

SYLLABUS FOR COMPUTER BASED TEST (CBT) FOR THE RECRUITMENT OF TECHNICAL ASSISTANTS IN ICMR-NICED, KOLKATA

Reference Vacancy Notification No. NICED/01/2023 dated 05-07-2023

- (1). **Written Examination:** Paper-I (Common for all posts) and Paper-II (as per subject specialization)
- (2). **Level of questions:** Graduate/Diploma Level
- (3). **Marks:** Total 100 marks. Paper-I is with 40/50 Marks (Logical Reasoning & Quantitative aptitude, General Knowledge, Computer Skills, and Knowledge on ICMR) and Paper-II is with 60/50 Marks (as per subject specialization)
- (4). **Marking Scheme:** 1 mark for each correct answer and 0 mark for unattended & incorrect answer.
- (5). **Subject / Specialization:** The questions will be designed to test the ability of candidate in the technical subject. The questions will be technical & scientific in nature depending on the specialization & level of the post demanded. Syllabus is given with reference to the post Code.

Syllabus for Paper -I (Common for all posts)

Logical Reasoning & Quantitative Aptitude: (It would include questions of both verbal and non-verbal type. This component may include questions on analogies, similarities and differences, space visualization, spatial orientation, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning and figural classification, arithmetic number series, non-verbal series, coding and decoding, statement conclusion, syllogistic reasoning etc. The topics are, Semantic Analogy, Symbolic/Number Analogy, Figural Analogy, Semantic Classification, Symbolic/Number Classification, Figural Classification, Semantic Series, Number Series, Figural Series, Problem Solving, Word Building, Coding & de-coding, Numerical Operations, symbolic Operations, Trends, Space Orientation, Space Visualization, Venn Diagrams, Drawing inferences, Punched hole/ pattern - folding & un-folding, Figural Pattern - folding and completion, Indexing, Address matching, Date & city matching, Classification of centre codes/ roll numbers, Small & Capital letters/ numbers coding, decoding and classification, Embedded Figures, Critical thinking, Emotional Intelligence, Social Intelligence, Other sub-topics, if any. The questions will be designed to test the ability of appropriate use of numbers and number sense of the candidate. The scope of the test will be computation of whole numbers, decimals, fractions and relationships between numbers, Percentage, Ratio & Proportion, Square roots, Averages, Interest, Profit and Loss, Discount, Partnership Business, Mixture and Alligation, Time and distance, Time & Work, Basic algebraic identities of School Algebra & Elementary surds, Graphs of Linear Equations, Triangle and its various kinds of centers, Congruence and similarity of triangles, Circle and its chords, tangents, angles subtended by chords of a circle, common tangents to two or more circles, Triangle, Quadrilaterals, Regular Polygons, Circle, Right Prism, Right Circular Cone, Right Circular Cylinder, Sphere, Hemispheres, Rectangular Parallelepiped, Regular Right Pyramid with triangular or square base, Trigonometric ratio, Degree and Radian Measures, Standard Identities, Complementary angles, Heights and Distances, Histogram, Frequency polygon, Bar diagram & Pie chart.)

General Knowledge: (General Ability: -General Knowledge, current Affairs, Logical reasoning, and analytical ability; English like Comprehensions & choosing the correct word, Decision making and problem-solving; General mental ability; Numeric ability; Data analysis, interpretation & Reasoning.

Current Affairs/ Events of National and International importance. Politics: PM, President, minister and ministry, center and state governance, election procedure, UN agency, G20 & its presidency, Art and Indian Culture: -Indian Paintings, Dance forms in India, Music, Puppetry, Pottery, Drama/ Theatre, Sports and films. History & Geography: -Distribution of Key Natural Resources like river, mountains, water bodies, ice-caps etc. Across the world (including South Asia and the Indian sub-continent; Geophysical Phenomena such as earthquakes, Tsunami, Volcanic activity, cyclone etc., Physical Geography- Origin and Evolution of Earth; Interior of the Earth; Distribution of continents and Oceans. Location of cities, State

and its capital, highways etc. Mughal period, British Era History of Medical Research Institutes like CRI, Kasauli, IRFA, Plague laboratory, National Nutrition Laboratory)

