

The Indian Forest Service (Probationers' Final Examination) Regulations, 1968

UNION OF INDIA

India

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Rule

THE-INDIAN-Forest-SERVICE-PROBATIONERS-FINAL-EXAMINATION of 1968

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The Indian Forest Service (Probationers' Final Examination) Regulations, 1968In pursuance of rule 8 of the Indian Forest Service (Probation) Rules, 1968, the Central Government, in consultation with the State Government and the Union Public Service Commission hereby makes the following regulations, namely :

1. Short title and commencement.

(1)These regulations may be called the Indian Forest Service (Probationers' Final Examination) Regulations, 1968.(2)They shall be deemed to have come into force on 1st April, 1968.

2. Definitions.

(1)In these regulations, unless the context otherwise requires, "Schedule" means a Schedule appended to these regulations.(2)All other words and expressions used in these regulations and not defined shall have the meanings respectively assigned to them in the Indian Forest Service (Probation) Rules, 1968.

3. Final Examination.

(1)Every probationer shall, during and at or about the end of the period of training at the Institute, appear at the Final Examination comprising-(i)written and practical examinations;(ii)exercises; and(iii)qualifying tests.(2)The written and practical examinations shall be held as follows :(i)First

year Examination at or about the end of the first year of training at the Institute, and(ii)Second year Examination at or about the end of the second year of training at the Institute.(3)Exercises in field work shall be held during the course of training at the Institute and during tours undertaken according to a phased programme.(4)The Final Examination shall be conducted by the President in the manner laid down in these regulations.(5)The dates on which and the places at which the various examinations and tests shall be held shall be fixed by the Central Government in consultation with the President.

4. [Subjects and Syllabus for. [Substituted by D.P. & A.R. Notification No. 7/5/72-A1S (IV), dated 1st March, 1974 (w.e.f dated 6th April, 1974).]

- (A) Written and Practical Examinations, and (B) Exercises. - The subjects for written and practical examinations and exercises shall be as mentioned below namely :](A)Written and Practical ExaminationsThe subjects for these examinations and the maximum marks allotted to each of them shall be as follows namely :

Group	Subjects	Paper	Theory	Practical	Total	Total of Group
1	2	3	4	5	6	7
First Year						
Forestry I (General)	1. Land Management and Soil Conservation		15		15	25
	2. Range Management		10	...	10	
Forestry II (Core)	3. Silviculture	I	25	...	25	25
	Silviculture	II	25	...	25	85
	4. Mensuration	I	20	...	20	
	Mensuration	II	20	...	20	
	Mensuration	III	20	...	20	
Earth Sciences	5. Geology		15	10	25	55
	6. Soil Sciences		20	10	30	
Physical Science	7. Surveying		25	25	50	85
	8. Engineering	I	35	...	35	
Biological Sciences	9. Botany	I	20	20	40	40
Forest Utilisation	10. Forest Utilisation	I	35	...	35	55
	Forest Utilisation	II	20	...	20	

	Total		305	65		370
Second Year			20	...	20	45
Forestry I (General)	1. Wild Life Management		10	...	10	
	2. Environmental Conservation		15	...	15	
	3. World Forestry		25	...	25	200
Forestry II (Core)	4. Silviculture	III	25	...	25	
	Silviculture Viva Voce in Silv.	IV	30	...	30	
	5. Forest Management		30	...	30	
	6. Working Plans		60	...	60	
	7. Forest Economics and Valuation		30	...	30	
Forestry III	8. Forest Production		15	...	15	50
	9. Forest Policy and Law		15	...	15	
	10. Social Forestry		10	...	10	
	11. Tribal Welfare		10	...	10	
Physical Science	12. Engineering	II	35	...	35	45
	13. Forest Machinery		10	...	10	
Biological Science	14. Botany	II	20	20	40	90
	15. Zoology and Entomology		20	10	30	
	16. Mycology and Pathology		15	5	20	
Forest Utilisation	17. Forest Utilisation	III	30	10	40	70
	Forest Utilisation	IV	30	...	30	
Electives	18. Biometry or Advanced Forest Economics and Valuation or Wildlife Management		25	...	25	25
	Total		420	105		525

(B) Exercises The subjects of these exercises and the maximum marks allotted to each of them shall be as follows :

Sl. No.	Subjects	First Year	Second Year	Total
1.	Study and practical work on tour	90	60	150
2.	Botanical collections during tours	12	8	20
3.	Engineering Plates	5	10	15
4.	Survey Plates	5	...	5
5.	Road Alignment	...	15	15

Total	112	93	205
Grand total for examination exercises	482	618	1100

The syllabus for the written and practical examinations and exercises shall be as specified in Part I of the First Schedule.

5. [Qualifying tests. [Substituted by D.P. and A.P. Notification No. 7/5/72-AIS (IV), dated 1st March, 1974.]

(1)Qualifying tests in the following subjects shall be conducted by the President and the maximum marks allotted to each of them shall be as follows, namely :

(i) First aid	10
(ii) Weapon Training	10
(iii) Equitation Training	10
(iv) Regional language	20
(v) Hindi	20
(vi) Use and Maintenance of mechanised equipment	20
(vii) Swimming	10

The syllabus for the qualifying tests shall be as specified in Part II of the First Schedule.](2)Every probationer shall be examined in the regional language or one of the regional languages shown in column 2 of the Second Schedule against the [cadre to which he is allocated. Where more than one regional language is shown against a] [Substituted by D.P. and A.P. Notification No. 7/5/72-AIS (IV), dated 1st March, 1974.] [cadre the President shall ascertain whether the probationer is already familiar with any of them and thereafter decide in consultation with the State Government in which one of the regional languages the probationer shall be examined :] [Substituted by D.P. and A.P. Notification No. 7/5/72-AIS (IV), dated 1st March, 1974.][Provided that probationers allocated to the following cadres shall be examined in one of the regional languages shown against them only with effect from such date as the Central Government may, by order, specify in this behalf, namely : [Substituted by D.P. & A.P. Notification No. 12/2/72-AIS (III)-C, dated 13th June, 1973.]

Cadre	Regional Language
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Assam-Meghalaya	Khasi or Garo
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Nagaland	[Nagamese in Roman Script Mizo] [Substituted by G.S.R. 640 (E), dated 27th July, 1988.]
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Union Territories

6. Minimum pass marks for examinations and standards of qualifying tests.

- Every probationer shall obtain in each group of subject a minimum of 50% and in the maximum aggregate 55% of the total number of marks at the written and practical examinations and exercises in the first year final examination and the second year final examination under Regulation 4 and to pass the qualifying tests conducted by the President under Regulation 5 by such standards as he may prescribe.

7. [Award of the Associate of Indian Forest College diploma. [Inserted by Notification No. 11041/2/85-AIS (III), dated 19th September, 1986.]

- Every probationer who is successful at the final examination by obtaining the minimum pass marks at the written and practical examinations and exercises and passes the qualifying tests as prescribed under Regulation 6 shall be awarded a diploma as "Associate of the Indian Forest College".]First Schedule[See Regulations 4 and 5]

Part I – Syllabus for the Indian Forest Service Probationers' Final Examination

I. Written and Practical Examinations in First Year

1. Land Management and Soil Conservation

Introduction. - Soil conservation, definition, scope, role in national economy, land use pattern; historical review problems, programmes and achievements. Erosion. - Definition and extent of erosion; principles or mechanics of soil erosions; agencies of erosion, wind and water, gravity geological versus accelerated erosion; water erosion, types-splash, sheet, rill and gully; Wind erosion types of soil movements siltation, suspension gravity, factors effecting wind erosion, prediction equation. Hydrological Cycle. - Hydrological cycle and its importance; rainfall, characteristics, their measurement, intensity, duration frequency, dropsize distribution, infiltration, percolation; evaporation and transpiration; runoff, definition, measurement of runoff; calculation of runoff, peak rates of runoff, time of concentration, water resources of India and world. Soil and Water Conservation Measures. - General principles of erosion, control and land reclamation; contour cultivation, contour trenching design and layout; bunding and terracing, design, construction, maintenance; erosion control and water conservation structures like spillways, their types, design, construction and maintenance; gully control, principles of planning, safety of works, use, design and maintenance of check dams; stream bank control; torrent control, control measures in catchment and in channel, landslide, definition, extent, causative factors and control measures; wind erosion control, wind breaks, shelterbelts, sand dunes fixation. Soil Conservation Planning. - Government policy and legislation, need for public cooperation, multiple land use; soil conservation planning in the field; unit of planning; watershed, sub-watershed, micro-catchment, village farm; watershed management, watershed workplan, priority determination in watershed management; soil survey and capability map, preparation and problem; collection of basic information for soil conservation planning pertaining to soil, climate, land use, crop yields, agronomic practices, engineering and forestry practices, population needs and customs, cattle census and allied details; proposed treatment dealing with watershed management practices, agronomic and forest practices, land treatment, structural measures, miscellaneous specifications, phasing of project work, provision for cost estimate, cost benefit ratio and general evaluation. Agronomic practices in soil conservation. - Contour farming, cover crops and legumes; strip cropping; mixed and rotational cropping; composting; green manuring and mulch farming; terracing and dry land farming. Practicals. - Designing of spillways and checkdams in hilly areas; stream gauging and reservoir survey;

watershed management exercise.

