

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|--|
| Discipline/Field of specialization | : | Soil Sciences (Soil Fertility/ Plant Nutrition (02)) |
| Place of Posting / Location | : | Arid Zone Research Institute (AZRI) D.I Khan = 01, Land Resources Research Institute (LRRRI) NARC = 01 |
| Subject Description | | Subject % Weight |
| A: Plant Nutrition | | 36% |
| A1: Essential Plant Nutrients | | 6 |
| A2: Plant Nutrient Functions | | 6 |
| A3: Plant Nutrient Deficiency and Toxicity | | 6 |
| A4: Nutrient availability and Fertilizer use efficiency | | 6 |
| A5: Rhizosphere: Plant Microbes and Interactions | | 6 |
| A6: Biological Nitrogen Fixation | | 6 |
| B: Soil Fertility & Soil Testing | | 22% |
| B1: Soil Fertility Evaluation | | 5 |
| B2: Soil test Calibration and Plant analysis | | 5 |
| B3: Fertilizer Management strategies | | 4 |
| B4: Organic Matter Composition and fractionation | | 4 |
| B5: Sorption and De-sorption: Chemical and Physical | | 4 |
| C: Soil & Water | | 22% |
| C1: Water and Solute interactions | | 5 |
| C2: Soil Water potential and its Components | | 5 |
| C3: Measurement of Water in Soil | | 4 |
| C4: Saturated and Unsaturated Water flow | | 4 |
| C5: Estimation of Crop Water requirement | | 4 |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|--|
| Discipline/Field of specialization | : | Soil Sciences (Soil Salinity) (01) |
| Place of Posting / Location | : | Land Resources Research Institute (LRRI) NARC = 01 |
| Subject Description | | Subject % Weight |
| A: Salt Affected Soils | | 20% |
| A1: Classification of Salt effected soils | | 5 |
| A2: Properties of salt effected soils | | 5 |
| A3: Characterization of Salt effected soils | | 5 |
| A4: Salinization and Sodification | | 5 |
| B: Ground Water | | 20% |
| B1: Ground Water Characteristics and Resources | | 5 |
| B2: Ground Water Resources | | 5 |
| B3: Irrigation water Criteria | | 5 |
| B4: Irrigation water Classification | | 5 |
| C: Water Logged Soils | | 20% |
| C1: Causes of Water Logged Soils | | 5 |
| C2: Salinity Buildup and Prediction | | 5 |
| C3: Chemistry of Soil Solution | | 5 |
| C4: Root Zone Salinity | | 5 |
| D: Reclamation and Management of Salt affected Soils. | | 20% |
| D1: Bio-Saline Agriculture | | 4 |
| D2: Potential field and Horticulture Crops for Bio-Saline Agriculture | | 4 |
| D3: Latest Advances and Techniques in Bio-Saline Agriculture | | 4 |
| D4 Salt Tolerance Mechanism in Plants | | 4 |
| D5: Environmental Impact of Soil Salinity | | 4 |

| Post Name | : | Scientific Officer (SPS-08) |
|--|---|--|
| Discipline/Field of specialization | : | Soil and Environmental Sciences (01) |
| Place of Posting / Location | : | Mountain Agricultural Research Center (MARC) Gilgit = 01 |
| Subject Description | | Subject % Weight |
| A: Soil Fertility and Plant Nutrition | | 10% |
| A1: Basic soil–plant relationships in plant nutrition | | 3.33 |
| A2: Essential plant nutrients, functions, deficiency and toxicity | | 3.33 |
| A3: Fertilizer management strategies, nutrients availability and fertilizer use efficiency | | 3.33 |
| B: Soil Physics | | 14% |
| B1: Soil physical properties and inter-relationships | | 3.5 |
| B2: Soil water potential and its components | | 3.5 |
| B3: Measurement of water in soil | | 3.5 |
| B4: Saturated and unsaturated water flow | | 3.5 |
| C: Soil Microbiology | | 13% |
| C1: Rhizosphere: plant-microbe and microbe-microbe interaction | | 3.25 |
| C2: Biological nitrogen fixation | | 3.25 |
| C3: Role of mycorrhizal association with respect to plant nutrient availability | | 3.25 |
| C4: Plant grown promoting substances | | 3.25 |
| D: Environmental analysis | | 10% |
| D1: Environmental impact assessment tools and techniques | | 3.33 |
| D2: Hazard Risk Management Processes | | 3.33 |
| D3: Principles of Environmental Impact assessment | | 3.33 |