Computer Skills: (Introduction, Characteristics of computers, Evolution of computers, Generation of Computers, Classification of Computers, The Computer System, Applications of Computers, Input / Output devices and Memory, Introduction, Keyboard, Pointing Devices, Speech Recognition, Digital Camera, Scanners, Optical Scanners. Classification of Output, Printers, Plotters, Computer Output Microfilm (COM), Monitors, Audio Output, Projectors. Random Access Memory (RAM), Read Only Memory (ROM), Types of ROM. Classification of Secondary Storage Devices, Magnetic Tape, Magnetic Disk, Optical Disk, Magneto Optical disk, MS-Office (MS-Word, MS-Excel, MS-Power Point), Net Surfing, Internet Services, Case Study, Intranet)

ICMR: (History of ICMR, Leadership of ICMR, Institutes and its Location, Mandate, scope, IJMR- Indian journal of medical research, About Going Viral Book, Landmark achievements in past, Fellowships Programs by ICMR, Outbreak investigations, Test tube baby landmark achievement, Covid-19 related information, ICMR Health Communication Ecosystem, Major work of ICMR Institutes, DG/Directors of ICMR, about Institutes/Centres of ICMR)

Subject / Specialization Syllabus for the Post Code TA (LS)

Physiology (Cell-Structure and function, Skeletal Systems-Bones, joints Cardiovascular System-Heart rate, Cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse Lymphatic System-Lymph glands and their function Blood- Composition and general function of blood. Description of blood cells – normal counts & function. Steps of coagulation, Anticoagulants Blood grouping, Respiratory System-Breathing and exchange of gases Gastrointestinal system- Digestion and absorption Endocrine glands Hormones-secretion and function, Excretion system- Excretory products and their elimination Nervous System-Neural control and coordination Reproductive system – Structure and functions of male & female reproductive organs)

Microbiology (Prokaryotic and eukaryotic cell structure; Microbial nutrition, growth and control; Microbial metabolism (aerobic and anaerobic respiration, photosynthesis); Nitrogen fixation; Chemical basis of mutations and mutagens; Basic ideas of Microbial genetics (Plasmids, transformation, transduction, conjugation); Microbial diversity and characteristic features; Viruses)

Biochemistry (Biomolecules and their conformation; Molecular interactions; Enzymes-Kinetics of enzyme catalyzed reactions; Bioenergetics; Metabolism (Glycolysis, TCA and Oxidative phosphorylation); Membrane transport and pumps)

Botany (Bacteria: Structure, Nutrition, reproduction and economic importance. An outline of plant diseases of important crop plants caused by bacteria and their control, **Viruses** (Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro, **Photosynthesis** (Photosynthetic pigments, Cyclic and Non-cyclic Photophosphorylation. Carbon assimilation pathways: C3, C4 and CAM. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle and oxidative phosphorylation. Nitrogen Metabolism: Biological nitrogen fixation. Basic idea of Phytohormones)

Zoology (Cell Biology Ultrastructure of animal cell, Structure and functions of plasma membrane proteins. Structure and functions of cell organelles –Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, Centrosomes, Mitochondria and Nucleus Chromosomes – Structure, types, Giant chromosomes, Cell Division - Mitosis, Meiosis).

Molecular Biology (DNA – Structure, RNA -Structure, types, DNA Replication, Protein Synthesis – Transcription and Translation, Gene Expression – Genetic Code; Operon concept, Molecular Biology Techniques- Polymerase Chain Reaction, Electrophoresis)

Immunology (Basic concepts; antigens and antibodies Basic concepts of immunology. Cells of immune system, Primary and secondary Organs of immune system, Types of Immunity –Innate and acquired, Basic properties of antigens, Structure, function and types of an antibody. B and T cell epitopes, haptens,

adjuvants. Antigen-antibody reactions, T-Cell and B-Cell activation, Monoclonal antibodies and their production. Major Histocompatibility Complex (MHC), Basic properties and functions of Cytokines, Interferons and complement proteins, Humoral and Cell mediated immunity. Types of hyper sensitivity. Concepts of autoimmunity and immunodeficiency. Introduction to Vaccines and types of Vaccines. Animal Biotechnology and Genetically modified organisms Concept Histocompatibility and Scope of Animal Biotechnology. Cloning vectors - Plasmids, Cosmids, Lambda bacteriophage, YAC Cloning- Cloning methods (Cell, Animal and Gene cloning) Animal Cell culture -Equipment and materials for animal cell culture; applications of cell culture techniques Recombinant DNA technology and its applications, Transgenesis – Methods of Transgenesis. Production of Transgenic animals and Application of Transgenic animals in Biotechnology. Stem cells –types and their applications).