2. Range Management

Cattle resources of India and world; fodder requirements of India; fodder resources - quantitative and qualitative; range lands or grasslands (definition); grassland types of the country and their distribution; ecological status of Indian grasslands; principles of grassland management, basic requirements of animals, plants and land, carrying capacity - definition, method of calculation, importance, conditional classification - different standard methods, work done in India, USDA (Soil Conservation Service), USDA (Forest Service), CAZRI condition classification system etc. Soil and Water Conservation Measures. - Erosion control in grasslands, contour Turrows, contour trenching, gully control; moisture conservation, basin listing, water spreading, irrigation. Grazing Management. - Controlled grazing, continuous controlled grazing, rotational grazing, deferred grazing, deferred rotational grazing. Grassland Management and Improvement - Closures. - Legal, voluntary, complete, partial/seasonal; method of effecting range protection - type of fencing with cost - stone wall fencing, barbed wire fencing, cattle proof trenches; effect of closure on forage yield, forage quality, palatability, nutritive value, forage vigour on soil and water resources; Seeding and planting, seed production, seed rates/seed weight, method of cultivation of important species, broadcast sowing, pellet sowing, seed, fertilizer rolls and aerial sowing, controlled burning, uniform grazing-entry points, weed control; need for weed control, methods of weed control-mechanical, chemical, effect of weed control; fertilizer application-dosages, methods, results in term of yield (forage) income and expenditure. Utilisation. - Silage, definition, method of preparation, storage and feeding, time of harvesting, hay, definition, methods of preparation and storage; hay banks. Tree and shrub feeds. Forest grazing. - Assessment of fodder resources, carrying capacity of forest areas, selection and introduction of shade tolerant, grasses/shrubs as under growth. Practicals. - Measurement, yield determination, botanical composition, basal area, grassland improvement plan, visit to Indian Grassland and Fodder Research Institute, Jhansi. Excursion

3. Silviculture

3.1 Paper I - (Foundation of Silviculture including Ecology)-Introduction, definition, extent of forest in India and other countries; role of forests-productive, protective, recreational, ameliorative in industrial development; history of forests and forestry in India; Silviculture; foundations of silviculture, practices of silviculture, silvical basis of rational silvicultural practice. Environment of forests. - Environment or site, factors of site, climatic factors, edaphic factors, physiographic factors, biotic factors; site quality; classification of site factors on their mode of affecting vegetation. Solar Radiation. - Importance; radiant heat and light; effects of solar radiation on forest vegetation, effects of light, duration of radiation (direct, diffused, cloudiness) and effects; temperature effect. Air-temperature. - Sources of a tree's heat; absorption of heat by a tree; injurious effects of high and low temperature; critical temperatures, extension of a tree's range; air-temperature and forest vegetation, acclimatization. Atmospheric Moisture. - Water and Vital processes in trees; sources of precipitation; mechanical action of rain, snow, sleet, hail etc., on forest vegetation; atmospheric humidity and its effect on vegetation; evaporation; transpiration; ratio of precipitation to evapotranspiration and its significance; precipitation-vapour pressure deficit quotient. Climate

and Weather. - Definition of climate and weather, importance of climate and weather in forestry; elements of climate and the factors which influence them-temperature, temperature and latitude, temperature zones, annual range, or frost-ground and pool, precipitation and humidity-rainfall, its distribution, summer monsoons, winter monsoons and seasonal distribution; annual variation; heavy rains and floods, rainfall intensity; drought, rainy days and their significance; dew, invisible condensation, fog and mist; light or insolation, wind (pressure, velocity diurnal variation), lightening, atmospheric impurities periodicity in climate, climatic provinces integration of climatic factors, bioclimate, climate and potential productivity. Physiographic conditions. - Earth configuration; altitude and its effects on insolation, temperature, rainfall, wind etc.; aspect and its effect on various climatic factors; slope and its effects on various climatic factors; topography and surface conditions. Soil conditions, soil moisture and site influence on forest vegetation, etc. will be dealt with in 'forest soils'. Biotic factors. - Competition; inter-relationship between plants; importance of plant parasites; effects on animals; interference by man. Interaction of locality factors. - Measuring effectiveness of site factors; effect of site factors on forest vegetation; compensating factors; most significant factors; modification of site factors in silvicultural practice. Influences of forests on their environment. - Reaction of forest vegetation on its physical environment, effect of forest vegetation on air-temperature, soil-temperature, atmospheric humidity, precipitation (local and general), effect of forest vegetation on conservation of water; evaporation (from free crowns and ground); transpiration loss; surface run off; seepage and water retention; springs; stream-flow; floods effect of forest vegetation on air currents, how windbreaks act, effect of wind breaks on air and soil temperature, effect of forest vegetation on erosion; microclimate or forest stands; effect of forests on animal life including mankind effect on animal life, effect on mankind, forest aesthetics. Forests-Form and life of forest trees. - Structure and functions; species, varieties, sport varieties, sport forms, races, individuals, hybrids and crossbreeds; trees form; form of crown and branching, form of hole crotched or double topped trees, epicormic branches and water sprouts, stool shoots and coppico shoots. Growth and development. - Growth characteristics of chief importance, height growth, diameter growth volume increase, quality growth, reproduction seed production, germination and establishment. Crop morphology. - Differentiation of stands; developmental stages in stands; differentiation of stands on the basis of composition; differentiation of stands on the basis of density; crown and canopy; crown classification, root closure and root competition, conditions which influence density of boles; development of stands. Hardiness and tolerance. - Injury at low temperatures; frost injury and frost hardiness; drought injury and drought hardiness; injury at high temperatures; correlations between resistance to various factors; relative hardiness of species. Forest composition and distribution. - Competition between species; concept of succession and climax, classification of forest types, definition of forest types, bases of classification, criteria for delimiting forest types, forest types in relation to climate, forest types in relation to soil, forest types in relation to topography, forest types in relation to biotic factors; geographical distribution, distribution of species, botanical areas; principal forest types of India and their distribution. 3.2 Paper II - (Practice of Silviculture, Regeneration and Tending) Natural regeneration; natural regeneration by seed, natural regeneration by coppice; natural regenerations by root suckers; cultural operations. Artificial regeneration - General consideration, objects of artificial regeneration, artificial versus natural regeneration, choice of species, hardwoods versus softwoods, quick versus slow growing species, exotics versus indigenous species, pure versus mixed crops, sowing versus planting, spencing organisation of staff and labour, village taungya plantation,

time table, protection problems, irrigation, paths and roads, seed supply general, seed collection, seed extraction etc., seed testing, seed certification, seed received from outside sources, seed storage and transport, pre-sowing treatment of seed, seed orchards; preparation of plantation area-clearing, burning, planting plan, direct sowing; nursery work-general consideration, site and area, seed-beds, method of sowing, quantity of seed, time of sowing, protection of seed sown, shading, watering and damping off, weeding and soil working including herbicides for the nursery, thinning out, transplanting, use of containers, maintenance of fertility; vegetative propagation-general considerations, root sucker, stem and branch cuttings, hormone stimulants to rooting, root and rhizome cuttings, layering, grafting, budding; planting out-survey and map, season of planting, size and age of stock, preparation of stock, transport to planting site, method of planting, watering, use of fertilizers, mixture of species, nurse crops, cover crops; mechanization-general considerations, site preparations, nursery work, pruning; maintenance-weeding soil working, watering, mulching, grazing, cost and financing-plantation costs, fencing cost, plantation records, statistics of plantation; artificial regeneration of fast growing species-definition, species, nursery practices, planting techniques, site preparation, after care cultivation of agricultural crops, genetical aspects; artificial regeneration of special sites; protection of plantations and natural regeneration; site maintenance and improvement; sites maintenance in regeneration operations; site maintenance in forest stands; tending introductory; necessity of tending, weeding and cleaning, weeding natural regeneration, weeding artificial regeneration, climber control, thinning in plantations; thinning in natural regeneration; thinning in irregular crops; pruning; use of fertilizers; excursions (nursery work thinning planting).

4. Forest Measurement

4.1 Paper I - Measurements of individual trees and of populations - Measurement of characteristics of individual trees - Diameter and girth measurement objects of these measurements, various instruments used, their construction and use, relative accuracy of each instrument, reference points of measurement i.e. breast height and other points, measurements of standing trees at these points, measurements of forked, buttressed, fluted and abnormal trees; bark thickness - need for measurement and method thereof, bark per cent tables. Height measurements. - Objects of height measurement, reference points for measurement; various instruments used for height measurements, their construction and relative accuracies, sources of error in measurement. Measurement of crown of trees e.g., crown length, crown width etc. Measurement of felled trees. - Direct measurements of volume (xylometric) and estimation of volume through sectional areas, length etc. Various formulae for volume estimation; description of various types of volumes, e.g., standard total timber, standard stem timber, branchwood volume including, commercial volumes, effect for errors in measurement of volumes, effect of using calliper, tapes and of length of log sections; units of measurement, F.R.I. procedure of measurement of volume for felled trees. Estimation of volume of standing trees. - Why estimation; different methods of estimation e.g., ocular, through measurement of diameter and heights; form of trees various theories to explain form; form factor and form quotients; taper tables; various kinds of out-turn from a tree e.g. plywood, sawn pieces, pulp etc., estimation of out-turn and conversion factors. Determination of age of trees. - Standing trees, ocular estimate, from records, from annual ring count, from borings, counting of whorls of branches; through successive measurements and