| E: Environment and Human Health | | 13% |
| E1: Public health concept | | 3.25 |
| E2: Communicable and Non-communicable diseases | | 3.25 |
| E3: Water and Sanitation Borne diseases | | 3.25 |
| E4: Food and Air Borne diseases | | 3.25 |
| F: Population dynamics and Environment | | 10% |
| F1: Population and Natural Resource Sustainability | | 3.33 |
| F2: Population and poverty | | 3.33 |
| F3: Unplanned Migration and Urbanization | | 3.33 |
| G: Environmental Pollution and Management | | 10% |
| G1: Land Degradation and Management | | 3.33 |
| G2: Trace Elements in Agriculture and Management | | 3.33 |
| G3: Munciple Waste Management | | 3.33 |

| Post Name | : | Scientific Officer (SPS-08) |
|--|---|--|
| Discipline/Field of specialization | : | Soil Sciences (01) |
| Place of Posting / Location | : | Balochistan Agricultural Research and Development Center (BARDC) Quetta = 01 |
| Subject Description | | Subject % Weight |
| A: Soil Fertility and Plant Nutrition | | 16% |
| A1: Basic soil–plant relationships in plant nutrition | | 4 |
| A2: Essential plant nutrients, functions, deficiency and toxicity | | 4 |
| A3: Soil fertility evaluation, soil test calibration and plant analysis | | 4 |
| A4: Fertilizer management strategies, nutrients availability and fertilizer use efficiency | | 4 |
| B: Soil Chemistry | | 16% |
| B1: Chemical principles | | 4 |
| B2: Water and solute interactions | | 4 |
| B3: Organic matter, composition and fractionation | | 4 |
| B4: Sorption and desorption: Chemical, physical and specific | | 4 |
| C: Soil Physics | | 16% |
| C1: Soil physical properties and inter-relationships | | 3 |
| C2: Soil water potential and its components | | 3 |
| C3: Measurement of water in soil | | 3 |
| C4: Saturated and unsaturated water flow | | 3 |
| C5: Estimation of crop water requirement | | 4 |
| D: Soil Microbiology | | 16% |
| D1: Rhizosphere: plant-microbe and microbe-microbe interaction | | 4 |
| D2: Biological nitrogen fixation | | 4 |
| D3: Role of mycorrhizal association with respect to plant nutrient availability | | 4 |
| D4: Plant grown promoting substances | | 4 |
| E: Soil Salinity | | 16% |
| E1: Genesis of saline and sodic soils | | 4 |
| E2: Classification systems of salt-affected soils | | 3 |
| E3: Effect of salinity and sodicity on soil characteristics | | 3 |
| E4: Amelioration strategies for salt-affected soils | | 3 |
| E5: Waterlogging: causes and extent | | 3 |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|---|
| Discipline/Field of specialization | : | Forestry / Range Management (04) |
| Place of Posting / Location | : | Arid Zone Research Institute (AZRI) D.I Khan = 01 , Rangeland Research Institute (RRI) NARC Islamabad = 01 , Arid Zone Research Institute (AZRI) Umerkot = 01 , Arid Zone Research Institute (AZRI) Bahawalpur = 01 |
| Subject Description | | Subject % Weight |
| A: Rangelands and Forests | | 6% |
| A1: Ecological Regions of Rangeland | | 2 |
| A2: Vegetation types of Rangelands | | 2 |
| A3: Forest types of Pakistan, Classification | | 2 |
| B: Silviculture | | 16% |
| B1: Classification of Forest by Origin and Species | | 2 |
| B2: Factors effecting Tree growth | | 2 |
| B3: Seed production, Collection and Storage | | 2 |
| B4: Seed Testing: Purity viability and Germination, Seed Dormancy: Breaking Techniques | | 2 |
| B5: Regeneration Types | | 2 |
| B6: Evaluation of Planting sites and choice of Species | | 2 |
| B7: Fast Growing vs Slow Growing multipurpose Tree Species | | 2 |
| B8: Advances in Agro-forestry and Forest Utilization | | 2 |
| C: Watershed Management | | 12% |
| C1: Types of Watershed | | 2 |
| C2: Integration of Watershed Management with Grazing | | 2 |
| C3: Advances in improving Watershed | | 2 |
| C4: Watershed Management Planning, Socio Economic Consideration and Policy | | 2 |
| C5: Evaluation of Watershed Management | | 2 |