Human Diseases (Pathogens; parasites causing human diseases (common cold, dengue, chikungunya, typhoid, pneumonia, amoebiasis, malaria, filariasis, ascariasis, ring worm) and their control; Basic concepts of vaccines; cancer, HIV and AIDS Communicable and non-communicable diseases; modes of transmission, causative agents, symptoms and prevention; viral diseases (common cold, chikungunya and dengue), bacterial diseases (typhoid, pneumonia, diphtheria and plague), protozoal diseases (amoebiasis, and malaria, graphic outline of life cycle of Plasmodium), helminthic diseases (ascariasis, and filariasis); fungal (ringworm); cancer - types of tumour (benign, malignant), causes, diagnosis and treatment, characteristics of cancer cells (loss of contact inhibition and metastasis).

Others (Bioinformatics databases (nucleotide and protein databases) such as EMBL, NCBI, DDBJ, SWISSPROT, PDB. Sequence file format: FASTA. Concept of pairwise and multiple sequence alignment. Sequence analysis through BLAST. Definition, introduction, tools used in Genomics).

Subject / Specialization Syllabus for the Post Code TA (LT/LA)

Clinical Biochemistry: (Collection, Separation, preservation and transport of the biological specimens, anticoagulants. Clinical laboratory instrumentation (Balance, Oven, Water bath) Concept of solute, solvent; colloidal solution, Normal solution, Molar solution, molal solution, osmol, osmolar solution, standard solution (Primary; Secondary) ionic strength of solution. Acid, Base, Buffer (Definition, example, pK, pH, Henderson-Hasselbalch's equation, Principles of Photometry, (Lambert-Beer's Law, Flame photometry, Reflectance Fluorometry, Definition of Antigen; Antibody, Antigen-Antibody reaction, Detection of Antigen-Antibody Reactions (ELISA, RIA), Clinical Enzymology: (Definition of enzyme, classification with examples, types of enzyme-substrate reactions, assay of enzymes. End point ;Kinetic, clinical importance of enzymes, isoenzymes, Basic concept of laboratory automation (Configuration of clinical laboratory analyzers, Basic concept of laboratory statistics (Reference value, mean, median, mode, standard deviation, coefficient of variation, Basic concept of quality control in clinical biochemistry laboratory (Control material, Leavy Jennings Plot, Electrophoresis...Principle, types, application in clinical biochemistry, Serum; Hemoglobin electrophoresis, Detection of Drugs; Toxic substances. Principles of Chromatography, paper; thin layer Chromatography, their application in detection of drugs; toxic substances)

Clinical Hematology: (Composition of blood and its function. Basic principles of semi or automated blood cell counters &HPLC. Blood Group (ABO &Rh) – methods of grouping; reverse grouping. Basics of quality control methods and Laboratory accreditation. Biosafety measures and disposal of laboratory waste.)

Clinical Microbiology: (Sterilization – principles; different methods adopted. Preparation of culture media. Bacterial staining – Gram/Ziehl Nielsen/others, Methods of colony count; morphological identification of bacteria by colony characters, staining; motility tests. Biochemical tests and interpretation. Antibiotic sensitivity tests. The microbial world and the structure of microbes. Collection of specimens for microbiological examination. Methods of inoculation of culture media from different samples. Basic concept of individual Bacteria. Laboratory diagnosis of Enteric fever. Laboratory diagnosis of Bacillary dysentery. Laboratory diagnosis of Diarrhoeal diseases. Laboratory diagnosis of Urinary tract infection. Laboratory diagnosis of Meningitis. Examination of stool, Laboratory diagnosis of UTI, Sore throat, acute pyogenic meningitis, Food poisoning and others, Laboratory diagnosis of Malaria, Protozoal

dysentery, Kala -azar, Hook worm infection, Ascariasis, Filariasis, Taeniasis, hepatitis, Cholera, Viral diarrhea, HIV/AIDS, Candidiasis, Cryptococcal meningitis.)