application of formulae for trees without annual rings; age of felled trees; ring count; methods for trees without annual rings. Growth of trees. - Various kinds of growth - growth in diameter, height, volume, quality and value; methods of determination of growth of trees with annual rings - stem analysis, stump analysis and increment borings with Pressler's borer, determination of growth of trees without annual rings from data from continuous inventory, sample plots, linear increment plots; M.A.I. and C.A.I. characteristics of growth curves for trees; relationship between volume of trees and other variables e.g. diameter, form, site quality etc. Volume tables and form class, taper tables. - Need for the volume tables, kinds of volume tables, direct and indirect methods, graphical techniques, an elementary idea of least square solutions and use of regressions (without actually solving these), tests of precision; taper tables. 4.2 Paper II - Forest Inventories and crop measurements - Definitions, basic concepts, e.g. population, quantitative and qualitative characteristics, frequency distributions, histograms, frequency polygon and frequency curves; concept of population mean (diameter, height etc.); sample estimate of population mean; dispersion of values, variance and standard deviation, co-efficient of variation, standard error of estimate; normal distribution, errors and distribution, expected values of mean and confidence limits. Enumerations and samplings. - Complete enumeration-advantages and disadvantages; calculation of population mean and standard deviation; nonsampling errors; sample enumeration - advantage and precision of results; complete u/s partial enumeration; the use of wedge prism and relaskop; small scale intensive surveys; layout of permanent sample plots including methods of computation of volumes including mean tree methods and grouping (arithmetic, Ulrich's, Hartig's and Block's) the F.R.I. method now adopted; layout and measurements and uses of L.I.Ps., continuous inventory plots, preservation plots, etc. Large scale extensive surveys. - Objectives of surveys; decision about the design of surveys' design of field forms and decision on final tables. Design of surveys. - Why a design; role of statistics in minimising cost at a given level of precision; some elementary designs for forest surveys, simple random sampling, stratified random sampling, stratified systematic sampling; what these are and why followed (in brief). Estimation of volume of crops. - Crop volume tables; estimations for crops volumes (regression estimations, use of volume tables, etc.). Growth estimations of stands. - Concept of growth and definitions of growth, stand growth and tree growth, steps in estimating growth; continuous inventory; yield tables-preparation and uses; site quality determination, density thinning grades growth estimation; money yield tables; stand tables; use of stand tables; stand table projection; Dynamics of forest stands population. Recent trends in mensurational studies (use of computers, mathematical models, etc., only brief indications). 4.3 Paper III - Remote sensing techniques in forestry-General (brief theoretical discussion) on aerial photography and photogrammetry; types of aerial photographs, taking of aerial photographs, obtaining and handling of aerial photographs, storage, measurement on aerial photos, how a photo differs from a map scale and horizontal measurement, displacements on a single photo, stereoscopy, displacement in stereoscopic pair of photographs; agencies for obtaining aerial photographs (new or old) in India, what are formalities given here, forms prescribed by Survey of India for requisition of photos (only briefly); Satellite imageries-their techniques, uses and limitations. Basic exercises. - Proper orientation of aerial photographs under stereoscopic transfer of points, construction of principal points, flight or course lines or match lines, indexing of aerial photographs on map; recognition and identification of objects on photographs, orientation and use of parallax bars; measurements of distances, angles and area in a stereoscopic model, measurement of height, contour and form line drawing using parallax bar. Forestry

applications. - Measurement of characteristics of single tree; measurement of characteristics of a stand; area determination and stock maps, kinds of maps, planimetries and topo maps (Discuss relations, precision, time and cost involved in doing one of standard alternatives), use of aerial photographs in forestry inventory; use of aerial photographs in forest management; forest maps; forest record e.g., aerial photographs as records for past history, insect and disease survey; silvicultural and ecological surveys, timber scale, road location, logging plan, afforestation, wildlife management. Compilation of photo interpretative maps-preparation of minor control plot and combination by Arundel method; combination by allotted template method; air survey compilation of base map; transfer of photo interpretation data to base map by various methods e.g. ocular, sketchmaster, photograph etc. Specimen report of a Forest Survey with use of aerial photo interpretation.

5. Geology

5.1 Paper I (Theory) - Introduction-Geology, its relation to other sciences; earth as a planet, views about its origin. Relief of earth. Topography and Geomorphology. - Humid regions; arid regions; dissected topography and morphology of mountain region. Classification of land forms and their significance in forestry. Rocks and minerals. - Rocks and minerals of the crust; minerals and components of rocks; identification of mineral through physical characters; important rock forming and ore-forming minerals; igneous rocks-forms, types; sedimentary rocks; metamorphic rocks. Geological structures and their topographical expressions. Classification of geological formations. - Principles followed; methods adopted; correlation of widely separated formations; standard geological sequence; geological formations of India. Weathering and Soil formation. - Mineral constituents of various rocks; weathering action and agencies responsible; residual soils from various rocks; soil minerals, soil clays and their effect on soil properties. Correlation of geological formations with forests. 5.2 Paper II (Practical) Minerals - Physical characters of minerals; important rock forming minerals. Rocks - Igneous rocks; sedimentary rocks; metamorphic rocks. Fossils - Introduction of fossils. Maps - Simple geological maps.

6. Soil Science

6.1 Paper I (Theory) - Introduction-Definition of soil and concept of soil-plant relationship, soil and site; soil with special reference to forestry. Social composition. - Mineral composition of soil; mineral constituents of soil. Soil profile. - Definition of soil profile; development of soil profile-effect of soil forming factors and soil forming process, development of some typical soil profile. Soil properties. - Physical properties-Soil texture of particle size distribution, soil water, soil structure, soil air; chemical properties-soil pH, cation exchange in soils and its significance, availability of nutrients; biological properties; organic matter decomposition and significance of C : N ratio, role of microbes in nutrient transformations, role of mycorrhiza in mineralisation of nutrients. Soil survey and classification. - Objectives of soil survey; types of soil survey; soil classification. Soil types of India. Plant nutrition. - Essential nutrients and role of nutrients in plants metabolism; deficiency symptoms of nutrient elements on plants. Soil fertility evaluation and fertilisation of soils. - Soil fertility evaluation techniques and usefulness; applicability of these techniques; fertilization of soil with inorganic materials, fertilisation of soils with organic materials. Improvement of problem soils.

- Improvement of acid soils; improvement of salt affected soils, improvement of soils affected by diseases and pests. Management of forest soils. - Nursery soil management; management for optimum returns from the inputs. 6.2 Paper II (Practicals) - Handling soil samples for the laboratory analysis; determination of soil pH; mechanical analysis of soil; soil moisture determination; soil organic matter determination; determination of nitrogen, phosphorus and potassium in soil; determination of bulk density and porosity in soil.

7. Forest Surveying

7.1 Paper I (Theory) - Objects and scope - Introductions; definitions, plane and geodetic surveys; cadastral, topographical, geographical, city, route and engineering surveys - field and office work; principles of surveying; errors in surveying - cumulative and compensating errors and mistakes; scope of surveying in forestry. Scales. - Definition, representative fraction; construction of scales, requirements of a good scale, simple diagonal, vernier and comparative scales; choice of scales and scales generally adopted. Maps and map reading. - Introduction, definitions, objects of map reading - scope in forestry, conventional signs; history of map publication in India - the 1824 and 1905 schemes; classification and nomenclature of maps, geographical and topographical maps - forest maps; the map catalogue - how to obtain maps; map reading; orientation of map, methods of finding true North; finding one's own position on the map; relief and its representation; hachures hill shading spot height, contours and form lines - layer tints. Measurement of distances. - Units of measurements - the foot and the metre; direct measurement and computations; the field party and equipment; the chain and arrows; the steel band; the tapes; the ranging rods, the cross staff and optical squares - their construction and use; linear measurements, ranging of chain and lines, testing and adjustment of chains, chaining the line on flat ground, chaining on sloping ground and hypo-tensal allowance, sources of error in ordinary chaining and measures to minimise them, correction of distances and areas measured with incorrect chains; chaining round obstacles. Chain Surveying. - Principle, suitability surveys with straight and irregular boundaries, the lines and offsets, field work, reconnaissance, selection of stations and well conditional triangles, marking of stations, the base line, running survey line and accuracy of offsets, oblique offsets and offsets to different kinds on objects such as buildings, fences, river margin etc., the field books - single and double line systems, method of recording, method of plotting, the drawing Board and recording, method of plotting, the drawing board and plotting scale; arrangement of work on the sheet including the title, North point and scale, lettering, printing, inking and colouring. Measurement of angles. - Objects, triangulation; instruments, prismatic compass, construction, use testing, sources of error and corrections; magnetic bearings, forward and back-bearings and their relationship, whole circle bearing and reduced bearing and their relationship; the meridian true, magnetic, grid and arbitrary meridians; the magnetic declination and its variations - isogonic and agonic lines, dip of the needle and isoclinic lines; local attraction - causes and correction. Chain and compass surveying. - Methods of surveying, radiation, intersection and traversing; the closed and open traverse - comparison with chain survey, applicability; the field book - data for plotting sources of error and measures to minimise them, accuracy - methods of checking closed and open traverse data, interior and exterior angles, latitudes and departures, Northings and Southings; methods of plotting - parallel meridian, the paper protractor, consecutive coordinates and the independent coordinates; Sale's Traverse Table; closing error, its distribution - graphically and by computation;

field problems - to find horizontal distance to an inaccessible point, supplying omission of one side of a closed traverse; laying out coupe, its demarcation. Plane table survey. - Instruments - Plane table, alidade declinator, plumbing fork and bob; mounting of paper; centering and orientation; methods of plane tabling - radiation, intersection, traversing and resertion; the three point problem and its solution - mechanical trial and error and the Bessel's graphical solutions, the two point problem and its solution; sources of error in plane tabling; advantages and disadvantages of plane tabling, applicability. Levelling. - Introduction definitions and scope, the level surface; horizontal and vertical planes, datum surface and reduced levels. Topographical surveying. - Introduction, utility and scope; methods of contouring - direct and indirect/by interpolation, indirect contourings by radiating lines, spot height and grids; characteristics of contours; uses of contours. Computation of areas. - Computation field notes, by offset distances from a straight survey line, midordinate; average ordinate, Trapezoidal and Simpson's rule; from the plan-by division into triangles and trapeziums, by area squares and polar planimeter. Copying, enlargement and reduction of maps. - Copying - maps - tracing, pricking and ferro-printing, enlargement and reduction by proportional compass-by squares, by pantograph, by photography. 7.2 Paper II (Practicals) - Drawing equipment and their uses; lettering construction of diagonal and vernier scales map reading; chain surveying instruments; chain survey of an area - field work plotting and finishing; prismatic compass and theodolite; chain and compass surveying - intersection; traversing; plotting and distribution of error; Gales traverse table, plane tabling - surveying and finishing; two and three point problems. Computation of areas - The popular planimeter. Copying, enlargement and reduction of maps - Proportional compass and pantograph.

