel : Factors of safety and load factors. Rivetted, bolted and welded joints and connections. Design of tension and compression member, beams of built up section, rivetted and welded plate girders, gantry girders, stanchions with battens and lacings, slab and gusseted column bases.

Design of highway and railway bridges : Through and deck type plate girder, Warren girder, Pratt truss.

Design of Concrete and Masonry Structures :

Concept of mix design. Reinforced Concrete : Working Stress and Limit State method of design—Recommendations of I.S. codes Design of one way and two way slabs, stair-case slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity, Isolated and combined footings.

Cantilever and Counterfort type retaining walls.

Water tanks : Design requirements for Rectangular and circular tanks resting on ground.

Prestressed concrete : Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress.

Design of brick masonry as per I.S. Codes

Design of masonry retaining walls.

Part-C

Fluid Mechanics, Open Channel Flow and Hydraulic Machines

Fluid Mechanics : Fluid properties and their role in fluid motion, fluid statics including forces acting on plane and curve surfaces.

Kinematics and Dynamics of Fluid flow : Velocity and accelerations, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions, flownet, methods of drawing flownet, sources and sinks, flow separation, free and forced vortices.

Control volume equation, continuity, momentum, energy and moment of momentum equations from control volume equation, Navier-Stokes equation, Euler's equation of motion, application to fluid flow problems, pipe flow, plane, curved, stationary and moving vanes, sluice gates, weirs, orifice meters and Venturi meters.

Dimensional Analysis and Similitude : Buckingham's Pi-theorem, dimensionless parameters, similitude theory, model laws, undistorted and distorted models.

Laminar Flow : Laminar flow between parallel, stationary and moving plates, flow through tube.

Boundary layer : Laminar and turbulent boundary layer on a flat plate, laminar sublayer, smooth and rough boundaries, drag and lift.

Turbulent flow through pipes : Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, hydraulic grade line and total energy line, siphons, expansion and contractions in pipes, pipe networks, water hammer in pipes and surge tanks.

Open channel flow : Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force, critical depth, resistance equations and variation of roughness coefficient, rapidly varied flow, flow in contractions, flow at sudden drop, hydraulic jump and its applications surges and waves, gradually varied flow, classification of surface profiles, control section, step method of integration of varied flow equation, moving surges and hydraulic bore.

Hydraulic Machines and Hydropower :

Centrifugal pumps—Types, characteristics, Net Positive Suction Height (NPSH), specific speed. Pumps in parallel.

Reciprocating pumps, Airvessels, Hydraulic ram, efficiency parameters, Rotary and positive displacement pumps, diaphragm and jet pumps.

Hydraulic turbines, types classification, Choice of turbines, performance parameters, controls, characteristics, specific speed.

Principles of hydropower development. Type, layouts and Component works. Surge tanks, types and choice. Flow duration curves and dependable flow. Storage an pondage. Pumped storage plants. Special features of mini, micro-hydel plants.

Part-D

Geo Technical Engineering

Types of soil, phase relationships, consistency limits particles size distribution, classifications of soil, structure and clay mineralogy.

Capillary water and structural water, effectives trees and pore water pressure, Darcy's Law, factors affecting permeability, determination of permeability, permeability of stratified soil deposits.

Seepage pressure, quick sand condition, compressibility and consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test.

Compaction of soil, field control of compaction. Total stress and effective stress parameters, pore pressure coefficients.

Shear strength of soils, Mohr Coulomb failure theory, Shear tests.

Earth pressure at rest, active and passive pressures, Rankine's theory, Coulomb's wedge theory, earth pressure on retaining wall, sheetpile walls, Braced excavation.

Bearing capacity, Terzaghi and other important theories, net and gross bearing pressure.

Immediate and consolidation settlement.

Stability of slope, Total Stress and Effective Stress methods, Conventional methods of slices, stability number.

Subsurface exploration, methods of boring, sampling, penetration tests, pressure meter tests.

Essential features of foundation, types of foundation, design criteria, choice of type of foundation, stress distribution in soils, Boussinessq's theory, Newmarks's chart, pressure bulb, contact pressure, applicability of different bearing capacity theories, evaluation of bearing capacity from field tests, allowable bearing capacity, Settlement analysis, allowable settlement.

Proportioning of footing, isolated and combined footings, rafts, buoyancy rafts, Pile foundation, types of piles, pile capacity, static and dynamic analysis, design of pile groups, pile load test, settlement of piles, lateral capacity. Foundation for Bridges. Ground improvement techniques—preloading, sand drains, stone column, grouting, soil stabilisation.