Clinical Pathology: (Transportation laboratories of different clinical materials to distant labs. Different human organs and their gross and histological structure and functions. Fixation of tissue- different fixatives and their mode of action. Staining of tissue sections, preparation of different stains, staining methods for Hematoxylin & Eosin, Reticulin, PAS, Van-Gieson, Massion's trichrome, Lipid & Mucin stains & Perl's stain. Cytochemistry, immunohistochemistry. Processing of tissues-protocol for manual & automated tissue processors, paraffin embedding preparation of blocks, preparation of reagents, different techniques, application and frozen section/ cryostat.)

Immunology and Serology (Antigens; Antibodies – definition, types, preparation, preservation. Types of Antigen and Antibody reactions. Diagnostic serological methods – Agglutination; Flocculation_Latex agglutination tests, Elisa testing RIA – principles and demonstration and interpretation of results of Widal Test, VDRL Test, Aldehyde Test, ASO Titre, Rheumatoid factor, C-reactive protein, HBsAg, Anti HCV, Anti-HIV.)

Laboratory Animal Care (Veterinary Anatomy, Veterinary Physiology, Veterinary Biochemistry, Veterinary Pharmacology and Toxicology, Veterinary Parasitology, Veterinary Microbiology, Veterinary Pathology Veterinary Public Health and Epidemiology, Animal Nutrition, Animal Genetics and Breeding, Livestock Production Management, Livestock Products Technology)

Subject / Specialization Syllabus for the Post Code TA (FI)

Health (Definition of health, Determinants of health, Assessment of health – tools and techniques, Approaches for health promotion, and Health and lifestyle)

Measurements to Describe Disease Occurrence (Distribution of disease (place, time, person), Rates, ratios, proportions, Morbidity, mortality and disability, Disease burden, and Endemic, epidemic and pandemic diseases)

Disease Prevention and Control (Levels of disease prevention – primary, secondary and tertiary, Immunization – childhood and adult, Health education; IEC – principles, activities and types, Water, sanitation and hygiene, Nutrition and health, Emerging and re-emerging diseases)

Social and behavioural factors affecting human health (Societal norms, culture and values, Basic human needs, Growth and development, Stress and adaptation, Child and adolescent health, Gender issues in public health, Substance use and related health issues, Social stigma, Counselling – principles and techniques, Behaviour change theories, Health equity)

Health Care Delivery in India (Three tier system of health care delivery, Major stakeholders in health care delivery (Government / Non-Govt), Health care workforce and infrastructure, Information, education and communication, Tele-medicine, Alternative systems of medicine, Public-private partnership, Inter-sectoral coordination)

Population Dynamics and Health (Population growth, population structure and their implications, Population control – targets and programs, National population policy, Methods of family planning and birth spacing, Census of India)

Health Surveys and Surveillance (Public health surveys – types, Morbidity and mortality surveys, Important health surveys in India, Disease surveillance – Definition, types, purposes, major examples)

Tools and Methods of Data Collection (Types of variables, Data sources, Data collection methods / techniques - quantitative and qualitative, Tools for data collection – types, characteristics and their development, Validity and reliability of tools, Procedure for data collection)

Application of Bio-Statistics in Health Data summarization: Measures of central tendency and dispersion, Data visualization: Preparation and interpretation of simple graphs and charts, Data confidentiality and data security, Common statistical software

Special Issues Related to Health and Health Research (Tribal health, Health of marginalized population, Ethical issues in health care and health research, Application of traditional medicines in health, Application of technologies in health care sector, Health financing and health insurance (public / private)

International Health ((International Codes of Disease (ICD), Notifiable diseases, Isolation and quarantine, International health agencies (e.g., WHO, UNICEF, DFID, Red Cross), Sustainable Development Goals (SDGs), and Globalization and health)

Subject / Specialization Syllabus for the Post Code TA (ES)

