

APPENDIX

Standard and Syllabus

The standard of paper in General Ability Test will be such as may be expected of an Engineering/Science Graduate. The standard of papers in other subjects will approximately be that of an Engineering Degree Examination of an Indian University. There will be no practical examination in any of the subjects.

GENERAL ABILITY TEST

Part A : General English and Essay : The question paper in General English will be designed to test the candidates' understanding of English and Workmanlike use of words.

Part B : General Studies : The paper in General Studies will include knowledge of current events and of such matters as of everyday observation and experience in their scientific aspects as may be expected of an educated person. The paper will also include questions on History of India and Geography of a nature which candidates should be able to answer without special study.

MECHANICAL ENGINEERING

(For both objective and conventional type papers)

Paper I

1. **Thermodynamics :** Laws, properties of ideal gases and vapours, Power cycles. Gas Power cycles, Gas Turbine cycles, Fuels and Combustion.

2. **I.C. Engines :** C.I. and S.I Engines Detonation, Fuel injection and Carburation. Performance and Testing. Turbo Jet and Turbo-prop, Engines, Rocket Engines Elementary Knowledge of Nuclear Power Plants and Nuclear Fuels.

3. **Steam Boilers, Engines, Nozzles and Steam Turbines** Modern boilers. Steam Turbines types, Flow of Steam through nozzles. Velocity diagrams for impulse and Reaction Turbines. Efficiencies and Governing.

4. **Compressors Gas, Dynamics and Gas Turbines, Reciprocating, Centrifugal and axial flow compressors, Velocity diagrams, Efficiency and performance. Effect of Mach number of flow, Isentropic flow, Normal Shock and Flow through nozzles. Gas Turbine cycle with multistage compression, Reheating and Regeneration.**

5. **Heat Transfer, Refrigeration and Air-Conditioning** Conduction, convection and Radiation. Heat exchangers, types combined Heat Transfer. Overall Heat Transfer coefficient Refrigeration and heat pump cycles, Refrigeration system Coefficient of performance, Psychrometrics and psychrometric chart. Comfort indices. Cooling and dehumidification methods. Industrial Air-conditioning Processes. Cooling and heating loads calculations.

6. **Properties and classifications of fluids. Fluid statics, kinematics and dynamics ; principles and applications. Menometry and Buoyancy. Flow of ideal fluids. Laminar and turbulent flows. Boundary layer theory. Flow over immersed bodies. Flow through pipes and Open Channels. Dimensional analysis and similitude technique. Non-dimensional specific speed and classification of fluid machines in general. Energy transfer relation performance and operation of pumps and of impulse and reaction water turbines. Hydraulic power transmission.**

Paper II

7. **Theory of Machines** : Velocity and acceleration (i) of moving bodies, (ii) in machines. Klein's construction Inertia forces in machines. Cams, Gears and Gearing. Fly wheels and Governors. Balancing of Rotating and Reciprocating masses. Force and forced vibrations of systems. Critical speeds and whirling of shafts.

8. **Machine Design** : Design of : Joints—Threaded fasteners and Power Screws—Keys, Knotters, Coupling—Welded Joints—Transmission system : Belt and Chain drives—Wire ropes—Shafts. Gears—Siding and Rolling bearings.

9. **Strength of Materials** : Stress and strain in two dimensions ; Mohr's circles relations between Elastic Constants. Beams : Bending moments, shearing forces and reflection. Shafts : Combined bending, direct and torsional stresses. Thick Walled cylinders and spheres under Pressure, Spring, Struts and columns, Theories of failure.

10. **Engineering Materials** : Alloys and Alloying Materials, heat treatment; composition ; properties and uses. Plastics and other newer engineering materials.

11. **Production Engineering** : Metal Machining : Cutting Tools, Tool Materials water and Machinability, measurement of cutting forces, process : Machining—Grinding, Boring, Gear Manufacturing, Metal forming, Metal casting and joining, Basic, Special Purpose, Programme and numerically-Controlled Machine Tools, Jigs and fixtures (locating elements)

12. **Industrial Engineering** : Works study and work measurement Wage incentive, Design of production System and Product Cost, Principles of Plant layout, Production Planning and Control, Material handling, Operations Research, Linear Programming Queuing Theory, Value Engineering Network Analysis, CPM and PERT. Use of Computers.

ELECTRICAL ENGINEERING

(For both objective and conventional type papers)

PAPER—I**1. Electrical Circuits**

Network theorems, Response of Network to step, ramp, impulse and sinusoidal inputs, Frequency domain analysis. Two port networks elements of network synthesis. Signal-flow graphs.