Paper-II

Part-A

Construction Technology, Equipment, Planning and Management

1. Construction Technology :

Engineering Materials :

Physical properties of construction materials : Stones, Bricks and Tiles; Lime, Cement and Surkhi Mortars; Lime Concrete and Cement Concrete, Properties of freshly mixed and hardened concrete, Flooring Tiles, use of ferro-cement, fibre-reinforced and polymer concrete, high strength concrete and light weight concrete. Timber : Properties and uses; defects in timber; seasoning and preservation of timber. Plastics, rubber and damp-proofing materials, termite proofing, Materials, for Low cost housing.

Construction :

Building components and their functions; Brick masonry : Bonds, jointing. Stone masonry. Design of Brick masonry walls as per I.S. codes, factors of safety, serviceability and strength requirements; plastering, pointing. Types of Floors & Roofs. Ventilators, Repairs in buildings.

Functional planning of building : Building orientation, circulation, grouping of areas, privacy concept and design of energy efficient building; provisions of National Building Code.

Building estimates and specifications; Cost of works; valuation.

2. Construction Equipment :

Standard and special types of equipment, Preventive maintenance and repair, factors affecting the selection of equipment, economical life, time and motion study, capital and maintenance cost.

Concreting equipments : Weigh batcher, mixer, vibration, batching plant, Concrete pump.

Earth-work equipment : Power shovel hoe, bulldozer, dumper, trailers, and tractors, rollers, sheep foot roller.

3. Construction Planning and Management : Construction activity, schedules, job layout, bar charts, organization of contracting firms, project control and supervision. Cost reduction measures.

Network analysis : CPM and PERT analysis, Float Times, crashing of activities, contraction of network for cost optimization, up dating, Cost analysis and resource allocation.

Elements of Engineering Economics, methods of appraisal, present worth, annual cost, benefit-cost, incremental analysis. Economy of scale and size. Choosing between alternatives including levels of investments. Project profitability.

Part-B

Survey and Transportation Engineering

Survey : Common methods of distance and angle measurements, plane table survey, levelling traverse survey, triangulation survey, corrections, and adjustments, contouring, topographical map. Surveying instruments for above purposes. Techeometry. Circular and transition curves. Principles of photogrammetry.

Railways : Permanent way, sleepers, rail fastenings, ballast, points and crossings, design of turn outs, stations and yards, turntables, signals, and interlocking, level-crossing. Construction and maintenance of permanent ways : Superelevation, creep of rail, ruling gradient, track resistance, tractive effort, relaying of track.

Highway Engineering : Principles of highway planning, Highway alignments. Geometrical design : Cross section, camber, superelevation, horizontal and vertical curves. Classification of roads : low cost roads, flexible pavements, rigid pavements. Design of pavements and their construction, evaluation of pavement failure and strengthening.

Drainage of roads : Surface and sub-surface drainage.

Traffic Engineering : Forecasting techniques, origin and destination survey, highway capacity. Channelised and unchannelised intersections, rotary design elements, markings, sign, signals, street lighting; Traffic surveys. Principle of highway financing.

Part-C

Hydrology, Water Resources and Engineering :

Hydrology : Hydrological cycle, precipitation, evaporation, transpiration, depression storage, infiltration, overland flow, hydrograph, flood frequency analysis, flood estimation, flood routing through a reservoir, channel flow routing-Muskingam method.

Ground water flow : Specific yield, storage coefficient, coefficient of permeability, confined and unconfined equifers, aquifers, aquitards, radial flow into a well under

confined and unconfined conditions, tube wells, pumping and recuperation tests, ground water potential.

Water Resources Engineering : Ground and surface water resource, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation, economics of water resources projects.

Irrigation Engineering : Water requirements of crops : consumptive use, quality of water for irrigation, duty and delta, irrigation methods and their efficiencies.

Canals : Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, most efficient section, lined canals, their design, regime theory, critical shear stress, bed load, local and suspended load transport, cost analysis of lined and unlined canals, drainage behind lining.

Water logging : causes and control, drainage system design, salinity.

Canal structures : Design of cross regulators, head regulators, canal falls, aqueducts, metering flumes and canal outlets.

Diversion head work : Principles and design of weirs of permeable and impermeable foundation, Khosla's theory, energy dissipation, stilling basin, sediment excluders.

Storage works : Types of dams, design, principles of rigid gravity and earth dams, stability analysis, foundation treatment, joints and galleries, control of seepage.

Spillways : Spillway types, crest gates, energy dissipation.

River training : Objectives of river training, methods of river training.

Part-D

Environmental Engineering

Water Supply : Estimation of surface and subsurface water resources, predicting demand for water, impurities, of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.