- **Civil Engineering** (ENGINEERING MECHANICS: Forces and moments- Vectors and scalars, types of supports. Location of centroid of T, L, I, channel, Z sections. Built-up sections. Unit-II: REINFORCED CONCRETE STRUCTURES Grades of concrete, characteristic strength, Modulus of Elasticity-I.S.456-2000- Philosophy of Limit state design. Limit state of Strength and Serviceability, partial safety factor-design strength of materials and design loads- assumptions. Analysis and Limit state design of rectangular Beams-Singly, doubly reinforced and T-beams. Shear in RCC beams - Development length. Slabs-analysis and limit state design of one-way and two-way slabs as per I.S.456-2000, Torsion reinforcement. Design of continuous slabs and beams - Deflection check for slabs and beams. Detailing of reinforcement in singly reinforced and doubly reinforced simply supported beams of rectangular sections and lintels, one way and two-way slabs. Columns: Code provisions of I. S 456-2000 - short and long columns-different shapes-design of short columns by limit state method-long columns- concept, effective length for different end conditions. Footings-Isolated column footings-one-way shear and two-way shear. Stairs- types. Unit-III: SURVEYING Methods of calculation of area. Leveling -definitions - component parts of Dumpy level - errors - Methods of levelling - contouring - characteristics and methods. Civil Engineering, Curves-simple curves, elements of simple curve, setting out of simple curves by chain & tape, single & double the odolite method. Unit-IV: HYDRAULICS Reciprocating and Centrifugal pumps (without problems). Unit-V: IRRIGATION ENGINEERING Cross drainage works – types and functions. Soil erosion, Types and causes-measures to control erosion. Unit-VI: TRANSPORTATION ENGINEERING Water bound macadam roads, Cement concrete roads. Unit-VII: WATERS SUPPLY AND SANITARY ENGINEERING, Quality of water, need for protected water supply, Total quantity of water for a town, per capita demand and factors affecting demand, forecasting population by arithmetical, geometrical and incremental increase methods, Sources and conveyance of water: surface sources, underground sources, Types of Intakes. Quality and Method of purification of water. Distribution System: Methods of supply, Storage-Distribution systems, Types of layouts- dead end, grid, radial and ring system their merits and demerits and their suitability. General layout of water supply arrangements in buildings. System of sewage disposal-types of sewerage systems, Different shapes of cross-section for sewers, Strength of sewage, sampling of sewage, characteristics of sewage-principles of treatment, Preliminary treatment, secondary treatment. Sewers –sewer appurtenances-shapes, merits and demerits. Unit-VIII: BUILDING MATERIALS AND CONSTRUCTION PRACTICE Stones-classification of rocks. Bricks- manufacturing, tests on bricks. Tiles- types of tiles. Cement classification -manufacturing-tests. Mortars – classification - proportioning. Concrete proportioning – water-cement ratio – workability – admixtures-curing methods-R.M.C. Timber and surface protective materials. Characteristics-types and uses. Classification of buildings, foundations-N.B.C. classification-bearing capacity of soil- types of foundations. Masonry-Bonds in brick masonry. Plastering-purpose. Pointing purpose and types.)
- **Electrical Engineering** (Electrical Circuit Theory, Electrical Machines-I, Electronic Devices and Circuits, Computer Applications, Electric Machines-II, Measurements and Instruments, Digital Electronics, Transducers and Signal Conditioners, Communication and Life Skills Practice, Power System-I

Microcontroller, Special Electrical Machines, Programmable Logic Controller, Electrical Machine Controller, Power System-II, Electrical Estimation and Energy Auditing, Computer Hardware and Networks