8. Forest Engineering I

Building materials - Stones. - Classification, characteristics, quarrying and dressing, natural bed; bricks and tiles - suitable earth, method of manufacture, characteristics of good bricks and tiles, standard size, lime stone and surkhi - sources and classification, burning of lime stone, storing and uses of lime, bulking of sand; cement - properties, types, storing uses; mortars - definition, kinds, proportions, mixing, laying, curing, quantities needed for masonry and brick work; concrete - lime and cement concrete, essentials of good concrete, proportions, mixing, laying and curing of concrete, water-cement ratio and consistency, quantities of ingredients needed; reinforced cement concrete - principles and advantages, location of reinforcements in simple supported beams T-beams, beams, slabs, lintels, balanced cantilevered beams and slabs, columns and their bases, formwork or shuttering; finishing - proportions of lime and cement plasters, method of application and curing, pointing, proportion of ingredients, method of pointing, kinds of pointing, white washing, colour washing and distempering; timber characteristics of a good structural timber, paints and varnishes - characteristics, methods of painting timber and steel structures, wood ceiling, tarring. Building construction. - Selection of site for a forest building or forest colony, preparation of site; foundation - objects, causes of failure and precautions, foundation bed, safe bearing capacities of soils, safe loads on masonry and foundation beds, footing, width of foundation beds, thickness of concrete bed, depth of foundation bed by Rankine's rule, improving bearing power of soft soils, methods of securing safe foundations on soft soils, setting out of buildings, excavation of trenches, plinth courses precautions against termites, damp proof courses; super structure - thickness of walls, scaffoldings stone versus brick, methods of constructing mud, brick, masonry C.G.I. and

wooden walls, bonds in brick work-kinds, difference between English and Flemish bonds, details of English bond at comers, junctions and intersection of 1 brick and $\frac{1}{2}$ brick walls, construction of different kinds of masonry walls. Ashlar, Ashlerfaced, random and coursed rubble and dry rubble masonry and dry stone revetments; sills, lintels and arches - kinds of sills and intels and their construction, position of reinforcements in RCC lintels, uses of arches in building and their classification, names of parts, principles of construction and centerings; carpentry - principles of jointing, types of joints, lengthening, bearing and framing joints, common types of joints used in wooden floors, door leaves, roof trusses, roofs - types - sloping and flat roof, sloping roofs - single, double or purlin and trussed roofs, roof slopes, nature of stresses in roof members - wall bearing - wind filling gable and hipped roofs flat the jack arch roof, terraced and RCC flat roofs; roof coverings - thatching, country tiles roofings, Allahabad tiling, Mongalore tiling C.G.D. and sheeting, salting, flashings gutters, hips and valleys, ceilings; floors - trench and basement filling, earth floor, stone floor, tile floor, concrete and wooden floor, doors and windows, fan light, ventilator, clerestory types and sizes normally used, fittings - the frame work, types - ledged and braced batten doors, pancelled, glazed, ventilated and wire gauge doors, swing doors, of and dormer windows, sky light stairs - the stair case, types of stairs, straight, dog - legged, open wall, Newal, bifurcated and geometrical stairs, location and design of stair cases, fire places and chimneys-location, essential parts and common sizes of fire - places, chimney stack, the smokeless chullah and cooking range, lighting conductors - principle materials used, earth connections, estimating - principles and essential parts, project report, specifications, units of measurements, procedure and proformas for detailed measurements and bill of quantities for buildings, taking out quantities for simple buildings, abstracts of cost, plinth area and cube rate estimates, analysis of rates, measurement book; drawings-plan, section and elevation of small building.Strength of materials. - Introduction to stress and strain-Hook's law, Poisson ratio, elastic limit - elastic constants and their mutual relationship, ultimate strength, factor of safety and working stresses, application to timber; bending moments and shear force-definition, BM and SF diagrams, cases of simply supported beams and cantilevers carrying concentrated and uniformly distributed loads.Practicals. - Location of reinforcements in RCC lintels, beams and slabs, columns and weather shades; foundations of buildings, standard foundations and design by Rankine's formula; bonds in brickwork, English bond at comers, junctions and intersections of one and one timber joints in roof trusses and timber stairs; doors and windows different types; plan, section and elevation of a small building with gable roof half brick walls; hipped roof; preparation of a building estimate; BM and SF diagrams - cases of simply supported beams and cantilevers, carrying concentrated/uniformly distributed loads.

9. Botany I

9.1Paper I (Theory) - Histology - cell - cell structure, physical and chemical nature of cytoplasm, nucleus and plastids, cell wall, growth and thickening of cell wall, cell inclusion i.e. carbohydrates, proteins, aminoacids, fats and oils, minerals, crystals, latex, etc., cell formation; tissues - meristematic tissues of stem and roots - permanent tissues and tissue systems, xylem and phloem; anatomy of stems - dicot; monocot and gymnosperms with one example of each, anatomy of roots, dicot and monocot roots; anatomy of leaves, secondary growth in thickness of dicot stems, formation of bark, leaf fall, development of knots and healing of wounds.Physiology. - Absorption and conduction of water and mineral salts, escent of sap - theories regarding transpiration -

mechanism and important factors affecting transpiration and adaptations for regulating the same; photosynthesis - mechanism and factors affecting the same transportation and storage of foods, carbohydrates, fats and oils; nitrogen fixation and assimilation by plants, root nodules; special modes of nutrition carnivorous plants; symbionts, saprophytes and parasites; respiration - conditions affecting respiration; growth and movements; reproduction - vegetative, asexual and sexual. General. - Instructions for botanical collection (before first tour); general instructions regarding identification of plants and use of flora. 9.2 Paper II (Practicals). - Morphology - algae, fungi, mosses, ferns, etc. and use of microscope, parts of flowering plants, leaf and leaf parts, phyllotaxy, flower and floral parts, aestivation, inflorescences - types, fruits and seeds, placentation, stem and root modifications, description of plants: histology - anatomy of stem and roots, anatomy of leaves, secondary growth (only slides to be shown); collection of botanical specimen and their preservation.

10. Utilisation

10.1 Paper I. - Definition scope and terminology; development of logging in India - of research, development, training, users and manufacturers; logging development process, coordination; basic logging - hand tools and their maintenance, power; chain saw, short bar power chain saw - use and attachments, felling (including felling of leaning trees)-cross cutting, delimbing etc., of road transport - ground skidding, various kinds of tractors and attachments used in skidding, dragging winches, winches, aerial transportation; major transportation-loading devices, truck transportation, water transportation; departmental logging and its merits; marketing and sales; timber depots-size, organisation and management; forest labours organisation and management, wages to labourers; physiological studies in logging; logging planning-various factors and their impact, investment calculations - machine cost calculator's for various forestry machines, road planning, logging organisation and administration control; work study and its application in logging; safety measures in logging; logging machines in advanced countries. Practical. - Maintenance of saws, hand tools, work study methods and planning. 10.2 Paper II - Introduction - definition; non-timber forest products of India and their importance in rural and industrial economy of the country; survey of non-timber forest products; fibres and flosses - fibre yielding plants; method of cultivation of important fibre yielding plants; grasses, bamboos and canes, various grasses and their uses; bamboos-species of bamboo, their occurrence, cultivation, exploitation and uses, bamboo survey, important species of canes - their distribution, practice of cultivation harvesting, processing and uses; essential oils - methods of extraction of essential oils; essential oil bearing plants of commercial importance and the methods of their cultivation and exploitation. Oil seeds. - Important oil seeds obtained from forests, their methods of collection, processing, packing and storage. Gum resins and oleoresins. - Commercial gums, resins and oleoresins and their economic importance; methods of tapping of important gums, resins and oleoresins; processing, grading, packing and storage of gums. Tans and dyes - vegetable tanning materials obtained from forests, their extraction, processing handling and storage; important dyes. Drugs, poisons and insecticides - Important drugs available from forests, method of cultivation, harvesting; processing and grading; poisons and insecticides. Edible plants, nuts and spices. Rubber and gutta percha; method of tapping, processing and uses of rubber. Charcoal. - Various types of kilns used for manufacture of charcoal; charcoal dust briquettes. Miscellaneous products. - Bidi leaves; products of destructive distillation of wood, leaf

folder, others. Animal products. - Lac and shellac; silk and tassar, miscellaneous products-honey wax and ivory etc. Mineral products. II. Exercises in the First Year

1. Study and practical work during tours

1.1 Summer tour. - Study of locality factors leading to forest vegetation and site quality. Forestry terminology; stem analysis; stump analysis; increment boring, sample plot layout; enumeration; field botany, soil profile and its description. 1.2 Dehra Dun, Punjab and Himachal Pradesh tour. - Soil Conservation, watershed management, farm forestry; ravine reclamation. Succession, nursery practices, enumeration, compartment description, forest types and field botany. 1.3 Winter tour. - Study of ecological succession, natural and artificial regeneration, tending, mechanized plantations of fastgrowing species, yield and volume tables forest types. Natural and artificial regeneration, taungya technique, afforestation techniques in various types of areas; forest types forest based industries; cooperative management of forests.