Intake of water : pumping and gravity schemes. Water treatment : principles of coagulation, flocculation and sedimentation; slow-, rapid-, pressure-, filters; chlorination, softening, removal of taste, odour and salinity.

Water storage and distribution : storage and balancing reservoirs : types, location and capacity. Distribution system : layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations.

Sewerage systems : Domestic and industrial wastes, storm sewage—separate and combined systems, flow through sewers, design of sewers, sewer appurtenances, manholes, inlets, junctions, siphon. Plumbing in public buildings.

Sewage characterisation : BOD, COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal water course and on land.

Sewage treatment : Working principles, units, chambers, sedimentation tanks, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of waste water.

Solid waste : collection and disposal in rural and urban contexts, management of long-term ill-effects.

Environmental pollution : Sustainable development. Radioactive wastes and disposal. Environmental impact assessment for thermal power plants, mines, river valley projects. Air pollution. Pollution control acts.

MANIPUR PUBLIC SERVICE COMMISSION

SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

COMMERCE & ACCOUNTANCY

Paper-I Accounting & Finance Part-I

Accounting, Taxation & Auditing

Financial Accounting

Accounting as a financial information system; Impact of behavioural sciences.

Accounting Standards e.g., accounting for depreciation, inventories, gratuity, research and development costs, long term construction contracts, revenue recognition, fixed assets, contingencies, foreign exchange transactions, investments and government grants.

Advanced problems of company accounts.

Amalgamation absorption and reconstruction of companies.

Valuation of shares and goodwill.

Cost Accounting

Nature and functions of cost accounting.

Job Costing

Process Costing

Marginal Costing; Techniques of segregating semi-variable costs into fixed and variable costs.

Cost-volume-profit relationship; aid to decision making including pricing decisions, shutdown etc.

Techniques of cost control and cost reduction.

Budgetary control, flexible budgets.

Standard costing and variance analysis.

Responsibility accounting, investment, profit and Cost centres.

Taxation

Definitions

Basis of charge.

Incomes which do not form part of total income.

Simple problems of computation of income under various heads, i.e., salaries, income from house property, profits and gains from business or profession, capital gains, income of other persons included in assessee's total income.

Aggregation of income and set off/carry forward of loss.

Deductions to be made in computing total income.

Auditing

Audit of cash transactions, expenses, incomes, purchases, sales.

Valuation and verification of assets with special reference to fixed assets, stocks and debts.

Verification of liabilities.

Audit of limited companies; appointment, removal, powers, duties and liabilities of company auditor, significance of 'true and fare', MAOCARO report.

Auditor's report and qualifications therein.

Special points in the audit of different organisations like clubs, hospitals, colleges, charitable societies.

Part-II

Business Finance and Financial Institutions.

Finance Function-Nature, Scope and Objectives of Financial Management-Risk and Return relationship.

Financial Analysis as a Diagnostic Tool.

Management of Working Capital and its Components-Forecasting working capital needs, inventory, debtors, cash and credit management.

Investment Decisions-Nature and Scope of Capital Budgeting-Variety of types of decisions including Make or Buy and Lease or Buy-Techniques of Appraisal and their application-

Consideration of Risk and Uncertainty-Analysis of Non-financial Aspects.

Rate of Return on Investments-Required Rate of Return-its measurement-Cost of Capital-Weighted Average Cost-Different Weights.

Concepts of Valuation-Valuation of firm's Fixed Income Securities and Common Stocks.

Dividend and Retention Policy-Residual Theory or Dividend Policy-Other Models-Actual Practices.

Capital Structure-Leverages-Significance of Leverages-Theories of Capital Structure with special reference to Modigliani and Miller approach. Planning the Capital Structure of a Company; EBIT-EPS Analysis, Cash-flow ability to service debt, Capital Structure Ratios, other methods.

Raising finance-short term and long term. Bank finance-norms and conditions.

Financial Distress-Approaching BIFR under Sick Industrial Undertakings Act : Concept of Sickness, Potential Sickness, Cash Loss, Erosion of Networth.

Money Markets-the purpose of Money Markets, Money Market in India-Organization and working of Capital markets in India-Organization, Structure and Role of Financial Institutions in India. Banks and Investing Institutions-National and International Financial Institutions-their norms and types of financial assistance provided-inter-bank lending-its regulation, supervision and control. System of Consortium-Supervision and regulation of banks.

Monetary and Credit policy of Reserve Bank of India.

Paper-II
Organisation Theory and Industrial Relations
Part-I

Organisation Theory

Nature and concept of Organisation-Organisation goals; Primary and secondary goals, Single and multiple goals, ends means chain-Displacement, succession, expansion and multiplication of goals-Formal organisation; Type, Structure-Line and Staff, functional matrix, and project-Informal organisation-functions and limitations.