- **INSTRUMENTATION** (Basic Control System, Digital Electronics, IC, Transducers and Telemetry, Control System Components, Microprocessor and Assembly Language Programming, Process Technology Analytical Instrumentation, Electronic & Pneumatic Instrumentation, Microprocessor Interfacing & Applications, Process Instrumentation, Applied Instrumentation, Industrial Electronics and Control, Biomedical Instrumentation, Micro Controllers, Advance Process Control, BSL-3, BSI-2+)
- **COMPUTER SCIENCE & ENGINEERING** (Digital Electronics (Basics) Number systems - Conversions-Codes - Logic gates AND, OR, NOT, NOR, NAND and XOR - Boolean Expressions-De-Morgan's theorems-K-Map-Combinational Circuits-Adders-Encoders & Decoders - Multiplexers and De-multiplexers- Latches - Flip-flops - Edge and Level triggering Counters -Registers - Semiconductor memories. Unit-II: Microprocessors (Basics) 8086 Microprocessor - Architecture, Segmentation concepts - Instruction set of 8086 - Instruction formats - Addressing modes of 8086 - Interrupts Assembly Language Programming - Peripheral devices & interfacing-INTEL8255, 8257, 8251A, and 8279. Unit-III: Computer Organization Functional blocks of Digital Computer - Stored program concept - Fixed-point, Floating-point number representations - Instruction formats - Addressing modes- Memory hierarchy - Virtual memory, Associative memory - Cache memory - I/O Organization - Modes of data transfer -Programmed/O, DMA, Interrupt initiated I/O-Pipeline and Vector processing- Flynn's classification. Unit-IV:C Programming and Data Structures Algorithms - Flowcharts - C Tokens - Data types - Operators and expressions - Precedence and Associativity of operators-Type conversions-Control statements-Arrays-Memory allocations - Strings-Functions, parameter passing-Pointers-Structures, Unions-Storage classes-Preprocess or directive statements - Files Data Structures- Abstract Data Types - Time and Space complexities - Stacks and Queues - Linked Lists - Binary trees - Tree traversal techniques - Sorting: Bubble, Selection, Insertion, Quick and Merge sorts -Searching: Sequential and Binary search technique

Computer Hardware & Networking BIOS-Components of Motherboard -Processors-Hard Disk Drives-Input & Output devices - Networking-Classification of networks-OSI reference model, TCP/IP preference model-Network topologies: Bus, Ring, Star, Mesh, Hybrid - LAN components: Coaxial, Twisted pair, Optical fiber cables and Connectors - LAN devices: Repeaters, Hubs, Bridges, Switches, NIC, Routers, Modems - TCP/IP addressing scheme - IP address classes - IP Sub-netting - Linux commands. Unit-VI: Operating Systems Operating System concepts, Services, Types, System calls-Process Management- CPU scheduling algorithms: FCFS, SJF, Round Robin, Priority, Multilevel scheduling-Threads- Semaphores - Inter Process Communication - Deadlocks - Memory Management - Overlays, Paging, Segmentation, Virtual memory, Page replacement algorithms: FIFO, LRU, Optimal -Thrashing - Disk scheduling - Disk scheduling algorithms: FIFO, SSJF, SCAN, CSCAN - File management- file operations, access methods, directory structure. Unit-VII: RDBMS Concepts of Database systems, Data abstraction - Data independence, Data models, E-R model - Structure of Relational database - DDL, DML and DCL commands - Keys - Normal Forms: 1st, 2nd, 3rd and BCNF - SQL - data types, operators - joins - views, sequences, synonyms and indexes-PL/SQL- datatypes, control structures, cursor management, triggers, exceptions, functions, procedures, recursion and packages.

Object Oriented Programming Through C++ Concept of OOPs - classes and objects - Constructors and destructors -Function overloading and Operator overloading - Inheritance types Virtual functions - friend functions -inline functions -this pointer-I/O manipulators- File and I/O functions -Templates. Unit-IX: Java Programming Java - data types, variables, operators, arrays - Classes and Objects - Methods - Constructors - Method overloading, Method overriding-Static final members-

Inheritance– super, final keywords – Interfaces –Packages- Exception handling – Multi threading – Applets – AWT –Event handling - JDBC – Servlets. Unit-X: Internet Programming Internet fundamentals – HTML, Tags, Attributes, Formatting text – Cascading Style Sheets - Webservers- JavaScript–datatypes, Operators–control structures–procedures, functions and arrays – PHP – data types, variables, operators, control structures, arrays, functions, concept of accessing databases– sessions and cookies. Unit-XI: Data backup, Data security, Server Management, Data retrieval, FTP Management Unit-XII: Design and Analysis of Algorithm, Dynamic programming- Optimal binary search trees, Travelling Sales person problem, Greedy Method-Applications-Job Sequencing, Divide and conquer- Quick sort, Merge sort Performance Analysis –Space complexity, Big on Notation, Omega Notation, FIFO Branch and Bound Solution, Back Tracking, Unit-XIII: Distributed System. OS layers, Process and Threads, Distributed File System- Introduction. Transactions & concurrency, Replication – Fault tolerant services, distributed shared memory, peer to peer system Introduction Unit-XIV: Mobile Computing, Introduction to Android Operating system, User interface components, Persistent storage, Secure and retrieving data, Grid and Table Layouts.)