2. Botanical collections during each tour

Collection and submission of complete botanical specimens of not less than 30 plants properly dried, mounted and labelled at the end of each of the tours mentioned in 1 above.

3. Engineering Plates

Brick bonds, foundations; plan's elevations and cross-sections of two simple buildings, sketch plans of buildings, bridges, lime kiln etc. made during the tours in a graph note book.

4. Surveying Plates

Drawing work. - lettering, chain survey, prismatic compass and chain survey, plan table and chain survey, topographic survey. III. Written and Practical Examination in Second Year

1. Wildlife Management

Introduction. - Concept of wildlife and history of wildlife management; relationship with the allied subject. Wildlife values and conflicts. - Values-aesthetic, economic, scientific, ecological, religious, recreational; conflicts-land use priorities, crop destruction, disease carriers. Biological and ecological base of management. - Distribution and behaviour of animals as affected by various environmental factors and adaptations, concepts of niche, habitat and ecosystem, environmental gradients; zoogeographic regions of world with special reference to wildlife in India; fundamental requirements of wildlife - food - concepts of food chains, food webs, pyramid of numbers, water pinch period, shelter - territory, home range, edge effect, factors affecting animal populations - concepts of age and sex structure, mortality and natality, density and saturation point, gregariousness and flocking, breeding potential, biological pressure, environmental resistance, internal adjustment factors, biological surplus and extinction threshold, social organisation and

behaviour - animal communities, general inter and intra - specific relationship, dominance, predator and pre-relationship, engestive, eliminative and aganistic behaviour, commenselism, mutualism, parasitism, symbiosis. Techniques of field studies of wildlife populations. - Field observations and records; tracks, trails and other animal signs; trapping, capturing and marking; rumen and focal matter analysis. Population estimation. - Censuses and estimates - visual counts (direct counts and indirect counts), use of animal tracks and signs; sample estimates - King's method and its modifications, peliet group counts, use of pug marks; indices - Lincoln's index. Rare and threatened species in India. - Studies of important rare and threatened species of India and steps taken for their preservation. Sanctuaries, national parks and zoological parks. - General concepts of their creation and administration; discussion of some important national parks, sanctuaries and zoological parks of the country. Wildlife legislation. - Wildlife Preservation Act, 1972, Games Act, Shooting Rules, Arms Act; international and national organisations for wildlife conservation.

2. Environmental conservation

Introduction, environment. - its definition, components, ecosystems; environmental conservation and management; the nature of natural resources - renewable and non-renewable; the major biotic regions of India and world; man's record on the earth, land, its characteristics, use and problems - agriculture, forestry, livestock, wildlife; water, its uses and problems, resources, the conservation of environments; the problem of population, the outlook; rural and landscaping; pollution aspects - air, water, noise, rural, urban, industrial; pollution monitoring; environmental policy - education, research and coordination in India; environmental legislation in India.

3. World forestry

Forest geography of the world-factors influencing the world distribution of forests; historical background and present distribution of world forests. Forest resources and forestry practices in different regions of the world. - North American region; Central American region (Tropical); South American region; Scandanavian region; European region; Mediterranean region; U.S.S.R.; Central Africa (Tropical); South Africa; South East Asia; Eastern Asia (Japan and China); Australia. Regional development of wood based industries in the world. Trade patterns in forest raw materials. - To be given greater importance. World geography. - Physical features; climate, vegetation types; distribution of forests and types. Historical. - Historical phytogeography, evaluation and migration of plants; historical zoo-geography, evolution and migration of animals. World forestry literature (periodicals, journals, etc.) with display. World forest organisation. - Development world agencies and organisations, e.g. SID., D. NIDA and others; world forestry research agencies and organisations, e.g. IUFRO, IUCN, WWF and others; status of world forestry research and education. Congresses, commissions, conferences and conventions relevant to forestry on global basis.

4. Silviculture

4.1 Paper III - Silviculture of Indian Trees - General description. - Dealing with general nature, growth characteristics, distribution (Geographic and Geological) phenology, silvicultural characters, autecology, synecology, community environment, regeneration methods and management of Indian species of economic importance. At Headquarters Main species - Broad leaved, *Acacia nilotica*, *Acacia catechu*, *Dipterocarps*. *Dalbergia sissoo*, *Santalum album*, *Juglans regia*. *Bombax ceiba*, *Anacardium occidentale*; exotics-study of below mentioned exotics under the headings like importance, their role in forest economy, purpose of introduction, suitability of species, ecological and economic factors, means of establishment, management and other consideration for the following species - *Casuarina equisetifolia*. *Prosopis juliflora*, exotic conifers (tropical pine in particular), species of secondary importance - *Toona ciliata*. *Ailanthus excelsa*. *A. grandis*, *A. malabaricum*. *Dalbergia latifolia*. *Gmelina arborea*. *Adina cordifolia*, *Lagerstromia* species, *Holoptelea integrifolia*, *Terminalia*, *Hymenodictyon excelsum*. *Quercus* species. *Boswellia serrata*, *Hopea parviflora*. *Pterocarpus* species, *Anogeissus pendula*. On Tours Main species Conifers. - *Cedrus deodara*, *Picea smithiana*, *Abies pindro*. *Pinus excelsa*, *Pinus roxburghii* : Broad leaved - *Shorea robusta*, *Tectona grandis*. Bamboos - general, *Dendrocalamus* and *Bambusa arundinacea*; Exotics - *Eucalyptus*, *Eucalyptus camalulensis* (Mysore gum), Tan bark wattles specially *Asacia mearnsi*, *Poplars*. 4.2 Paper IV-Silvicultural Systems. - Introduction, definition and objectives, classification. Clearfelling systems and its modifications. Shelterwood systems (involving concentrated regeneration fellings) - Uniform system, group system, irregular shelter system. Shelterwood system (involving scattered removal of trees)-selection system. Coppice system. - Simple coppice system, coppice with standards, coppice with reserves. Conversion. - Reasons for conversion from one system to another; types of conversion - conversion from selection to uniform, conversion from coppice to high forests. Modification and combination of various systems to suit local conditions in India. - Discussion on the justification of giving new names to modifications of systems in India. U.P. Selection System, Punjab Shelterwood System, Coppice with Reserves. 4.3 Viva Voce in Silviculture. - This shall cover general silviculture, Silviculture of Indian trees, Silvicultural systems etc.

5. Forest Management

Introduction. - Definition and scope, management of forests and its peculiarities, principles of forest management and their application. Objects of Management. - Purpose and policy, choice of objectives, owner's attitudes and social role of forestry. Sustained Yield. - General definitions, e.g. felling series, rotation felling cycle, cutting series etc., concept and meaning of sustained yield. Rotation. - Definition, kinds of rotation, factors affecting choice of rotation, rotation and conversion periods. The Normal Forest. - Definition and concept, normality in regular forests, normality in irregular forests. The actual growing stock and its increment. - General considerations, distribution of age gradations or classes in regular forests-normal and actual; distribution of age gradations or classes in irregular forests-normal and actual; distribution of age gradations or classes in forests under coppice systems; growth estimation and reduction factors for density, quality, miscellaneous quality and price increment and forest per cent. Yield regulation - General principles of yield calculation; silvicultural systems in relation to yield regulation; methods of yield regulation -

yield regulation in regular forests, by area - reduced areas and Hufnegl's modification, by volume and increment methods yield regulation in irregular forests - methods based on growing stock only, Von Mantel's formula and its modifications, methods based on increment only - Biolley's method du controle, methods based on volume and increment - Austrian method. Hufnegl's, French method of 1883 and its modification, method based on number of trees in various age classes and time taken to pass from one age class to the next - Brandis' method, Hufnegl's method, Smythies safeguarding formula. Application and control of the different methods of yield regulation in forest management in Indian Forestry. Multiple Uses of Forestry.

6. Working plan

Introduction - Definition, object, scope, sphere, necessity for revisions, division of forests into various units, maps, concepts of national, regional and local plans, project formulation, evaluation and appraisal. Preparation of a Working Plan - Preliminary working plan report; field work - stock mapping, checking of maps, compartment description, collection of statistical data, collection of other data, evaluation of management alternatives. Office work - Collection of data for Part I and analysis, writing of Part I and II, Management of information systems for working plans. Control of Working Plan. Working Plan exercise will be conducted in any suitable sal or other forest covering as many types as possible. Each trainee will be required to write up a working plan for an area not less than 1,000 hectares.

7. Forest Economics and valuation

Introduction - Definition, role and relevance to forestry; general tools of economic analysis; peculiarities of forest economics; role of forestry in Indian economy. Demand and supply - Theory of consumer behaviour; concepts of demand and supply; concept of elasticity of demand and supply; demand and supply of forest products. The market - Market structures; pricing of forest products; market structure for forest products. Production and costs - Factors of production; law of diminishing returns; long and short run productions function; cost of production. Timber production economics - Factors influencing timber production; timber production and its economic peculiarities, locational theory and transportation. Wood products economics - Demand, supply and pricing of major forest products; demand, supply and pricing of minor forest products; forecasting techniques. Forest valuation - Concept of interest on capital; present worth, internal and rate of return with practical examples; land expectation value and concept of profit with illustration; stumpage appraisal. Non-wood products - Techniques of evaluating non-market values; general concepts of wildlife economics; application of economic theories to outdoor (forest) recreation. Forestry planning and budgeting - Planning in forestry; project formulation and evaluation; concepts of budgeting with applications to forestry. Operation research techniques - Optimisation methods in forestry; practical application.