| C6: Major Watershed projects in Pakistan | | 2 |
| D: Range Vegetation Analysis | | 8% |
| D1: Vegetation Analysis Methods | | 2 |
| D2: Carrying Capacity Concept | | 2 |
| D3: Intensive and Extensive Sampling | | 2 |
| D4: Biomass Sampling Methods | | 2 |
| E: Grazing Management | | 14% |
| E1: Grazing systems | | 2 |
| E2: Pasture Establishment, Utilization and Management | | 2 |
| E3: Stocking Rate | | 2 |
| E4: Nutritional Values of Grasses, Shrubs and Trees, Animal Nutrition in Relation to Range Management | | 2 |
| E5: Plant response to Defoliation | | 2 |
| E6: Pastoral Communities and Range Management | | 2 |
| E7: Diet learning Models in Herbivores | | 2 |
| F: Drought Management in Rangelands | | 6% |
| F1: Causes and effects of Land Degradation in different Regions | | 2 |
| F2: Drought Controlling Strategies, Options and Information System | | 2 |
| F3: Drought Management Issues in Rangelands | | 2 |
| G: Management of Wildlife | | 10% |
| G1: Ecology and Distribution of Major Wildlife Species | | 2 |
| G2: Biotic Communities and Habitat Analysis | | 2 |
| G3: Conservation strategies of important Fauna | | 2 |
| G4: Feed and Management of Wild Ungulates in Exclosures and Zoological gardens | | 2 |
| G5: Wildlife Sanctuaries: Policies and Laws | | 2 |
| H: Forest Protection | | 4% |
| H1: Harmful and Beneficial Worms, Rodents, Birds and Insects | | 2 |
| H2: Forests Pests, Major Diseases and Insects of Trees | | 2 |
| I: Research Methodology | | 4% |
| I1: Research Techniques and Methods used in Rangeland and Forest Sciences | | 2 |
| I2: Survey Designs, Experimental Designs | | 2 |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|--|
| Discipline/Field of specialization | : | Agri. Engineering/ Electrical Engineering (Power) relevant experience in Solar / Renewable Energy (01) |
| Place of Posting / Location | : | CAEWRI, NARC Islamabad = 01 |
| Subject Description | | Subject % Weight |
| A: Energy and Power | | 12% |
| A1: Energy crisis in the country | | 3 |
| A2: Power generation and its sources | | 3 |
| A3: Environmental aspects of electric energy generation, atmospheric pollution, oxides of sulphur, oxides of nitrogen, oxides of carbon | | 3 |
| A4: Conversion of energy/ power and Instrument used for its measurement | | 3 |
| B: Renewable Energy | | 18% |
| B1: Sources and Potential of Renewable energy | | 3 |
| B2: Forms of energy and conversion | | 3 |
| B3: Use of Renewable energy for agricultural development | | 3 |
| B4: Bio-mass Resources | | 3 |
| B5: Solar Energy | | 3 |
| B6: Wind Energy | | 3 |
| C: Farm Machinery | | 18% |
| C1: Power Machinery | | 3 |
| C2: Stress Analyzer | | 3 |
| C3: Tillage and traction dynamics | | 3 |
| C4: Harvesting Machinery | | 3 |
| C5: Theory of Manufacturing process | | 3 |
| C6: Operational Research | | 3 |
| D: Channel Hydraulics and Surface water hydrology | | 20% |
| D1: Hydrological Simulation | | 2.5 |
| D2: Hydrological Budget (Surface Water, Soil Water, Ground water) | | 2.5 |
| D3: Ground Water modeling | | 2.5 |
| D4: Irrigation systems design | | 2.5 |
| D5: Sprinkler and trickle irrigation systems | | 2.5 |
| D6: Water resources of Barani Areas | | 2.5 |
| D7: Water conservation structures | | 2.5 |
| D8: Remote sensing and GIS application in water resources | | 2.5 |
| E: Electrical Engineering Techniques | | 12% |
| E1: Power Systems Engineering | | 3 |
| E2: Communication Systems and Networks | | 3 |
| E3: Electronics and Embedded Systems | | 3 |
| E4: Control and Automation Engineering | | 3 |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|---|
| Discipline/Field of specialization | : | Agri. Engineering (01) |
| Place of Posting / Location | : | Arid Zone Research Institute (AZRI) D.I Khan = 01 |
| Subject Description | | Subject % Weight |
| A: Surveying and Leveling | | 3% |
| A1: Surveying instruments uses | | 1.5 |