2. EM Theory

Electrostatics Magnetostatics using vector methods Fields in dielectrics in conductors and in magnetic materials. Time varying fields, Maxwell's equations Planewave Propagation in conducting and Dielectric media) properties of Transmission lines.

3. Material Science : (Electric Materials)

Band Theory, Behaviour of dielectrics in static and alternating fields. Piezoelectricity. Conductivity of Metals. Super conductivity. Magnetic properties of materials. Ferro and ferri-magnetism. Conduction in Semiconductors, Hall effect.

4. Electrical Measurements :

Principles of Measurement. Bridge measurement of Circuit parameters. Measuring Instruments. VTVM and CRO, Q-Meter, Spectrum analyser. Transducers and measurement of non-electrical quantities, digital measurement, telemetering data recording and display.

Paper—II**5. Elements of Computation :**

Digital system algorithms, flow-charting. Storage : type statements, array storage Arithmetic expression logical expressions, Assignments statements, Programme structure Scientific and Engineering applications, should be included in Electronics/Telecommunication as well.

6. Power Apparatus and Systems :

Electromechanics : Principles of electro mechanical energy conversion. Analysis of D.C., synchronous and Induction Machines. Fractional horse-power motors. Machines in Control Systems. Transformers, Magnetic Circuits and Selection of motors for drives. Power System Power generation : Thermal Hydro, and Nuclear Power Transmission, Corona Bundle conductors, Power Systems Protection. Economic operation. Load frequency control, stability analysis.

7. Control Systems

Open-loop and closed-loop systems. Response analysis Rootlocus technique, stability, compensation and design technique. State variable approach.

8. Electronic and Communications

Electronics : Solid state devices and circuits. Small signal amplifire design, feedback amplifires Oscillators and operational amplifires, FET circuit and linear ICs Switching circuit Boolean Algebra. Logic circuits. Combinational and sequential digital circuit. **Communications :** Signal analysis Transmission of signals. Modulation and Detection. Various types of communication systems. Performance of communication system.

ELECTRONICS/TELECOMMUNICATION
(For both objective and conventional type papers)

PAPER—I

1. Materials Components and Devices : Structure and properties of electrical engineering materials. Passive components types and properties. ACTIVE components- types and properties solid State Devices- Physics, Characteristics and models.

2. Network Theory

Network Theorems. Steady State and transient response of electric circuits. Network analysis Elementary network synthesis.

3. Electromagnetic Theory

Field theory. Transmission line theory, Antena Theory. Propagation of electromagnetic waves in bounded and unbounded media.

4. Measurements and Instrumentation

Measurement of basis, electrical quantities. Measuring instruments and their principles of working. Transducers. Measurement of non-electrical quantities.

5. Elements of Computation

Digital system algorithms, flow-charting. Storage : Type statement, array storage Arithmetic expression logical expressions, Assignments statements, Programme structure Scientific and Engineering applications.

PAPER—II**1. Linear and Non-linear Analog Circuits.**

Basic Linear electronics circuits, Pulse shaping circuits. Wave from Generators, Stabilizers.

2. Digital Circuits

Logic circuits and Gates. Computing Circuits Combinational and sequential circuits.

3. Control Systems

Feedback theory, Control system components. Response of Control Systems. Design of Practical System.

4. Communication System

Basic Information Theory. Modulation and Detection processes. Various types of communication systems. Radio and Line communications. Television and Radar Navigational aids Satellite Communication principles.

5. Microwave Engineering

Microwave Sources, Microwave Components and networks. Measurement at Microwave frequencies Microwave communication Systems.

COMPUTER ENGINEERING

(For both objective and conventional type papers)

PAPER—I**1. Electronics :**

Solid State device-Physics, characteristic and model logic families-DTL, RTL, TTL, CMOS, nMOS, logic design—Binary arithmetic, Number system, Codes Boolean algebra circuit minimisation, combinational circuits, synchronous, sequential circuits, Asynchronous sequential circuits, flip flops, counters and shift registers.

2. Computer Programming and Data structures :

Programming in FORTRAN, PASCAL and C, Syntax and semantics, variables, control flow, arithmetic and Boolean expression, structural programming, Sub-programming, Algorithms, Array, stack, queue, linked lists, tree, binary tree, B-tree, tree traversal, internal sorting techniques. .