8. Forest Protection

General consideration - The place of forest protection in Indian forestry; classification of injurious agencies-animals, insects, plants, atmospheric agencies. Prevention - Its importance. Man as a source

of injury to forest - Following fires; causes and character of forest fires; five prevention activities; pre-suppression activities in fire control; fire suppression; fire control policy and objectives. Protection against shifting cultivation and faulty land use. Protection against mismanagement; protection against domestic animals and wildlife; protection against injurious plants; protection against atmospheric agencies.

9. Forest policy and law

Forest policy - Definition, necessity, scope, range and various considerations; foundations of a stable forest policy; contents of a national forest policy; India's national forest policy; contents of the 1952 forest policy and its correlation with the policy of 1894; need for a revised forest policy for India. Forest law - Legal definitions, application of Penal Code to forests; general principles of criminal law; legal principles of punishment; the Criminal Procedure Code as applied to forestry matters; the Law of Evidence and the Indian Evidence Act as applied to forestry matters; objects of special forest law; the Indian Forest Act; general provisions; detailed study; legal organization of the forest service. Connected laws (dealing with wildlife etc.) Forest administration (including forest cadres, forest manuals etc.)

10. Social Forestry

Introduction - Definition, scope, necessity, special significance in the context of energy and small timber requirements of India, environmental pollution and recreation place of social forestry in the national forest policy in India. Farm forestry - Its need and scope on and around agricultural lands; role in rural economy and its effect on agricultural practices; establishment of farm forests, choice of species, planting techniques, maintenance; organization of the programme, role of the forest departments protection. Social forestry - Objectives and scope vis-a-vis farm forestry; raising of trees for fodder, timber, firewood, creation of pasture lands; avenue plantations, canal bank plantations, plantations along railway lines; choice of species, techniques, maintenance; extension approach, organisation of the programme, role of the forest department; protection. Recreation forestry - Needs of the urban population; scope of its application in forests, city forests and concept of integrated town planning and forestry; creation of forest parks in natural forests close to urban centres. Wind breaks, shelterbelts and catchment forest - Scope of creation of wind breaks, shelterbelts; choice of species, techniques, maintenance; scope in the catchment forests of water works, etc.; protection. Organisation, legislation and publicity - Extension, organisation, training and demonstration, public participation and publicity; need for a defined policy, suitable legislation to support the programme.

11. Tribal welfare

General - Definition, types, distribution and demography of tribes, racial classification. Concept of races, tribe, family, clan and kinship, principles of social grouping. Cultural traditions, customs, ethos, beliefs and practices of tribals in general, political organisations and social controls. Tribal economy. Details of few important tribes of India, e.g. Bhils, Santhals, Gonds and nomadic tribes. Administration of tribal affairs, constitutional provisions for their welfare and tribal

development plans. Approaches towards tribal policies of isolation, assimilation and middle path. Tribals and forests, their symbiotic relationship. Practicals - Case studies of FLCS (forest labourer co-operative societies), Case studies on colonisation of tribal communities. Case studies on exercise of right and concessions by tribals.

12. Engineering II

Roads - Introduction - necessity of roads, classification, cross-section, systems of metalling, road gradients; alignment-reconnaissance, obligatory points, alignment of a plain road, alignment of a hill road, preliminary survey, paper location, demarcation; design - road and land width, the shoulders, camber, section on hill sides, gradients, earth work, drainage of plain and hill roads, road curves; superelevation, widening and sighting distance, retaining walls and breast walls-necessity, materials used, forces acting, conditions of stability and thumb rules for design of brick-work, masonry and timber - crib retaining walls; estimating - principles, earthwork by trapezoidal and prismoidal rules, the slope template, the abstract of cost; setting out - use of the field level and boning set for setting out gradients, instrument - levelling instrument, dumpy level, adjustments, difference of levels - back sight, intermediate sight, fore - sight, height of instrument and change part - axes of telescope and line of collineation, negative readings, reduction of levels, rise and fall system and the collineation or HI system, their relative merits, arithmetical checks, the level book, classification of levelling - simple, compound or differential, profile, cross-sectioning, reciprocal levelling; setting out buttings and embankments, setting out of simple circular curves by the method of ordinates from the long chord, vertical curves; construction, organisation of labour, tools, clearing, economical digging, load and lift, construction of earth stabilized and water-bound macadam roads, corduroy roads, use of camber template; maintenance - general wear of roads, surface maintenance, improvement of existing roads, renewal of surface, road water-tables and pole drains, road signs., notice boards and guard stones. Bridges - Introduction - Types of forest bridges, the ford, Irish bridge, causeway, road syphon, culverts, timber bridges, cantilever bridges, suspension bridges; selection of site and waterway - selection of site - factors affecting afflux and free board, provision of waterway - factors affecting waterway for culverts and small bridges, scour and its prevention; masonry arched culverts - names of parts, economical spans, thumb rules for design, principles of construction - centering; simple wooden bridges - a typical small wooden bridge, the abutment and piers, the timber bank seat, timber post, pile and masonry abutments and piers - single and double trestle piers-timber crib piers, construction of the super - structures, the through and deck span timber girder bridges, common suspension bridges - parts, stability, principles of construction - towers and anchorages, the roadway. Water supply - Introduction - Sources of supply, springs, streams and rivers, ponds and lakes, dams and reservoirs and wells, types of wells-shallow wells, deep wells and artisan wells, bore wells and tube wells; sinking of wells - selection of site for shallow and deep wells, staining, sinking of masonry lined wells; yield calculations - springs, streams and rivers, ponds lakes and dams, wells, spacing of well; purification of water - principles, clarification and sterilization, cleaning and protection of wells. Design of timber structure - Simple elastic theory of bending - bending and shear stresses in simply supported beams and cantilevers carrying concentrated and uniformly distributed loads, direct and bending stresses; stress diagrams - stress diagrams for roof trusses with and without wind loads; design - timber beams, short timber columns - ties and struts of a framed structure. Practicals - Road design -

cross-section of a road in the plains/hills and retaining walls; preparation of road estimate - earthwork calculations; setting out road curves by ordinates; a masonry arch culvert; a simple timber girder bridge; a cantilever bridge; a suspension bridge; stress diagrams for timber trusses - with and without wind load; design of ties and struts of a timber frame. A masonry arch culvert. A simple timber bridge. A cantilever bridge. A suspension bridge. Stress diagrams for timber trusses with and without wind load. Design of ties and struts of a timber frame.

13. Forest Machinery

Motor Mechanics - Petrol and diesel engines; 4-stroke and 2-stroke engines; fuel system; ignition system, lubrication system; transmission system; cooling system; fault detection and daily checks. Maintenance and operation of machineries - nursery; plantations; harvesting; transport; fire fighting.

14. Botany

14.1 Paper 1 (Theory). - Taxonomy and its significance-brief history of classification; systems of classification, viz., Bentham and Hooker, Engler and Prantl and Hutchinson. Plant nomenclature - Importance of plant nomenclature; brief history. Modern trends in plant taxonomy. Systematic botany of Indian forest plants following Bentham and Hooker's system, with emphasis on families of forestry importance (tree species), their distribution, field characters and their economic importance. Dicotyledons - Polypetales -

1. Magnoliaceae

2. Guttiferae

3. Dipterocarpaceae

4. Malvaceae

5. Stereuliaceae

6. Rutaceae

7. Moliaceae

8. Sapindaceae

9. Anacardiaceae

10. Leguminosae

11. Rosaceae

12. Rhizophoraceae

13. Combretaceae

14. Myrtaceae

15. Lythraceae

Gamopetalae

16. Rubiaceae

17. Sapotaceae

18. Ebenaceae

19. Bleaceae

20. Apocynaceae

21. Bignoniaceae

22. Verbenaceae

Apetalae

23. Lauraceae

24. Euphorbiaceae

25. Urticaceae

26. Cupuliferae

27. Salicaceae

Monocotyledonss

28. Pal-maceae

29. Grasmineae

14.2Paper II (Practical). - Dissection, sketching, description and identification (with flora) of forest plants.

