## SYLLABUS FOR TIER-I & TIER-II COMBINED EXAMINATION FOR THE POST OF ASSISTANT ENGINEER (CIVIL)

### GENERAL TOPICS- TIER-I – SECTION-A

(I) **GENERAL AWARENESS:** QUESTIONS WILL BE DESIGNED TO TEST THE ABILITY OF THE CANDIDATE'S GENERAL AWARENESS OF THE ENVIRONMENT AROUND HIM/HER AND ITS APPLICATION TO SOCIETY. THE QUESTIONS WILL BE DESIGNED TO TEST KNOWLEDGE OF CURRENT EVENTS AND OF SUCH MATTER OF EVERYDAY OBSERVATION AS MAY BE EXPECTED OF AN EDUCATED PERSON. THE TEST WILL ALSO INCLUDE QUESTIONS RELATING TO HISTORY, POLITY, CONSTITUTION, SPORTS, ART & CULTURE, GEOGRAPHY, ECONOMICS, EVERYDAY SCIENCE, SCIENTIFIC RESEARCH, NATIONAL/INTERNATIONAL ORGANIZATIONS /INSTITUTIONS ETC.

(II) **GENERAL INTELLIGENCE & REASONING ABILITY:** THE SYLLABUS OF GENERAL INTELLIGENCE & REASONING ABILITY INCLUDES QUESTIONS OF BOTH VERBAL AND NON-VERBAL TYPES. TEST MAY INCLUDE QUESTIONS ON ANALOGIES, SIMILARITIES, DIFFERENCES, SPACE VISUALIZATION, PROBLEM SOLVING, ANALYSIS, JUDGMENT, DECISION MAKING, VISUAL MEMORY, DISCRIMINATION, OBSERVATION, RELATIONSHIP, CONCEPTS, ARITHMETICAL REASONING, VERBAL AND FIGURE CLASSIFICATION, ARITHMETICAL NUMBER SERIES ETC.

(III) **ARITHMETICAL & NUMERICAL ABILITY :** THE TEST OF ARITHMETICAL AND NUMERICAL ABILITIES WILL COVER NUMBER SYSTEMS INCLUDING QUESTIONS ON SIMPLIFICATION, DECIMALS, DATA INTERPRETATION, FRACTIONS, L.C.M., H.C.F., RATIO & PROPORTION, PERCENTAGE, AVERAGE, PROFIT & LOSS, DISCOUNT, SIMPLE & COMPOUND INTEREST, MENSURATION, TIME & WORK, TIME & DISTANCE, TABLES & GRAPHS ETC.

(IV) **HINDI LANGUAGE & COMPREHENSION**: TESTING OF CANDIDATE'S UNDERSTANDING AND COMPREHENSION OF THE HINDI LANGUAGE. IN ADDITION TO THIS, QUESTIONS ON ITS VOCABULARY, GRAMMAR, SENTENCE STRUCTURE, SYNONYMS, ANTONYMS AND ITS CORRECT USAGE ETC. WOULD ALSO BE COVERED.

(V) **ENGLISH LANGUAGE & COMPREHENSION**: TESTING OF CANDIDATE'S UNDERSTANDING AND COMPREHENSION OF THE ENGLISH LANGUAGE. IN ADDITION TO THIS, QUESTIONS ON ITS VOCABULARY, GRAMMAR, SENTENCE STRUCTURE, SYNONYMS, ANTONYMS AND ITS CORRECT USAGE ETC. WOULD ALSO BE COVERED.

## SUBJECT SPECIFIC TOPICS FOR THE POST OF ASSISTANT ENGINEER (CIVIL)

## TIER I -SECTION B & TIER II- PART -I & II

### ENGINEERING PHYSICS

- PHYSICS OF MOTION
- OPTICS
- ELECTROMAGNETISM
- QUANTUM IDEAS
- PHYSICS OF MATERIALS
- RELATIVITY
- LASERS
- QUANTUM THEORY
- PHYSICS OF MATERIALS

### ENGINEERING CHEMISTRY

- CHEMICAL AND INSTRUMENTAL METHODS OF ANALYSIS
- ELECTROCHEMISTRY AND SURFACTANTS
- MOLECULAR STRUCTURE AND PHASE RULE
- POLYMERS
- NANOMATERIALS AND COMPOSITES