3. Microprocessor :

Organisation and programming of 8 bit microprocessors, microprocessor support chips, (PPI, PIC, DMA controller etc.) interfacing memory and I/O devices, microprocessor development tools, microprocessor based system design Introduction to 16 and 32 bit microprocessors.

4. System Software :

Microprocessor and assemblers, linker, loader, monitor, editor, relocation, re-entrant routine, co-routine

PAPER—II**1. Computer Architecture :**

Micro instructions, memory organisation, cache memory, virtual memory, stack array processor, pipeline processor, interconnection scheme for parallel processing, data flow machines.

2. Operating System :

Function and Component of OS. . Batch processing, time sharing Device driver, File system, process scheduling, concurrent processes, memory management, swapping segmentation and paging, virtual memory, disk scheduling, deadlock, case study of DOS and UNIX.

3. Compiler Design Programming languages :

Lexical analysis, grammer, syntax analysis, topdown and bottom up parsing, semantic analysis, symbol table, error detection and recovery, code generation and optimisation. Data abstraction, Design philosophy of pascal, functional languages.

4. Data Processing :

File organisation techniques, performance of sequential, indexed sequential, indexed, hashed inverted and multiring files, DBMS, relational data model, integrity constraints, relational algebra, relational calculus, normalisation, concurrency control.

5. Computer Graphics :

Graphics I/O devices, Display adapters, CGA, EGA, VGA, 2D line and curve drawing, 2D transformation, windowing, curves of 3D surfaces, 3D modelling and transformation, 3D viewing, Hidden line and surface removal, shading, device independant graphics system.

SCHEDULE-II

PART 'A'

SYLLABUS FOR WRITTEN EXAMINATION FOR RECRUITMENT TO THE POST OF ASSISTANT ENGINEER (CIVIL) IN ARUNACHAL PRADESH PUBLIC WORKS DEPARTMENT, GOVERNMENT OF ARUNACHAL PRADESH.

1.	Compulsory Paper	(i) General English	Maximum marks = 100
		(ii) General Knowledge	Maximum marks = 100
2.	Technical Paper	Civil Engineering	Maximum marks = 200
3.	Interview/Personality test		Maximum marks = 50

SYLLABUS

GENERAL ENGLISH:

Syllabus:-

The questions will be designed to test their standard of English Grammar and Comprehension of language. The paper in English will consist of Comprehensive questions (Conventional essay type) including Objective type question carrying 1 to 15 marks of matriculation standard.

GENERAL KNOWLEDGE:

Syllabus:-

The General Knowledge will include current event and of such matters of every day observations and experiences in the area of scientific aspect as may be expected from a educated person who has not made an special study of any scientific subject. The paper will also include question of History of India and Geography of Nature which candidates should be able to answer without any special study. Certain questions will be based on analytical ability. The papers in General Knowledge will consist of Objective type questions only.

CIVIL ENGINEERING (SECTION-A)

1. Building materials and properties and strength of materials.
2. Building materials – Timers, stone, brick, lime tile, sand, surkhi, mortar and concrete, metal and glasses structural properties of metals and alloys used in engineering practice.

Stress and strains-Hook's Law-bending. Torsion and direct stresses. Elastic theory of bending of beams maximum and minimum stress due to eccentric leading. Bending moment and shear force diagram and defection of beams under static and live loads.

3. **Building construction and water supply and sanitary engineering.**

Construction- Brick and stone masonry walls, floors and roofs, staircases, carpentry in wooden floors, roofs ceiling, door and windows, finishes (plastering pointing painting and varnishing etc.)

Soil mechanics – Soils and their investigations,, Bearing capacities and foundation of buildings and structures-principles of design.

Building estimates - Principle units of measurement taking out quantities for building and preparation of abstract of costs-specifications and data sheets for important items.

4. **Structural Engineering:**

Steel structures: Permissible stress, Design of beams simple and built-up columns and simple roof trusses and girders column bases and grillages for axially and eccentrically loaded columns - Belted, reverted and welded connections.

RCC structures: Specification of materials used proportioning workability and strength requirement ISI standards for design loads permissible stresses in RCC members subject to direct and bending stressed-design of simple supported overhanging and cantilever beams, rectangular and Tee beams in floors, roofs and lintels-axially loaded columns, their bases.

CIVIL ENGINEERING SECTION-B

1. **Water supply:** Sources of water, standards of purity, methods of unification, layout of distribution system, pumps and booster.