Evolution of organisation theory : Classical, Neo-classical and system approach-Bureaucracy; Nature and basis of power, sources of power, power structure and politics-Organisational behaviour as a dynamic system : technical, social and power

systems-interrelations and interactions-Perception-Status system. Theoretical and empirical foundation of theories and Models of motivation. Morale and productivity-Leadership : Theories and styles-Management of conflicts in organisation-Transactional Analysis-Significance of culture to organisations. Limits of rationality-Organisational change, adaptation, growth and development, Professional management Vs. family management, Organisational control and effectiveness.

Part-II

Industrial Relations.

Nature and scope of industrial relations, the socio-economic set-up, need for positive approach.

Industrial labour in India and its commitment-stages of commitments. Migratory nature-merits and shortcomings.

Theories of Unionism.

Trade Union movement in India-origin, growth and structure; Attitude and approach of management of India-recognition. Problems before Indian Trade Union movement.

Industrial disputes-sources; strikes and lockouts.

Compulsory adjudication and collective bargaining-approaches.

Worker's participation in management-philosophy, rationale; present day state of affairs and future prospects.

Prevention and settlement of industrial disputes in India.

Industrial relations in Public Enterprises.

Absenteeism and labour turnover in Indian Industries-causes

Relative wages and wage differentials; wage policy.

Wage policy in India; the Bonus issue.

I.L.O. and India;

Role of Personnel Department in the Organisation.

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SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

COMPUTER SCIENCE

PAPER – I

1. Formal Languages and Automata Theory

Finite state machines, push down automata, Finite automata, context free language, context sensitive language, Turing machine, Decision question and undecided problems.

2. Computer Organisation

Functional components, CPU design, Memory organization and I/O organization.

3. Operating Systems.

Process management, Memory management, File management I/O management.

4. Software Engineering

Life cycle model, function oriented design, object oriented design, User interface design, coding and Testing, software requirement, project management, software reliability and Maintenance.

PAPER – II

1. Data Structures

Continuous and Non-continuous data structures, Dynamic storage allocations, File organization techniques.

2. Principle of Programming Languages.

Various programming paradigms Syntax, Semantics, Block structure, Scoping, Binding, Object oriented programming, Functional programming, Logic and concurrent programming.

3. **Database Management**

Concept, Data independence, Different models, Storage organization, query languages, Normal forms, Decomposition, Security, concurrency, Recovery.

4. **Data communication and computer Networks**

Basics of digital communication, Network architecture, physical layer, Medium access protocols, Data-link layer, Network layer, Transport layer and Application layer.

MANIPUR PUBLIC SERVICE COMMISSION

SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

ECONOMICS

Paper-I

1. Ricardian, Marshallian and Walrasian approaches to price determination. Types of Markets and price determination. Criteria of Welfare improvement. Alternate theories of distribution.

2. Functions of money-Measurement of price level changes-Money and real balances-Monetary standards-High-powered money and the Quantity theory of money, its variants and critiques thereof-Demand for and supply of money-The money multiplier. Theories of determination of interest rate-Interest and prices-Theories of inflation and control of inflation.

3. Full employment and Says' Law-underemployment equilibrium-Keynes' Theory of employment (and income) determination-Critiques of Keynesian Theory.

4. The modern monetary system-Banks, non-bank financial intermediaries, Discount House, and Central Bank. Structure of Money and financial markets and control. Money market instruments, bills and bonds. Real and nominal interest rates. Goals and instruments of monetary management in closed and open economies. Relation between the Central Bank and the Treasury. Proposal for ceiling on growth rate of money.

5. Public finance and its role in market economy in stabilisation, supply stability, allocative efficiency, distribution and development. Sources of revenue-Forms of Taxes and subsidies, their incidence and effects; Limits to taxation, loans, crowding-out effects, and limits to borrowing. Types of budget deficits-Public expenditure and its effects.

6. International Economics

(i) Old and New theories of International Trade.

a) Comparative advantage, Terms of trade and offer curve.

b) Product cycle and Strategic trade theories.

c) "Trade as an engine of growth" and theories of underdevelopment in an open economy.

- (ii) Forms of protection.
- (iii) Balance of Payments Adjustments Alternative Approaches.
 - a) Price versus income, income adjustments under fixed exchange rates.
 - b) Theories of policy mix.
 - c) Exchange rate adjustments under capital mobility.
 - d) Floating Rates and their implications for developing countries; Currency Boards.
- (iv) (a) IMF and the World Bank.
 - (b) W.T.O.
 - (c) Trade Blocks and monetary unions.