15. Zoology and Entomology

15.1Paper I (Theory). - Introduction - importance of forest entomology. Animal ecology - Relations of animals to their biotic and abiotic environments; niche, habitat and ecosystem; inter-relationship of insect populations, forest stands and forest practices. Elementary Entomology - Insect anatomy; insect biologies, life histories, metamorphosis and hibernation; insect taxonomy - classification into orders. Forest Entomology - Insect pests of standing trees (plantations and natural forests)-injury, biology, life history and control of insects of economic importance in forestry with special reference to the following tree species - sal, teak, toon, mahogany, cacia, cashew, semul, ailanthus, mechellia, gmelina, eucalyptus, poplars, willows, deodar, tropical pines and high level conifers (spruce and fir); insect pests of felled and converted timbers injury, biology, life history and control; insect pests of nurseries and their control; insect pests of seeds - injury and methods of seed storage, control; termites in relation to forestry and timber - biology, ecology, life history and control; insect vectors of plant diseases with special reference to sandal spike disease; ecological classification of harmful and beneficial insects. Principles and methods of insect pest control - General principles integrated control measures; methods - chemical control, insecticides, technique (appliances), biological control, biological control agents, silvicultural control (management), mechanical and physical control, attractants and repelants, male sterile technique etc., legislative control and plant quarantine measures. 15.2Paper II (Practical). - Visit to entomology museum to see insect pests and their damage with particular reference to the following pests of standing forest trees, sal heartwood borer, teak defoliators, teak canker grub, melicene shoot borer, ailanthus defoliator, champ bug, gamhar defoliator, poplar stem borer, deodar defoliator, bark beetles, spruce budworm, pine shoot borer; nursery pests, cutworms, chafen/grubs and circkets; seed pests, bruchids, weevils and microlepidoptera; insect vectors of plant diseases. Cocolidia indica and Nephotettix impicticeps; termite nest, termite castes; timber entomology - pests of felled timber, bark borers, pin hole borers, ambrosia beetle, sapwood borers, shot hole borers, heartwood borers, drywood borers; beneficial insects; parasites, wasps and flies, predators, bugs, beetles, mantids, wasps, lac insect, honey bees, silk worms. Visit to insectary - Diagnosis of insect attack by symptoms; how to report and send specimen to Forest Research Institute asking for advice. Spraying equipment and demonstration of spraying. Insect collection - Setting, pinning and preservation-probationers shall submit a collection

of 50 insects to cover 9 orders and 20 families collected during their tours, field observations of the collection to be written in field note book, collection (wet and dry, damage and life histories) should be systematically and biologically grouped, labelled and identified upto family. Excursion to forest areas, felling sites and timber depots.

16. Mycology and Pathology

16.1 Paper I (Theory). - Fungi - definition; position in plant kingdom; broad classification; important families in Mycetes; important genera in Polyporaceae. Nutrition in fungi - Mycorrhiza. Timber decay and stain - Causes; types, effects on wood. Diseases - Causes and symptoms. Protection of timber from decay (after felling in forests, in storage and in use). Wilt diseases - Nursery diseases; wilt of shisham due to *Fusicladium solani*; wilt of Casuarina due to *Trichosporium vesiculosum*. Root diseases - Root rots of sal due to *Polyporus shoreae*; root rot of hardwoods due to *Ganoderma lucidum*; root rot of deodar due to *Fomes annosus*. Heart rots in trees - In sal in blue pine. Heart rots in coppice forests of sal and teak. Diseases due to rusts and other microfungi - Stem rusts - *Cronartium himalayense* on chir and *C. ribicola* on blue pine; witches brooms rusts in deodar due to *Peridermium cedri* and leaf rust of teak due to *Ophiostoma tectonae*. Diseases due to physiological causes - Dying of sal; dying of *Eucalyptus citriodora*; water blister in teak; failure of casuarina. Virus diseases - Sandal spike. Internationally dangerous forest diseases-plant quarantine; principle of forest diseases control. 16.2 Paper II (Practical) - Examination of the mycelium of *Mucor* or *Rhizopus* growing on a moist bread and study of asexual reproduction of the fungus; Study of fruiting structures of an Ascomycetes (e.g. *Xylaria* and Basidiomycetes) (e.g. *Polyporus*), reproductive structures (ascus and ascospores in the former and basidia and basidiospores in the latter) to be examined. Examination of sporophores in Basidiomycetes - Thelephoraceae - *Hymenochaete* (*H. rubiginosa*); Polyporaceae-*Polyporus* (*P. shoreae*), *Trametes* (*T. pini fomes* pine), *Fomes* (*F. annosus*; *F. caryophylli*), *Ganoderma* (*G. lucidum*, *G. applanatum*), Agaricaceae - *Armellaria* (*A. mella*); distinguishing characters of the families in general to be stressed. Study of the types of decay in timber - white fibrous rot; white picket rot; brown cuboidal rot; dry rot. Study of rust diseases of conifers - *Cronartium himalayense* on chir; *Peridermium cedri* on deodar. Local Excursions to acquaint with common tree diseases on sal; shisham, khair and other hardwoods.

17. Forest Utilisation III

17.1 Paper III (Wood Technology) - Wood structure - introduction - scope of wood anatomy, what is wood; gross features of wood-pith, heart - wood, sap - wood, bark, earlywood, latewood, growth ring etc.; minute structure of wood - tracheids, fibres and vessels, parenchyma, rays - resin canals etc., general properties - colour - fluorescence, lustre, odour, weight, hardness, grain, texture and figure; ultra-structure of wood - electron microscope characteristics; identification of timber with key for 25 important timbers. Properties of wood, defects and abnormalities - Physical properties of wood; mechanical properties of wood; factors influencing strength properties of wood; suitability indices and their use; safe working stresses and their evaluation; testing and evaluation of timber products and stores; classification of defects in wood and their influences on utilisation characteristics, methods of identification, measurement and evaluation of defects. Wood reasoning - Introduction -

Object, need and importance of seasoning; general principles of seasoning; air seasoning; kiln seasoning and other special methods of seasoning; seasoning schedules and classification of timber; design of seasoning kilns, air drying sheds and solar kilns. Wood preservation - Introduction - Need of wood preservation, natural durability of timber and wood destroying agencies; types of wood preservatives, their characteristics, composition and properties; preparation of material for treatment; methods of wood preservation; factors affecting penetration of preservative; properties of treated wood; testing of wood preservatives and treated timber; treatment of timber for different end uses including cost aspects. 17.2 Paper IV-Industries. - Composite wood - adhesives - manufacture, properties, uses; plywood manufacture - properties, uses; fibre boards, manufacture, properties, uses; particle boards - manufacture, properties, uses; improved wood-impregnated and compregnated woods, heat stabilised wood and chemically modified wood; present status of composite wood industry in India and future expansion plans. Cellulose and paper - Chemistry of cellulose, hemicellulose and lignin; production of mechanical pulp; production of chemical pulp, production of semi-chemical and semi-mechanical pulps; manufacture of paper; manufacture of rayon; raw materials for paper and rayon. Saw milling - Type of saws and saw mill machinery; design and layout of saw mills and wood workshops; wood working-hand and machine tools. Grading - Commercial grading systems; stress grading including machine grading; existing Indian standards on grading; Wood based industries - Historical background of wood based industries in India; present status of and suitability of Indian timbers for agricultural implements and furniture industry; present status and suitability of Indian timbers for mathematical and musical instruments industry and turnery; present status and suitability of Indian timbers for packing case industry; present status and suitability of Indian timbers for coach building and sleeper industry; planning for development of wood based industries.

18. Genetics

Introduction - definition, scope, application to plant improvement. Heredity - History; Mendel's laws of heredity; physical basis of heredity - the cell and chromosomes; cell division - mitosis meiosis. Variation - Sources of variation; genetic v/s environmental variation and their estimation. Qualitative and quantitative characters - Single gene and multiple gene determined characters; modification of mendelian ratios; inheritance of quantitative or polygenic characters. Forest tree breeding - Objectives of tree breeding; methods of tree breeding; recent advances in vegetation propagation of tree sp. Selective methods of tree improvement - Seed stands and seed production areas to meet interim need for seeds plus tree selection; seed orchards and their establishment; management of seed orchards; progeny trial one parent and two parent for estimation of genetic parameters. Hybridization - Objects of hybridization; inter-racial and inter-specific hybridization - exploitation of heterosis; seed orchards for raising hybrid seeds. Breeding for special characters - For improvement of wood characteristics; for incorporating resistance to specific diseases; for incorporating resistance to specific pests; incorporating resistance to specific edaphic and climatic factors. Polyploid and Mutation breeding - Definition conversation of natural polyploid in some important tree genera; experimented indication of polyploids with conclusion and method of treatment; utilization of polyploid in tree improvement mutation - definition, natural and induced mutation; experimental induction of mutation with polyploid and physical and chemical mutagens; utilization of mutants in tree improvement. Practicals -

Preparation of slides for studies of chromosomes; vegetative propagation and use of growth promoters; plus tree selection; seed orchards and their establishment; various methods of hybridization; various types of grafting and budding, controlled pollination, treatment of seed orchards.Or

19. Forest Ecology

Basic ecological principles and concepts - definition of ecology and forest ecology, scope and importance of ecology in conservation of natural resources in general, land use, forestry, grassland - management and wildlife, ecology and its relation to other sciences, sub-division of ecology including syn and aut-ecology; basic concepts of plant ecology (forest ecology), concepts of ecosystem habitat and ecological niche, ecosystem components, biogeochemicals cycles; fundamental concepts related to energy in ecological systems, the food chain, trophic structure and ecological pyramids. Forest environment - Environment of the forest - biotic and abiotic components and environment, thereunto relations and importance in forest ecology, effect of inter-action of different environmental factors on the development of vegetation; environmental measurements - measurement of environmental factors (instrumentation) like solar radiation, light intensity, temperature, atmospheric gases, particles and electric properties, etc., limiting factors, principles of limiting factors, combined coning factors, principles of limiting factors of importance as limiting factor, ecological indicators. Forest community (syn-ecology) - Liotic community concept; methods of studying vegetation - life forms, structure and physiognomy, charting and mapping of vegetation, quadrats, transects, etc., methods of rating for frequency, analysis of data with qualitative and quantitative methods (indices, coefficients, formulae, symbols, pattern, etc.), description, classification and ordination of communities, statistical methods and mathematical methods; concept of ecological dominance, competition, tolerance aggression, serial and climax communities, ecotones and concept of edge effects vegetation dynamics (temporal and spatial development of vegetation) - origin and development of vegetation, ecological succession, primary and secondary succession, retrogression, arrested succession and climax, mono and polyslimaxes, mosaic theory; phytogeography - basis of classification vegetation types brief description of the forest types of the world and of India; palaeo-ecology - palaeobotanical patterns in relation to present distribution, lines of evidence fossil woods, dendrochronology-radio carbon dating, peat analysis, pollen analysis, etc. Aut-ecology - Studies on growth requirement of species-seed production and their germination, methods of studying competitive potential, moisture requirements of species, etc.; root development - studies on development of root system in varied habitats. Ecological adaptations and evolution - Adaptations, origin or adaptations, fate of adaptations, the genecological classification, isolation and evolution. Production ecology (forest productivity) - Concept of productivity; biological productivity - production of organic matter (plant biomass), accumulation of organic matter, organic balance sheets; nutrient cycle - uptake of nutrients, nutrient loss, nutrient input, nutrient budget; energy flow, energy accumulation, energy budget; water circulation - interception of precipitation, evaporation and runoff, transpiration, soil moisture, water budgets; methods of assessing forest site quality (forest productivity), direct measurements of forest productivity, vegetation as indicator of site, indicator type and indicator spectra, environmental factors as a measure of productivity, climatic factors and soil factors; site as a dynamic concept. Radiation ecology - Definition - radioactive substances - radiation and environment; nuclear concepts - type of ionizing radiations,