2. **Sanitation:** Sewers, storm water over flows, house drainage requirements appurtenances, septic tanks, amboff tanks, sewage treatment and dispersion trenches - Activated sludge process.

3. **Road and Bridges:**

Survey and alignment - Highway materials and their placements principles of design-width of foundation and payment, camber, gradient curves and super-elavation-retaining walls.

Contruction: Earth roads, stabilized and water bound macadam roads, bituminous surfaces and concrete roads, draining of roads.

Bridges: Types, economical spans, IRC loading designing superstructure of small span bridges-principles of designing foundation of abutments and piers of bridges, pile and well foundations.

Estimating earthwork for roads and canals:

This paper will consist of conventional questions and will be of a standard expected from a Bachelor of Engineering.

GENERAL INSTRUCTION:

1. All question papers must be answered in English, candidates may be permitted to use battery-operated calculators for the optional subject only.

2. Commission has discretion to fix qualifying marks in any or all the subject of the examination.

SYLLABUS FOR WRITTEN EXAMINATION OF AGRICULTURAL ENGINEERING:

1. Compulsory Paper	(i) General English	Maximum marks = 100
	(ii) General Knowledge	Maximum marks = 100
2. Technical Paper	Agricultural Engg.	Maximum marks = 200
3. Interview/Personality test		Maximum marks = 50

SYLLABUS

GENERAL ENGLISH:

Syllabus:-

The questions will be designed to test their standard of English Grammar and Comprehension of language. The paper in English will consist of Comprehensive questions (Conventional essay type) including Objective type question carrying 1 to 15 marks of matriculation standard.

GENERAL KNOWLEDGE:

Syllabus:-

The General Knowledge will include current event and of such matters of every day observations and experiences in the area of scientific aspect as may be expected from a educated person who has not made an special study of any scientific subject. The paper will also include question of History of India and Geography of Nature which candidates should be able to answer without any special study. Certain questions will be based on analytical ability. The papers in General Knowledge will consist of Objective type questions only.

AGRICULTURAL ENGINEERING (SECTION-A)

1. **Soil and water conservation:** Definition and scope of soil conservation; Mechanics and types of erosion, their causes Hydrologic cycle rainfall and run off-factors affecting them and their measurements; stream gauging-evaluation of run off from rainfall; Erosion control measure-biological and engineering.

Basic open channel hydraulic: Design of soil conservation structure-terraces, bunds, outlets and grassed waterways. Principles of flood control. Flood routing. Design of farm ponds and earth dams. Stream bank erosion and its control. Wind erosion and its control. Principles of watershed management. Investigation and planning in river valley projects.

2. **Irrigation and drainage:** Soil water-plant relationship, sources and types of irrigation. Planning and design of minor irrigation projects. Techniques of measuring soil moistures.

Duty of water-consumptive use. Water requirements of crops. Measurement and cost of irrigation water. Measuring devices. Flow through orifices, Weirs and flumes. Levelling and layout of irrigation systems. Design and construction of channels, Field channel, Pipelines, Head gates, Diversion boxes structures and road crossing, Occurrence of ground water, Hydraulics of wells, Types of wells, their construction, Drilling methods, Well development, Testing of wells.

Drainage: Definition causes of water logging. Methods of drainage. Drainage of irrigate lands. Design of surface and sub-surface systems.

3. **Building materials:** Kinds of building materials their properties- Timber, Brickworks and RC construction, Design of columns, Beams, roof trusses, Joints. Layout of a farm-stread. Design of farm houses, Animals shelters and storage structures. Rural water supply and sanitation.

AGRICULTURAL ENGINEERING (SECTION-B)

4. **Farm power and machinery:** Construction of different types of internal combustion engines. Ignition, fuel lubrication, cooling and governing systems of IC engines. Different types of tractors. Chassis transmission and steering. Farm machinery for primary and secondary tillage, seeding machinery for primary and secondary tillage, seeding machinery interculture tools and machinery. Plant protection equipment. Harvesting and threshing equipment. Machinery for land development. Pumps and pumping machinery.

5. **Electricity and Rural Electrification:** Power generation and transmission; Distribution of electricity for rural electrification.; A.C and D.C. circuits.

Uses of electric energy on the farm, Electric motors used in agriculture-types, selection, installation and maintenance.

GENERAL INSTRUCTION:

1. All question papers must be answered in English, Candidates may be permitted to use battery-operated calculators for the optional subject only.
2. Commission has discretion to fix qualifying marks in any or all the subject of the examination.