7. Growth and development.

- (i) Theories of growth : Classical and neo-classical theories; The Harrod model; economic development under surplus Labour; wage-goods as a constraint on growth; relative importance of physical and human capitals in growth; innovations and development; Productivity, its growth and source of changes thereof. Factors determining savings to income ratio and the capital-out put ratio.
- (ii) Main features of growth : Changes in Sectoral compositions of income; Changes in occupational distribution; changes in income distribution; changes in consumption levels and patterns; changes in savings and investment and in pattern of investment. Case for and against industrialization. Significance of agriculture in developing countries.
- (iii) Relation between state, planning and growth, Changing roles of market and plans in growth economic policy and growth.
- (iv) Role of foreign capital and technology in growth. The significance of multi-nationals.
- (v) Welfare indicators and measures of growth-Human development indices-The basic needs approach.
- (vi) Concept of sustainable development; convergence of levels of living of developed and developing countries; meaning of self-reliance in growth and development.

Paper-II

I. Evolution of the Indian Economy till independence. The Colonial Heritage : Land System & Agriculture, Taxes, Money and credit, Trade, Exchange Rate, the "Drain of

Wealth controversy" of late 19th Century. Randade's critique of Laissez-Faire; Swadeshi movement; Gandhi and Hind Swaraj.

II. Indian Economics in Post-Independent Era-Contributions of Vakil, Gadgil and Rao. National and percapita Income; Patterns, Trends, Aggregate and sectoral-composition and changes therein. Broad factors determining National Income and its distribution; Measures of poverty. Trends in below poverty-line proportion.

III. Employment : Factors determining employment in short and long periods. Role of capital, wage-goods, wage-rate and technology. Measures of unemployment. Relation between income, poverty and employment, and issues of distribution and social justice.

Agriculture-Institutional set-up of land system size of agricultre holdings and efficiency-Green Revolution and technological changes-Agricultural prices and terms of trade-Role of public distribution and farm-subsidies on agricultural prices and production. Employment and poverty in agriculture-Rural wages-employment schemes-growth experience-land reforms. Regional disparities in agricultural growth. Role of Agriculture in export.

IV. Industry : Industrial system of India : Trends in Composition and growth. Role of public and private sectors, Role of small and cottage industries. Indian industrial Strategy-Capital versus consumer goods, wage-goods versus luxuries, capital-intensive versus labour-intensive techniques, import-substituting versus export promotion. Sickness and high-cost Industrial policies and their effects. Recent moves for liberalisation and their effects on Indian industry.

V. Money and banking : The monetary institutions of India: Factors determining demand for and supply of money. Sources of Reserve money-money multiplier-Techniques of money supply regulation under open economy. Functioning of money market in India. Budget deficit and money supply. Issues in Reform of Monetary and Banking Systems.

VI. Index numbers of price levels-Course of Price level in post-Independence period-sources and causes of inflation-role of monetary and supply factors in price level determination-policies towards control of inflation. Effects of inflation under open economy.

VII. Trade, balance of payments and exchange : Foreign trade of India; composition and direction shifts in trade policy from import substitution to export promotion. Impact of liberalisation on pattern of trade. India's external Borrowings-the Debt problem. Exchange rate of the rupee; Devaluations, depreciations and their effects on balance of payments-Gold imports and Gold policy-convertibility on current and capital accounts-rupee in an open economy. Integration of Indian economy with world economy-India and the WTO.

VIII. Public Finance and Fiscal Policy : Characteristics of and trends in India's Public Finance-Role of Taxes, (direct and indirect) and subsidies-Fiscal and monetary deficits-public expenditures and their significance-Public Finance and Inflation-Limiting Government's debt-Recent fiscal policies and their effects.

IX. Economic Planning in India-Trends in Savings and investment-Trends in Savings to Income and capital-output ratios-Productivity, its sources, growth and trends-growth versus distribution-Transition from Central Planning to indicative planning-relation between Market and Plan-strategies for Growth, social justice and Plans. Planning and increasing the growth rate.

MANIPUR PUBLIC SERVICE COMMISSION

SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

EDUCATION

PAPER - I

PART - I

1. Meaning, definition and scope of education. Aims – individual, social, liberal and vocational and Harmonious development of education, Aims of education in a democracy.
2. School and community – their relation, functions and responsibilities.
3. Curriculum, Definition and types of curricula, defects of present curriculum, principles of curriculum construction, Importance of correlation of studies. Co-curricular activities and their values in education.
4. Freedom and discipline – Importance of freedom in education, Free-discipline, relation between freedom and discipline, Discipline meaning types and its importance, Reward and punishment.
5. Teacher – Qualities of a teacher importance of his personality. Functions of school teacher. Maternal Education needed for teaching.
6. Theories of play – play methods in education.
7. Education for National integration and international understanding.