units of measurements, . radioisotopes (radionuclides) of ecologicals, importance, comparative radiosensitivity; effects of radiation on individuals, populations, communities and ecosystems; radioactive substances released into the environment and the manner in which ecological communities and population control the distribution of radioactivity, the fallout problem, waste disposal, future radioecological research; use of radioactive tracers in biological sciences ecology, physiology, etc.

20. Forest Statistics

Introduction to theory of probability - Introduction to set theory, events, elementary set theory applied to events; addition and multiplication theorems of probability, conditional probability; expectation, random variable random numbers. Standard distributions - Frequency distributions, calculation of moments; binomial, poisson, normal and other important probability distribution (negative binomial, rectangular, beta and gamma not in detail), introductory, calculation of their expected values and variances. Theory of estimation and tests of hypothesis - Point estimation and interval estimation, confidence limits, significance; desirable properties of an estimator, maximum likelihood point estimation, tests of hypothesis, simple and composite hypothesis, size and power of a test; exact tests on samples from a normal population (E-test, difference of means in paired samples), F-test, Z-test, effect of non-normality. Analysis of variance - Test for homogeneity of variances; a test for difference of means; two way classification (complete blocks); estimation of fixed; estimation effects (model I), estimations of variable treatment effects (components of variances, model II), mixed model (model III). Sampling procedures - Simple random sampling for proportion and percentages, the estimation of sample size; stratified random; systematic sampling; cluster sampling (one and multistage sampling and sub-samples of equal and unequal sizes); ratio and regression estimates; double sampling; sources of error in surveys. Design of experiments - Completely randomised, randomised blocks and latin square design; factorial experiment; compounding split plot designs; masi latin squares, incomplete block design; balanced and partially balanced incomplete block design; lattice squares, incomplete latin squares. Distribution of pairs of variate-Classical regression problem, bivariate normal surface; linear regression as determined from a sample, computation of regression and correlation coefficients, variance regression line; regression when independent variable is not random; functional ratio between variables, subject to error; contingency table, yates correction for continuity; chisquare test of homogeneity. Multiple regression analysis and curve fitting - Equations of multiple regression; the solution of normal equations variance and covariance matrix; residuals.

21. Advanced Forests Biometry

Application of statistical techniques in forestry - introduction to statistics; use of electronic data processing machines; sampling techniques; test of significance; regression and correlation analysis; analysis of variance. Forest measurements - Tree and log volume estimation from rules and tables; forest inventory application of sampling with probability proportional to size in forest inventory; use of computers in analysis of inventory data; measuring instruments and procedure for forest measurements. Stand structure and growth - Stand structure, density, site quality and yield tables; stand growth analysis of typical growth models; simulation techniques and application in growth

models. Management information system for forest management decisions - Evaluation of information needs for decision making by forest managers, application of operations research techniques for collecting stand information. Remote sensing techniques for forest measurement - Use of aerial photographs for forest measurements; remote sensing techniques using satellite imageries; use of aerial photographs in preparation maps; use of instruments and procedures for preparation of maps. Or

22. Advanced Forest Economics and Valuation

Review of economic principles - Theory demand; theory of production; theory of costs and marginal analysis; market structure; theory of distribution; theory of capital; application of economic principles to forest resources management. Analytical tools to decision making to resources management - Optimization models; linear and non-linear programming; game theory; decision theory; application of other operations research techniques to forest resource management; use of electronic data processing machines of resource management decision. Forest products economics - Contribution of forestry to national economy; forest based industries; problems in estimation of demand of tangible and intangible goods from forestry; case studies. Production problems in forestry - Application of production theory to forestry input and output decisions, analysis of financial objectives of forestry production; multiple products analysis; case studies. Analysis of market structure for forestry products - Market structure for forestry products; pricing of forest products; demand and supply of forest products; production, consumption and supply of forest products; case studies. Non-timber products economics - Multiple use; economics of forest recreation; wildlife; forestry and environment; forestry and quality of life. Forestry and international affairs - Broad trends of production and consumption of forestry products; trade patterns for forest products; marketing of forest products international context. Or

23. Wildlife Management

Wildlife management techniques - Field observations; instrumentation; habitat analysis and evaluation; food habit analysis; post mortem techniques; field detection of diseases and conditions; taxidermy; capture and marking techniques; establishment and maintenance of field laboratories and museum. Practice of wildlife management - Concept of wildlife management - definition and importance; history of wildlife management in India, Asia, Africa, Europe, America and Australia; concept of conservation including multiple use of land. Measurement of wildlife population - Need for census; census types and techniques; collection and analysis of census data. Control of food and water - Variety of food, palatability, essential nutrients etc.; food habit studies; availability of water. Habitat management - Habitat analysis, species, composition and indicator plants; techniques of dealing with environment; control of cover. Management of wildlife refuges - Mechanism of use of refuges; species suited to refuge. Management of special area - National parks and sanctuaries; game farms. Control of diseases - Types of diseases; methods of control. Predator control - Inter-predator - relationship; predator-prey relationship; sanitation; food habitat research. Population problem - Declining and dense population, shifting population etc.; corridors for dispersion and migration; introduction of species; population and habitat balance. Control of hunting - Purpose; kinds of control; balancing species and ecosystem. Wildlife management plans - Collection and analysis of

essential information; special techniques for use in the preparation of management plan; preparation of method plan. Management of important wildlife species - Endangered species; major wild animal species; important game birds, fish and crocodiles; case studies on selected problem in wildlife management. IV. Exercise in the Second Year

1. Study and practical work in tours

1.1 Summer tour. - Study of working plans and management of conifers and temperate broad-leaved species, introduction of exotics, mechanised jogging, watershed management planning and practice. 1.2 Winter tour. - Study of working plans and management of task; bamboo deciduous species, evergreen species; thinning research; utilisation methods including visits to wood-based industries; industrial planning and correlated industrial plantations.

2. Botanical collections during each tour

Collection and submission of complete botanical specimens of not less than 30 plants properly dried, mounted and labelled at the end of each of the tours mentioned in 1 above.

3. Engineering Plates

Stress diagrams, timber beams, roof trusses, timber bridges, sketch plans of buildings, bridges, lime kiln etc. made during the tour in a graph note-book.

4. Forest Road Alignment Exercises

Alignment, mapping and estimation of forest motor road through a hilly country.

Part II

Qualifying Tests (i) First Aid. - The probationers shall be trained and tested in Civil Defence, First Aid and St. John's Ambulance Drill. (ii) Weapon Training. - The probationers shall be trained and tested in the use of short-guns, rifles, pistols and revolvers. (iii) Riding. - Shall include the walk, trot, canter gallop and jumps (small fences and ditches). (iv) Regional languages. - The test shall comprise translation, free composition, set composition, conversation and dictation. The probationer knowledge of grammar shall be tested chiefly by composition, conversation and by passages for comment. (v) Hindi. - The test shall comprise translation, free composition, set composition, conversation and dictation. The probationer knowledge of grammar shall be tested chiefly by composition, conversation and by passages for comment. (vi) Use and maintenance of Mechanized Equipment. - Shall include maintenance of motor vehicles and elementary knowledge of their working. (vii) Swimming. - The standard of training and proficiency shall be determined by the President. [Second Schedule] [Substituted by G.S.R. 802, dated 12 July, 1989 (w.e.f. 4th June, 1989).] [See Regulation 5.21]

State	Regional Language
Andhra Pradesh	Telugu or Urdu
Assam-Meghalaya	Assamese, Bengali, Kashi or Garo
Bihar	Hindi
Gujarat	Gujarati
Haryana	Hindi or Urdu
Himachal Pradesh	Hindi
Jammu and Kashmir	Urdu, Kashmiri or Dogri
Karnataka	Kannada
Kerala	Malayalam
Madhya Pradesh	Hindi
Maharashtra	Marathi
Manipur-Tripura	Manipuri, Bengali or Hindi
Nagaland	Nagamese in roman Script
Orissa	Oriya
Punjab	Punjabi in Gurumukhi script or Hindi
Rajasthan	Hindi
Sikkim	Nepali
Tamil Nadu	Tamil
Uttar Pradesh	Hindi
West Bengal	Bengali or Hindi
ACMU Arunachal Pradesh	Assamese, Hindi, Malayalam
Goa, Mizoram	Marathi, Mizo, Tamil, Urdu, Gujarati
Union Territories	