| A2: Methods and principles of leveling | | 1.5 |
| B: Renewable Energy | | 8.55% |
| B1: Sources and Potential of Renewable energy (Bio-mass Resources, Solar Energy, Wind Energy) | | 2.85 |
| B2: Forms of energy and conversion | | 2.85 |
| B3: Use of Renewable energy for agricultural development | | 2.85 |
| C: Farm Machinery | | 14.25% |
| C1: Power Machinery | | 2.85 |
| C2: Tillage and traction dynamics | | 2.85 |
| C3: Harvesting Machinery | | 2.85 |
| C4: Theory of Manufacturing process | | 2.85 |
| C5: Operational Research | | 2.85 |
| D: Channel Hydraulics and Surface water hydrology | | 39.9% |
| D1: Hydrological Simulation | | 2.85 |
| D2: Hydrological Budget (Surface Water, Soil Water, Ground water) | | 2.85 |
| D3: Ground Water modeling | | 2.85 |
| D4: Irrigation systems design | | 2.85 |
| D5: Sprinkler, trickle, Centre Pivot irrigation systems | | 2.85 |
| D6: Water resources of Barani Areas | | 2.85 |
| D7: Water conservation structures | | 2.85 |
| D8: Remote sensing and GIS application in water resources | | 2.85 |
| D9: Water course design and improvement | | 2.85 |
| D10: Water Harvesting | | 2.85 |
| D11: Conjunctive use of water | | 2.85 |
| D12: Agronomic practices for water management | | 2.85 |
| D13: Water Requirement of Crops | | 2.85 |
| D14: Drainage System | | 2.85 |
| E: Power and Power Measurement | | 14.25% |
| E1: Thermodynamic principles of internal combustion engine | | 2.85 |
| E2: Fuel testing | | 2.85 |
| E3: Fuel-air Ratio Requirement | | 2.85 |
| E4: Diesel Engine | | 2.85 |
| E5: Lubrication and lubrication system | | 2.85 |

| Post Name | : | Scientific Officer (SPS-08) |
|---|--|--|
| Discipline/Field of specialization | : | Agriculture (Plant Protection) (01) |
| Place of Posting / Location | : | SARC, Karachi = 01 |
| Subject Description | | Subject % Weight |
| a. | Biotechnology: Principles & Applications | 6 MCQs from each sub-section of a subject. |
| b. | Biostatistics & Laboratory Mathematics | |
| c. | Bioethics, Bio-security & Bio-safety | |
| d. | Cell and Molecular Biology | |
| e. | Molecular Diagnostics | |
| f. | Molecular Genetics | |
| g. | Bioinformatics | |
| h. | Regulation of Gene Expression | |
| i. | Molecular Basis of Plant Breeding | |
| j. | Proteomics & Genomics | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|--|
| Discipline/Field of specialization | : | Bio-Chemistry (01) |
| Place of Posting / Location | : | NARC, Islamabad = 01 |
| Subject Description | | Subject % Weight |
| a. | Advanced Spectroscopic and Chromatographic Techniques | 6 MCQs from each sub-section of a subject. |
| b. | Nanochemistry | |
| c. | Food, pharmaceutical and Forensic analysis | |
| d. | Characterization of Natural Antioxidants and Essential Oils | |
| e. | Pharmaceutical Chemistry | |
| f. | Drug-Protein and Drug-DNA Interaction | |
| g. | Genomics, Proteomics and Metabolomics | |
| h. | Advanced Bioinformatics | |
| i. | PCR and ELISA Techniques | |
| j. | Alternative Energy Sources | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|--|
| Discipline/Field of specialization | : | Biotechnology / Genomics / Biochemistry (01) |
| Place of Posting / Location | : | SARC, Karachi = 01 |
| Subject Description | | Subject % Weight |
| a. Insect Pathology | | 6 MCQs from each sub-section of a subject. |
| b. Biological Control | | |
| c. Host Plant Resistance | | |
| d. Vectors of Plant Diseases | | |
| e. Advanced Integrated Pest Management | | |
| f. Pesticide Residue Analysis | | |
| g. Microbial Control | | |
| h. Plant Protection and Environment | | |
| i. SPS Measure and Quarantine | | |
| j. Pest Management Informatics | | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|--|--|
| Discipline/Field of specialization | : | Entomology (04) |
| Place of Posting / Location | : | NARC, Islamabad = 03, AZRI, D. I. Khan =01 |
| Subject Description | | Subject % Weight |