### ENGINEERING MATHEMATICS

- CURVE TRACING & APPLICATIONS OF DEFINITE INTEGRALS
- TECHNIQUES OF ONE VARIABLE CALCULUS & PARTIAL DIFFERENTIATIONS
- ORDINARY DIFFERENTIAL EQUATIONS
- PARTIAL DIFFERENTIAL EQUATIONS
- SOLID GEOMETRY & MULTIPLE INTEGRALS
- ORDINARY & PARTIAL DIFFERENTIAL EQUATIONS
- COMPLEX ANALYSIS

### BASICS OF CIVIL ENGINEERING

- STRESSES & STRAINS INTRODUCTION
- UNIAXIAL DEFORMATIONS
- ANALYSIS OF STRESSES
- ANALYSIS OF STRAINS
- STRUCTURES AND THEIR FORMS

### BASICS OF MECHANICAL ENGINEERING

- THERMODYNAMICS SYSTEMS, PROPERTIES, THERMAL EQUILIBRIUM, ZEROTH LAW OF THERMODYNAMICS AND CONCEPT OF TEMPERATURE. WORK, DISPLACEMENT WORK IN VARIOUS QUASI-STATE SYSTEMS, FIRST LAW OF THERMODYNAMICS, APPLICATION TO CYCLIC PROCESS, INTERNAL ENERGY, ENTHALPY. PURE SUBSTANCE, CONTROL VOLUMES, APPLICATION OF FIRST LAW TO NON-CYCLIC PROCESS, STEADY FLOW ENERGY EQUATION.

REVERSIBLE AND IRREVERSIBLE PROCESS, SECOND LAW OF THERMODYNAMICS, KELVIN-PLANCK AND CLAUSIUS STATEMENT AND THEIR EQUALITY. ENTROPY GENERATION, ENTROPY BALANCE EQUATION FOR CLOSED AND OPEN SYSTEMS.

- FIRST LAW AND SECOND LAWS EQUATIONS, MAXWELL'S RELATION, CARNOT CYCLE. DEFINITION AND PROPERTIES OF FLUIDS, CLASSIFICATION OF FLUIDS, NORMAL AND SHEAR STRESSES IN FLUIDS.

- KINEMATICS OF FLUID FLOW; TYPES OF FLOW, FLOW PATTERN, VELOCITY AND ROTATION, ACCELERATION OF FLUID PARTICLE, VELOCITY POTENTIAL FUNCTION, DIFFERENTIAL EQUATION OF CONSERVATION OF MASS.

- DYNAMICS OF IDEAL FLUIDS FLOW; EULER'S EQUATION OF MOTION, BERNOULLI'S EQUATION AND ITS APPLICATION, FLOW MEASURING DEVICE, VENTURE-METER, ORIFICE-METER AND NOZZLE METER, PILOT-STATIC TUBE, HYDRAULIC CO-EFFICIENT, FLOW THROUGH PIPES, MAJOR AND MINOR LOSSES IN PIPE FLOW.

**BASICS OF ELECTRICAL ENGINEERING**

- FUNDAMENTALS OF ELECTRIC CIRCUITS, KIRCHHOFF'S LAWS, MESH ANALYSIS, NODE ANALYSIS, DELTA-STAR AND STARDELTA CONVERSION, CLASSIFICATION OF NETWORK ELEMENTS, THEVENIN'S THEOREM, NORTAN'S THEOREM MAXIMUM POWER TRANSFER THEOREM, SUPERPOSITION THEOREM.

- SINGLE PHASE AC CIRCUITS, AVERAGE AND EFFECTIVE VALUES OF SINUSOIDS, SOLUTION OF R,L,C SERIES CIRCUITS, THE J OPERATOR, COMPLEX REPRESENTATION OF IMPEDANCES, PHASOR DIAGRAM, CONCEPT OF POWER FACTOR, POWER FACTOR IMPROVEMENT, POWER IN COMPLEX NOTATION, SOLUTION OF PARALLEL AND SERIES-PARALLEL CIRCUITS, RESONANCE. INTRODUCTION TO BALANCE THREE PHASE AC CIRCUITS.
- AMPERE'S CIRCUITAL LAW, B-H CURVE, SOLUTION OF MAGNETIC CIRCUITS, HYSTERESIS AND EDDY CURRENT LOSSES. RELAYS AS AN APPLICATION OF MAGNETIC FORCE. TRANSFORMERS- CONSTRUCTION, E.M.F. EQUATION, RATINGS, PHASOR DIAGRAM FOR NO LOAD AND FULL LOAD, EQUIVALENT CIRCUIT, REGULATION AND EFFICIENCY CALCULATIONS, OPEN CIRCUIT AND SHORT CIRCUIT TESTS, INTRODUCTION TO AUTO-TRANSFORMER.