PART – II

1. Psychology – its meaning, scope of definition, its importance in education, Methods of educational psychology.
2. Physical basis of mental life – Importance of sensation, perception and conception.
3. Adolescence – its significance and problems.
4. Emotions and instincts – their importance in education, Importance of needs, drives and motives.

5. Learning – its meaning and importance, laws of learning, efficiency in learning.
6. Image and imagination, its importance in education.
7. Memory – meaning and types of memory, cause of forgetting, attention and its relation to interest.
8. Intelligence – its meaning and nature.
9. Statistics in education – Calculation of mean, medium and mode, standard deviation and quartile deviation, Coefficient of correlation by rank, difference method.

EDUCATION

PAPER - II

1. Charter Act of 1813.
2. Anglicist – classicist controversy Macculay's minute and Lord Bentinck's resolution of 1835.
3. Wood's Despatch of 1854 – its impact on Indian education.
4. Indian Education Commission of 1882 – primary and secondary education.
5. Lord Curzon's educational policy – Primary, Secondary and University education.
6. Gokhale's Bill on primary education - resolution of 1913.
7. Hartog committees report of 1929.
8. Wardha Scheme of Education 1937, its implementation in India.
9. Universalisation of Elementary Education (UEE) in Manipur under EGS & AIE and SSA.
10. Adult Education – Problems in the implementation of Adult Education Programme – Objectives and aims of NAEP (now AEP).

MANIPUR PUBLIC SERVICE COMMISSION

SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

ELECTRICAL ENGINEERING

Paper-I

Electrical Circuits–Theory and Applications

Circuit components; network graphs; KCL, KVL; circuit analysis methods : nodal analysis, mesh analysis; basic network theorems and applications; transient analysis : RL, RC and RLC circuits; sinusoidal steady state analysis; resonant circuits and applications; coupled circuits and applications; balanced 3-phase circuits. Two-port networks, driving point and transfer functions; poles and zeros of network functions. Elements of networks synthesis. Filter-theory : design and applications. Active filters. Circuit simulation : Input formats; methods of equation formulation; solution of equations; output formats; SPICE.

Signals & Systems

Representation of continuous-time and discrete-time signals & systems; LTI systems; convolution; impulse response; time-domain analysis of LTI systems based on convolution and differential/difference equations. Fourier transform, Laplace transform, Z-transform, Transfer function. Sampling and recovery of signals DFT, FFT Processing of analog signals through discrete-time systems.

E.M. Theory

Maxwell's equations, wave propagation in bounded media. Boundary conditions, reflection and refraction of plane waves. Transmission line : Distributed parameter circuits, travelling and standing waves, impedance matching, Smith chart. Waveguides : parallel plane guide, TE, TM and TEM waves, rectangular and cylindrical wave guides, resonators. Planar transmission lines; stripline, microstripline.

Analog Electronics

Characteristics and equivalent circuits (large and small-signal) of Diode, BJT, JFET and MOSFET. Diode circuits : clipping, clamping, rectifier. Biasing and bias stability. FET amplifiers. Current mirror; Amplifiers : single and multi-stage, differential, operational, feedback and power. Analysis of amplifiers; frequency-response of amplifiers. OPAMP circuits. Filters; sinusoidal oscillators : criterion for oscillation; single-transistor and OPAMP configurations. Function generators and wave-shaping circuits. Power supplies.

Digital Electronics

Boolean algebra; minimisation of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinational circuits : arithmetic circuits, code converters, multiplexers and decoders. Sequential circuits : latches and flip-flops, counters and shift-registers. Comparators, timers, multivibrators. Sample and hold circuits, ADCs and DACs. Semiconductor memories. Logic implementation using programmable devices (ROM, PLA, FPGA).

Energy Conversion

Principles of electromechanical energy conversion : Torque and emf in rotating machines. DC machines : characteristics and performance analysis; starting and speed control of motors.

Transformers : principles of operation and analysis; regulation, efficiency; 3-phase transformers. 3-phase induction machines and synchronous machines : characteristics and performance analysis; speed control. Special machines : Stepper motors, brushless dc motors, permanent magnet motors single-phase motors; FHP.

Power Electronics and Electric Drives :

Semiconductor power devices : diode, transistor, thyristor, triac, GTO and MOSFET—static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters : fully-controlled and half-controlled; principles of thyristor choppers and inverters; basic concepts of speed control of dc and ac motor drives applications of variable-speed drives.