| a. | Origin and Phylogeny of Insects | 6 MCQs from each sub-section of a subject. |
| b. | Environmental Entomology | |
| c. | Numerical Taxonomy | |
| d. | Advanced Insect Physiology and Embryology | |
| e. | Insecticide Resistance and Management | |
| f. | Insects in Relation to Plant Diseases | |
| g. | Advances in Biological Control of Insect Pests | |
| h. | Integrated Pest Management | |
| i. | Host Plant Resistance | |
| j. | Pesticide Residue Analysis | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|--|--|
| Discipline/Field of specialization | : | Food Chemistry / Agri. Chemistry (01), Food Technology with research thesis on Food Microbiology (01) and Food Processing (01) |
| Place of Posting / Location | : | NARC, Islamabad = 02, NTHRI, Mansehra = 01 |
| Subject Description | | Subject % Weight |
| a. | Food biochemistry | 6 MCQs from each sub-section of a subject. |
| b. | Physical Properties of Food | |
| c. | Post-Harvest Engineering | |
| d. | Food Process Engineering | |
| e. | Food Engineering Operation | |
| f. | Food Quality Control | |
| g. | Food Storage Engineering | |
| h. | Food Packaging | |
| i. | Renewable Energy Resources for Food Industry | |
| j. | Agricultural Processing Engineering | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|---|
| Discipline/Field of specialization | : | Horticulture (05), Horticulture with research thesis on Fruit Crops (01), Potato Crops (01), Floriculture / Land Scape (01) |
| Place of Posting / Location | : | NARC, Islamabad = 03, NSTHRI, Thatta = 02, NTHRI, Thatta = 02, SARS, Kaghan = 01 |
| Subject Description | | Subject % Weight |
| a. | Advanced Fruit and Vegetable Science | 6 MCQs from each sub-section of a subject. |
| b. | Vegetable and Fruit Breeding | |
| c. | Plant Growth Regulators | |
| d. | Post-Harvest Physiology | |
| e. | Landscape Designs | |
| f. | Plant Tissue Culture | |
| g. | Environmental Horticulture | |
| h. | Prospective Horticultural Crops | |
| i. | Floriculture | |
| j. | Medicinal, Aromatic Plants, spices & condiments | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|---|
| Discipline/Field of specialization | : | Plant Breeding & Genetic (02), Plant Breeding & Genetics with research thesis on Oilseed (02), Maize (02), Wheat (01) and Pulses (02) Crops, Plant Breeding & Genetics with research thesis on Vegetable Crops (02) |
| Place of Posting / Location | : | AZRI, Bahawalpur = 01, NSTHRI, Thatta = 01, NARC, Islamabad = 09 |
| Subject Description | | Subject % Weight |
| a. | Principles of Plant Breeding | 6 MCQs from each sub-section of a subject. |
| b. | Methods in Plant Breeding | |
| c. | Breeding Field Crops | |
| d. | Breeding for Stress Environments | |
| e. | Hybrid Seed Production | |
| f. | Cytogenetics in Crop Plants | |
| g. | Mutation Breeding | |
| h. | Application of Biotechnology in Plant Breeding | |
| i. | Genetics of Plant Disease and Insect Resistance | |
| j. | Biometrical Techniques in Plant Breeding | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|--|--|
| Discipline/Field of specialization | : | Plant Pathology (02) |
| Place of Posting / Location | : | NARC, Islamabad = 01, NTHRI, Mansehra = 01 |
| Subject Description | | Subject % Weight |
| a. | Fungal Systematics | 6 MCQs from each sub-section of a subject. |
| b. | Plant Bacteriology & Nematology | |
| c. | Epidemiology of Plant Diseases | |
| d. | Biochemistry and Physiology of Diseased Plants | |
| e. | Genetics of Plant Pathogens | |
| f. | Seed Pathology | |
| g. | Plant Quarantine and SPS Measures | |
| h. | Advances in Plant Pathology | |
| i. | Plant Virology | |
| j. | Plant Microbe Interactions | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|--|--|
| Discipline/Field of specialization | : | Plant Protection / Plant Pathology / Entomology (01) |
| Place of Posting / Location | : | BARDC, Quetta = 01 |