- INTRODUCTION TO ELECTROMECHANICAL ENERGY CONVERSION, DC MOTORS- CONSTRUCTION, E.M.F. AND TORQUE EQUATIONS, CHARACTERISTICS OF DC GENERATORS AND MOTORS, SPEED CONTROL OF DC MOTORS. DC MOTOR STARTER- WORKING PRINCIPLE, RATINGS.

INTRODUCTION TO THREE PHASE INDUCTION MOTOR, INTRODUCTION TO ALTERNATOR AND SYNCHRONOUS MOTOR AND THEIR APPLICATIONS.

- PMMC INSTRUMENTS, SHUNTS AND MULTIPLIERS, MULTI-METERS, MOVING IRON AMMETERS AND VOLTMETERS, DYNAMOMETER WATTMETER, AC WATT-HOUR METERS, EXTENSION OF INSTRUMENT RANGES.

**ENGINEERING CHEMISTRY& ENVIRONMENTAL SCIENCE**

- **WATER TREATMENT**
- **ENERGY RESOURCES**
- **CORROSION AND ITS PROTECTION**
- **ENVIRONMENTAL CHEMISTRY**
- **ENVIRONMENTAL BIOTECHNOLOGY**

**BASICS OF ELECTRONICS &COMMUNICATION ENGINEERING**

- **SEMICONDUCTOR DIODES**
- **TRANSISTORS (BJT&JFET)**
- **OPERATIONAL AMPLIFIER**
- **FEEDBACK AND ELECTRONIC INSTRUMENTS**
- **COMMUNICATION SYSTEMS**

**FUNDAMENTAL OF COMPUTING**

- **BASICS OF COMPUTERS**
- **OPERATING SYSTEM**
- **NETWORKING & DBMS**

**ENGINEERING GRAPHICS**

- **ORTHOGRAPHIC PROJECTION**
- **ISOMETRIC PROJECTION**
- **SECTIONING**
- **BUILDING DRAWINGS**

**SOLIDS MECHANICS**

- **THIN CYLINDRICAL SHELLS**
- **SHEAR FORCE AND BENDING MOMENT**
- **BENDING IN BEAMS**
- **DEFLECTION OF BEAMS**
- **COLUMNS AND STRUTS**

**FLUID MECHANICS**

- **INTRODUCTION** DIFFRENT TREAL AND IDEAL FLUIDS, CONCEPT OF CONTINUUM APPROXIMATION, PROPERTIES OF FLUIDS, EQUATION OF STATE, COEFFICIENT OF COMPRESSIBILITY, BULK MODULUS OF ELASTICITY, NEWTONIAN AND NON- NEWTONIAN FLUID, SURFACE TENSION, CAPILLARITY, CONCEPT OF VISCOSITY, EFFECT OF TEMPERATURE ON VISCOSITY.
- **FLUID STATIC**
- **FLUID KINEMATICS**
- **FLUID ROTATION**
- **FLUID DYNAMICS**

## CIVIL ENGINEERING MATERIALS

- **CEMENT**
- **AGGREGATES**
- **SPECIAL CONCRETES**
- **BRICKS & STONES**
- **OTHER MATERIALS**

## SURVEYING

- CONCEPT OF PLANE AND GEODETIC SURVEYING, CLASSIFICATION OF SURVEYING, BASIC PRINCIPLES, MEASUREMENT OF HORIZONTAL DISTANCE BY CONVENTIONAL METHODS, SOURCES OF ERRORS; CONCEPT AND PRINCIPLE OF LEVELING, INSTRUMENTS FOR LEVELING, TYPES OF SPIRIT LEVELING, METHODS OF BOOKING AND REDUCTION OF LEVELS, ERRORS IN LEVELING.