Analog Communication

Random variables : continuous, discrete; probability, probability functions. Statistical averages; probability models; Random signals and noise : white noise, noise equivalent bandwidth; signal transmission with noise; signal to noise ratio. Linear CW modulation : Amplitude modulation : DSB, DSB-SC and SSB. Modulators and Demodulators; Phase and Frequency modulation : PM & FM signals; narrowband FM; generation & detection of FM and PM, Deemphasis, Preemphasis. CW modulation system : Superhetrodyne receivers, AM receivers, communication receivers, FM receivers, phase locked loop, SSB receiver Signal to noise ratio calculation for AM and FM receivers.

Microwaves and Antenna

Electromagnetic radiation, Propagation of waves : ground waves, sky wave, space wave, tropospheric scatter propagation. Extraterrestrial communications. Antenna : Various types, gain, resistance, band-width, beamwidth and polarization, effect of ground. Antenna coupling; high frequency antennas; microwave antennas; special purpose antennas. Microwave Services : Klystron, magnetron, TWT, gun diodes, Impatt, Bipolar and FETs, Microwave integrated circuits. Microwave measurements.

Paper-II

Control Systems

Elements of control systems; block-diagram representation; open-loop & closed-loop systems; principles and applications of feed-back. LTI systems : time-domain and transform-domain analysis. Stability : Routh Hurwitz criterion, root-loci, Nyquist's criterion, Bode-plots, Design of lead-lag compensators. Proportional, PI, PID controllers. State-variable representation and analysis of control systems. Principles of discrete-control systems.

Electrical Engineering Materials

Electrical/electronic behaviour of materials : conductivity; free-electrons and band-theory; intrinsic and extrinsic semiconductor, p-n junction; solar cells, super-conductivity. Dielectric behaviour of materials; polarization phenomena; piezo-electric phenomena. Magnetic materials : behaviour and application. Photonic materials : refractive index, absorption and emission of light, optical fibres, lasers and opto-electronic materials.

Microprocessors and microcomputers

8-bit microprocessor : architecture, CPU, module design, memory interfacing, I/O, Peripheral controllers, Multiprocessing. IBM PC architecture : overview, introduction to DOS, Advanced microprocessors.

Measurement and Instrumentation

Error analysis; measurement of current voltage, power, energy, power-factor, resistance, inductance, capacitance and frequency; bridge measurement. Electronic measuring instruments : multimeter, CRO, digital voltmeter, frequency counter, Q-meter, spectrum-analyser, distortion-meter. Transducers : thermocouple, thermistor, LVDT, strain-gauge, piezo-electric crystal. Use of transducers in measurements of non-electrical quantities. Data-acquisition systems.

IC Technology

Overview of IC Technology. Unit-steps used in IC fabrication : wafer cleaning, photolithography, wet and dry etching, oxidation, diffusion, ion-implantation, CVD and LPCVD techniques for deposition of poly-silicon, silicon, silicon-nitride and silicon dioxide; metallisation and passivation.

Power Systems : Analysis and Control

Steady-state performance of overhead transmission lines and cables; principles of active and reactive power transfer and distribution; per-unit quantities; bus admittance and impedance matrices; load flow; voltage control and power factor correction; economic operation; symmetrical components, analysis of symmetrical and unsymmetrical faults. Concept of system stability : swing curves and equal area criterion. Static VAR system. Basic concepts of HVDC transmission; FACTS.

Computer control and Automation : Introduction to energy control centres; various states of a power system; SCADA systems and RTUs. Active power control : Speed control of generators, tie-line control, frequency control. Economic dispatch.

Power system protection

Principles of overcurrent, differential and distance protection. Concept of solid state relays. Circuit breakers. Computer aided protection : Introduction; line bus, generator, transformer protection; numeric relays and application of DSP to protection.

Non-conventional Energy Sources and Energy Management

Introduction to the energy problem; difficulties with conventional energy sources. Wind-Energy : Basics of Wind turbine aerodynamics; wind-energy conversion systems and their integration into electrical grid. Solar-Energy : Thermal conversion : photo-voltaic conversion. Wave-energy. Importance of Energy Management : Energy audit; energy economics : discount rate, payback period, internal rate of return, life cycle costing.

Digital Communication

Pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation (DM), Digital modulation and demodulation schemes : amplitude, phase and frequency keying schemes (ASK, PSK, FSK). Error control coding : error detection and correction, linear block codes, convolution codes. Information measure and source coding. Data networks, 7-layer architecture.

Satellite Communication, Radar and TV

Satellite Communication : General overview and technical characteristics, earth station equipment, satellite link design, CNR of Satellite system. Radar : Basic principles, Pulsed systems : CW Doppler radar, FMCW radar, Phase array radars. Television Systems : Television systems and standards, Black-and White-and Colour-TV transmission and receiver systems.