- CONCEPT OF TRAVERSING, TYPES OF MERIDIANS AND BEARINGS; MEASUREMENT OF HORIZONTAL AND VERTICAL ANGLES, TRAVERSE MEASUREMENT AND COMPUTATION, OMITTED MEASUREMENTS.

- FUNDAMENTALS OF PLANE TABLE SURVEYING, INSTRUMENTS EMPLOYED, WORKING OPERATION, METHODS, ERRORS; INTRODUCTION AND IMPORTANCE OF TACHEOMETRY, STADIA AND TANGENTIAL METHODS; IMPORTANCE OF TOPOGRAPHICAL SURVEY, CONCEPT AND CHARACTERISTICS OF CONTOURS, METHODS AND USES OF CONTOURS.

- COMPUTATION OF AREA BY DIFFERENT METHODS, ESTIMATION OF VOLUME OF EARTHWORK; SETTING OUT OF BUILDING AND TUNNEL; RECONNAISSANCE, PRELIMINARY AND DETAILED SURVEY FOR CANALS, HIGHWAYS, RAILWAYS, SEWER LINES.

- ELEMENTS AND GEOMETRY OF HORIZONTAL CURVE, SETTING OUT OF SIMPLE CURVE BY LINEAR AND ANGULAR METHODS, COMPOUND, REVERSE AND TRANSITION CURVES; BASICS OF VERTICAL CURVES, SETTING OUT OF VERTICAL CURVE.

## ENGINEERING GEOLOGY

- STUDY OF THE INTERNAL STRUCTURES SUCH AS CRUST, MANTLE AND CORE OF THE EARTH. MINERAL MATTER AND PHYSICAL PROPERTIES OF THE ROCK FORMING MINERALS LIKE METALLIC AND NONMETALLIC MINERALS. SIGNIFICANCE OF MINERALS IN CIVIL ENGINEERING PRACTICES.
- STUDY OF ROCKS, MODE OF FORMATION AND CLASSIFICATION OF IGNEOUS ROCKS. PHYSICAL AND ENGINEERING PROPERTIES OF IGNEOUS ROCKS. RELEVANCE OF IGNEOUS ROCKS IN CIVIL ENGINEERING

PRACTICES. MODE OF FORMATION AND CLASSIFICATION OF SEDIMENTARY ROCKS. PHYSICAL AND ENGINEERING PROPERTIES OF SEDIMENTARY ROCKS. RELEVANCE OF SEDIMENTARY ROCKS IN CIVIL ENGINEERING PRACTICES. MODE OF FORMATION AND CLASSIFICATION OF METAMORPHIC ROCKS. PHYSICAL AND ENGINEERING PROPERTIES OF METAMORPHIC ROCKS. RELEVANCE OF METAMORPHIC ROCKS IN CIVIL ENGINEERING PRACTICES.

- STUDY OF TECTONIC ACTIVITY OF THE EARTH. EXPLANATION OF FOLD, FAULT, JOINT AND UNCONFORMITIES. TYPES OF FOLD, FAULT, JOINT AND UNCONFORMITIES. RELEVANCE OF FOLD, FAULT, JOINT AND UNCONFORMITIES IN CIVIL ENGINEERING PRACTICES.
- WEATHERING AND EROSION. NATURAL AGENCIES OF WEATHERING AND EROSION. TYPES OF WEATHERING. FORMATIONS OF VARIOUS TYPES OF LANDFORMS. GLACIAL LAND FORMS, WIND LANDFORMS AND FLUVIAL LANDFORMS. SIGNIFICANCE OF VARIOUS LANDFORMS IN CIVIL ENGINEERING PRACTICES. FORMATIONS OF VARIOUS TYPES OF SOILS.
- SITE INVESTIGATION TECHNIQUES. GEOLOGICAL INVESTIGATION FOR DAM SITE AND RESERVOIR, BRIDGES, TUNNELS AND BUILDING. LANDSLIDE AND LAND SUBSIDENCE. STUDY OF EARTHQUAKE, CLASSIFICATION OF EARTHQUAKE, EARTHQUAKE ZONING IN INDIA. ROCKS AS ENGINEERING MATERIAL. HYDROLOGIC CYCLE AND STUDY OF GROUND WATER.

**ENGINEERING MATHS**

- **VECTOR CALCULUS & HIGHER CALCULUS**
- **PROBABILITY & STATISTICS**
- **DIFFERENCE EQUATION & LINEAR PROGRAMMING**

**STRUCTURAL ANALYSIS**

- **FORMS OF STRUCTURES**
- **DEFLECTION OF BEAMS**
- **ENERGY METHODS**
- **DEFLECTION OF PIN JOINTED PLANE TRUSSES**
- **UNSYMMETRICAL BENDING**
- **INDETERMINATE STRUCTURES**
- **COLUMN ANALOGY METHOD**
- **STIFFNESS/ DISPLACEMENT METHOD**
- **ILD AND ITS APPLICATION**
- **MOMENT DISTRIBUTION METHOD**
- **PLASTIC ANALYSIS**
- **STRUCTURAL DYNAMICS**

**HYDRAULICS**

- DIMENSIONAL AND MODEL ANALYSIS: DIMENSIONAL ANALYSIS AND ITS UTILITY; BUCKINGHAM'S PI-THEOREM AND RALEIGH'S METHOD AND THEIR APPLICATION TO FLUID FLOW PROBLEMS; DIMENSIONLESS PARAMETER IN FLUID FLOW AND THEIR RELEVANCE; SIMILARITIES: APPLICATION OF DYNAMIC SIMILARITY TO MODEL INVESTIGATIONS, SCALE RATIO FOR DISTORTED MODEL.

- LAMINAR FLOW
- TURBULENT FLOW
- PIPE FLOW
- TURBINE
- PUMPS

**BUILDING CONSTRUCTION**

- FOUNDATION
- MASONRY
- FLOORS AND ROOFS
- SLOPED ROOFS
- STAIRS AND ESCALATORS
- DOORS AND WINDOWS
- LINTELS AND ARCHES
- BUILDING FINISHES
- DAMP PROOFING AND WATER PROOFING

**ESTIMATING AND COSTING**

- INTRODUCTION
- BUILDING ESTIMATES
- ANALYSIS OF RATES
- ESTIMATE OF MULTISTORY BUILDING

**DESIGN OF STRUCTURE**

- CHARACTERISTIC STRENGTH, STRESS-STRAIN RELATIONSHIP FOR CONCRETE AND STEEL, IS SPECIFICATIONS (IS 456, 875 & 1893), CHARACTERISTIC IMPOSED LOADS, DL, EL & WL. DESIGN PHILOSOPHIES – WORKING STRESS METHOD AND LIMIT STATE METHOD. STRENGTH AND SERVICEABILITY REQUIREMENTS, ANALYSIS AND DESIGN FOR FLEXURE OF SINGLY / DOUBLY RECTANGULAR AND FLANGED BEAM SECTIONS – BY WORKING STRESS METHOD.
- ANALYSIS AND DESIGN FOR FLEXURE OF SINGLY / DOUBLY RECTANGULAR AND FLANGED BEAM SECTIONS – BY LIMIT STATE METHOD. SERVICEABILITY LIMIT STATES FOR DEFLECTION AND CRACKING, REQUIREMENTS FOR CURTAILMENTS AND DETAILING OF REINFORCEMENT, MINIMUM / MAXIMUM TENSION AND COMPRESSION REINFORCEMENT, MINIMUM& MAXIMUM SPACING OF BARS; INTRODUCTION AND USE OF DESIGN AID (SP-16), CALCULATION OF DEFLECTION.
- BOND STRESS: FLEXURAL & ANCHORAGE BOND STRESS, DESIGN BOND STRESS, DEVELOPMENT LENGTH, ANCHORAGE LENGTH; BEHAVIOUR OF BEAMS IN SHEAR, DESIGN FOR SHEAR & TORSION AS PER LIMIT STATE METHOD; REINFORCEMENT DETAILING.
- COMPLETE DESIGN OF A CANTILEVER AND SIMPLY SUPPORTED BEAM WITH AND WITHOUT OVERHANG; DESIGN OF CONTINUOUS BEAMS WITH RECTANGULAR, T & L SECTIONS; INTRODUCTION TO SLABS: RECTANGULAR SLAB, ONE WAY SIMPLY SUPPORTED & CONTINUOUS SLAB AND THEIR DESIGN; COMPARISON OF MANUAL DESIGN WITH THE SOFTWARE AVAILABLE.