Fibre Optic System

Multiplexing : Time division multiplexing, Frequency Division multiplexing. Optical properties of materials : Refractive index absorption and emission of light, optical fibres, lasers and optoelectronic materials Fibre optic links.

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SYLLABUS FOR MCSCC (MAIN) EXAMINATION

OPTIONAL PAPER

English

The syllabus consists of two papers, designed to test a first-hand and critical reading of texts prescribed from the following periods in English Literature : Paper I : 1600-1900 and Paper II : 1900-1990.

There will be two compulsory questions in each paper : a) A short-notes question related to the topics for general study, and b) A critical analysis of UNSEEN passages both in prose and verse.

Paper-I

Answers must be written in English.

Texts for detailed study are listed below. Candidates will also be required to show adequate knowledge of the following topics and movements :

The Renaissance : Elizabethan and Jacobean Drama; Metaphysical Poetry; The Epic and the Mock-epic; Neo-classicism; Satire; The Romantic Movement; The Rise of the Novel; The Victorian Age.

Section-A

1. William Shakespeare : **King Lear** and **The Tempest**.
2. John Donne. The following poems :
 - Canonization;
 - Death be not proud;
 - The Good Morrow;
 - On his Mistress going to bed;
 - The Relic;
3. John Milton : **Paradise Lost**, I, II, IV, IX
4. Alexander Pope. **The Rape of the Lock**.

5. William Wordsworth. The following poems:

- Ode on Intimations of Immortality.
- Tintern Abbey.
- Three years she grew.
- She dwelt among untrodden ways.
- Michael.
- Resolution and Independence.
- The World is too much with us.
- Milton, thou shouldst be living at this hour.
- Upon Westminster Bridge.

6. Alfred Tennyson : **In Memoriam.**

7. Henrik Ibsen : **A Doll's House.**

Section-B

1. Jonathan Swift. **Gulliver's Travels.**

2. Jane Austen. **Pride and Prejudice.**

3. Henry Fielding. **Tom Jones.**

4. Charles Dickens. **Hard Times.**

5. George Eliot. **The Mill on the Floss.**

6. Thomas Hardy. **Tess of the d'Urbervilles.**

7. Mark Twain. **The Adventures of Huckleberry Finn.**

Paper-II

Answers must be written in English.

Texts for detailed study are listed below. Candidates will also be required to show adequate knowledge of the following topics and movements :

Modernism; Poets of the Thirties; The stream-of-consciousness Novel; Absurd Drama; Colonialism and Post-Colonialism; Indian Writing in English; Marxist, Psychoanalytical and Feminist approaches to literature; Post-Modernism.

Section-A

1. William Butler Yeats. The following poems:

- Easter 1916
- The Second Coming
- A Prayer for my daughter.
- Sailing to Byzantium.
- The Tower.
- Among School Children.
- Leda and the Swan.
- Meru
- Lapis Lazuli
- The Second Coming
- Byzantium.

2. T.S. Eliot. The following poems :

- The Love Song of J.Alfred Prufrock
- Journey of the Magi.
- Burnt Norton.

3. W.H. Auden. The following poems :

- Partition
- Musee des Beaux Arts
- in Memory of W.B. Yeats
- Lay your sleeping head, my love
- The Unknown Citizen

- Consider
- Mundus Et Infans
- The Shield of Achilles
- September 1, 1939
- Petition.

4. John Osborne : **Look Back in Anger.**

5. Samuel Beckett. **Waiting for Godot.**

6. Philip Larkin. The following poems :

- Next
- Please
- Deceptions
- Afternoons
- Days
- Mr. Bleaney

7. A.K. Ramanujan. The following poems :

- Looking for a Causim on a Swing
- A River
- Of Mothers, among other Things
- Love Poem for a Wife 1
- Small-Scale Reflections on a Great House
- Obituary

(All these poems are available in the anthology Ten Twentieth Century Indian Poets, edited by R. Parthasarthy, published by Oxford University Press, New Delhi).

Section-B

1. Joseph Conrad. **Lord Jim**

2. James Joyce. **Portrait of the Artist as a Young Man.**

3. D.H. Lawrence. **Sons and Lovers.**
4. E.M. Forster. **A Passage to India.**
5. Virginia Woolf. **Mrs Dalloway.**
6. Raja Rao. **Kanthapura.**
7. V.S. Naipal. **A House for Mr. Biswas.**

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SYLLABUS FOR MCSCC (MAIN) EXAMINATION

ESSAY - COMPULSORY PAPER

Candidates will be required to write an essay on a specific topic. The choice of subjects will be given. They will be expected to keep closely to the subject of the essay to arrange their ideas in orderly fashion, and to write concisely. Credit will be given for effective and exact expression.