- DESIGN OF CONNECTIONS
- DESIGN OF TENSION MEMBERS
- DESIGN OF COMPRESSION MEMBERS
- DESIGN OF BEAMS
- DESIGN OF SLABS AND STAIRS
- DESIGN OF COLUMNS
- PLATE GIRDER
- ROOF TRUSSES

SOIL MECHANICS

- CLASSIFICATION AND PROPERTIES
- FLOW THROUGH SOILS
- STRESSES IN SOIL
- COMPACTION AND CONSOLIDATION
- SHEAR STRENGTH AND LATERAL EARTH PRESSURE

ENVIRONMENTAL ENGINEERING

- WATER DEMAND
- INTAKES
- WATER QUALITY
- AERATION
- COAGULATION
- WATER SOFTENING
- WASTEWATER ENGINEERING
- WASTEWATER CHARACTERISTICS
- CLASSIFICATION OF TREATMENT PROCESS
- SECONDARY/ BIOLOGICAL TREATMENT OF SEWAGE
- AIR POLLUTION
- INTRODUCTION TO AIR POLLUTION CONTROL DEVICES
- SOLID WASTES
- NOISE POLLUTION

TRANSPORTATION ENGINEERING

- INTRODUCTION
- HIGHWAY GEOMETRIC DESIGN
- TRAFFIC ENGINEERING
- HIGHWAY MATERIALS

IRRIGATION ENGINEERING

- IRRIGATION IN INDIA
- DESIGN OF ALLUVIUM CHANNELS, SILT THEORIES
- WEIRS AND BARRAGES
- WATER LOGGING
- CANAL LINING

FOUNDATION ENGINEERING

- EARTH RETAINING STRUCTURES-1
- EARTH RETAINING STRUCTURES-2
- SHALLOW FOUNDATIONS
- DEEP FOUNDATIONS
- SOIL DYNAMICS & MACHINE FOUNDATIONS

## EARTHQUAKE RESISTANT DESIGN

- STRONG MOTIONS AND DYNAMICS OF STRUCTURE:STRONG MOTIONS, INTRODUCTION, TERMINOLOGY OF STRONG MOTION, NATURE OF GROUND MOTION: SOURCE EFFECT, PATH EFFECT, SITE EFFECT. AMPLITUDE, PEAK GROUND ACCELERATION, VERTICAL ACCELERATION, SEISMOMETER AND OTHER SEISMIC INSTRUMENTS.
- DYNAMICS OF STRUCTURE, MODELLING OF STRUCTURE, LUMPED MASS APPROACH, EQUATION OF MOTION, MATHEMATICAL AND STRUCTURAL MODELLING, SYSTEM OF MULTIPLE DEGREES OF FREEDOM, RESPONSES SPECTRUM.
- EFFECTS AND BEHAVIOR OF STRUCTURES UNDER EARTHQUAKE: INTRODUCTION, NATURAL TIME PERIOD OF SITE AND STRUCTURE, LIQUEFACTION OF SOIL, RESTORING FORCE, DAMPING, EFFECTS OF STRUCTURAL IRREGULARITIES (VERTICAL, PLAN AND MASS). SEISMORESISTANT BUILDING ARCHITECTURE, BUILDING CHARACTERISTICS. INTRODUCTION OF IS 1893:2002, DESIGN PHILOSOPHY, USE OF IS 1893:2002 AND DETERMINATION OF DESIGN LATERAL FORCES: EQUIVALENT STATIC LATERAL FORCE METHOD.
- DETERMINATION OF LATERAL FORCES: USE OF IS 1893:2002, DETERMINATION OF DESIGN LATERAL FORCES: RESPONSE SPECTRUM METHOD, TIME HISTORY METHOD.(EIGEN VALUES AND EIGEN VECTORS, MODAL PARTICIPATION FACTORS, MODAL MASS, USE OF ABS, SRSS, CQC METHODS)
- DUCTILE DETAILING OF RCC STRUCTURES, EARTHQUAKE RESISTANT DESIGN OF MASONRY BUILDINGS AND RETROFITTING: DUCTILITY CONSIDERATIONS: INTRODUCTION, ASSESSMENT OF DUCTILITY, FACTORS AFFECTING DUCTILITY, DUCTILITY FACTORS, DUCTILE DETAILING AS PER USE OF IS 13920: 1993, LOAD TRANSFER MECHANISM OF JOINTS
- EARTHQUAKE RESISTANT DESIGN OF MASONRY BUILDINGS AND RETROFITTING: BEHAVIOR OF MASONRY BUILDING UNDER EARTHQUAKE, LATERAL LOAD ANALYSIS OF MASONRY BUILDINGS. DESIGN OF BRICK MASONRY WALL UNDER VERTICAL AND LATERALS LOADS, CONCEPTS OF REPAIR, RESTORATION AND STRENGTHENING OF EXISTING BUILDINGS, METHODS OF RETROFITTING

## GROUND WATER ENGINEERING

- HYDROLOGIC CYCLE , CONCEPT OF GROUNDWATER IN HYDROLOGIC CYCLE, SUB SURFACE STRATA ANALYSIS AS AQUICLUDE, AQUITORD , AQUIFUGE AND AQUIFERS EXPLANATION OF UNCONFINED, SEMI – CONFINED AND CONFINED AQUIFERS, PERCHED AQUIFERS. GEOPHYSICAL METHODS FOR GROUNDWATER EXPLORATION , RESISTIVITY SYSTEM, APPLICATION OF SCHLUMBERGER AND WENNER'S CONFIGURATIONS.

- GROUNDWATER BALANCE STUDY. CONCEPT OF GROSS RECHARGE, RECOVERABLE RECHARGE , DRAFT AND STATUS OF GROUNDWATER ANALYSIS USING NABARD'S NORMS AND LOCAL NORMS . NUMERICAL PROBLEMS ON GROUNDWATER BALANCE EQUATION AND STATUS OF GROUNDWATER STAGE OF DEVELOPMENT. ANALYSIS OF CATEGORIES OF GROUNDWATER AS WHITE CATEGORY,GREY AND BLACK CATEGORY.

- PRINCIPLE AND DEFINITION OF RAINWATER HARVESTING. CLASSIFICATION AND DETERMINATION OF RAINWATER HARVESTING. NUMERICAL PROBLEMS ON RAINWATER HARVESTING. FEASIBILITY AND DESIGN OF RAINWATER HARVESTING. CASE STUDY ON RAINWATER HARVESTING.

- INTRODUCTION OF DRILLING TECHNIQUES. DRILLING IN ALLUVIUM AND SOFT ROCK AREA, REVERSE ROTARY DRILLING AND DIRECT ROTARY DRILLING METHODS,CALAYX METHOD, DRIILING IN HARD ROCK AREA, DTH METHOD AND WOODEX METHOD, PERCUSSION DRILLING. GEOPHYSICAL LOGGING AND TUBE WELL DESIGN.

**CONSTRUCTION PROJECT MANAGEMENT**

- BASIC CONCEPTS OF PROJECT MANAGEMENT, PROJECT ORGANIZATION, CLIENT'S ESTIMATION OF PROJECT COST, CONSTRUCTION CONTRACT.
- CONSTRUCTION PLANNING: LADDER NETWORK, PRECEDENCE NETWORK, THE LINE OF BALANCE, NETWORK TECHNIQUE ADVANTAGES, PROJECT SCHEDULING AND RESOURCE LEVELLING, NETWORK CRASHING AND COST-TIME TRADE-OFF. COMPUTER APPLICATIONS IN SCHEDULING AND RESOURCE LEVELLING.
- CONTRACTOR'S ESTIMATION OF COST AND BIDDING STRATEGY, CONSTRUCTION EQUIPMENT MANAGEMENT, CONSTRUCTION MATERIAL MANAGEMENT.
- PROJECT COST AND VALUE MANAGEMENT, RISK IN CONSTRUCTION, PROJECT MONITORING AND CONTROL SYSTEM. COMPUTER APPLICATIONS IN MONITORING AND REPORTING, CONSTRUCTION QUALITY MANAGEMENT, CONSTRUCTION SAFETY MANAGEMENT.