| Subject Description | | Subject % Weight |
| a. | Biotechnology: Principles & Applications | 6 MCQs from each sub-section of a subject. |
| b. | Biostatistics & Laboratory Mathematics | |
| c. | Bioethics, Bio-security & Bio-safety | |
| d. | Cell and Molecular Biology | |
| e. | Molecular Diagnostics | |
| f. | Molecular Genetics | |
| g. | Bioinformatics | |
| h. | Regulation of Gene Expression | |
| i. | Molecular Basis of Plant Breeding | |
| j. | Proteomics & Genomics | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|--|--|
| Discipline/Field of specialization | : | Plant Taxonomy (01) |
| Place of Posting / Location | : | NARC, Islamabad = 01 |
| Subject Description | | Subject % Weight |
| a. | Diversity of Plants | 6 MCQs from each sub-section of a subject. |
| b. | Plant Systematics, Anatomy and Development | |
| c. | Cell Biology, Genetics and Evolution | |
| d. | Biodiversity and Conservation | |
| e. | Diversity of Vascular Plants | |
| f. | Plant Physiology | |
| g. | Environmental Biology | |
| h. | Plant Taxonomy | |
| i. | Evolutionary Taxonomy | |
| j. | Plant Ecology | |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|--|
| Discipline/Field of specialization | : | Tissue Culture (01) |
| Place of Posting / Location | : | NSTHRI, Thatta = 01 |
| Subject Description | | Subject % Weight |
| a. | Principles of Plant Breeding | 6 MCQs from each sub-section of a subject. |
| b. | Methods in Plant Breeding | |
| c. | Breeding Field Crops | |
| d. | Breeding for Stress Environments | |
| e. | Hybrid Seed Production | |
| f. | Cytogenetics in Crop Plants | |
| g. | Mutation Breeding | |
| h. | Application of Biotechnology in Plant Breeding | |
| i. | Genetics of Plant Disease and Insect Resistance | |
| j. | Biometrical Techniques in Plant Breeding | |

| Post Name | : | Scientific Officer (SPS-08) |
|--|---|---|
| Discipline/Field of specialization | : | Agricultural Economics / Rural Development (02) |
| Place of Posting / Location | : | BARDC, Quetta = 01, MARC, Gilgit = 01 |
| Subject Description | | Subject % Weight |
| <u>Microeconomics</u> Economic systems, price determination, Theory of consumer behaviour, The theory of firm, patterns of market structure, Distribution of income, pricing of the productive factors, theory of production, Wages competition, welfare economics. | | 15% |
| <u>Macroeconomics</u> National income accounting, multiplier and acceleration principles. Consumption and saving function. Theory of national income & employment, Inflationary and deflationary gaps, the Keynesian theory and the under developed countries. Inflation, causes, consequences and remedies. Monetary and fiscal policies, central bank and control of credit, Deficit financing, Foreign exchange fluctuations. Fixed Vs. flexible exchange rates. | | 15% |
| <u>Agricultural/Resource Economics</u> Introduction and importance of agriculture, Structure and characteristics of agriculture in LDCs, Role of agriculture in economic development, Theory of rent and the concept of 'Surplus' Resource use efficiency and technical change in peasant agriculture, Supply response, Green revolution in Pakistan and responses. Present status of Green Revolution in Pakistan: Empirical analysis. Population and food supplies, Food security, Agricultural marketing, Agricultural project planning. Agricultural policy. | | 15% |
| <u>Rural development</u> Concept of general, agricultural and rural development. Scope of rural development in Pakistan, Purpose, objectives, Rural development models in Pakistan. Measures of general, agricultural and rural development, | | 15% |

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|---|------------|
| Research Methodology Research techniques in social sciences and their limitations. Process of field research, Exploratory Research, Communication technique in survey. Art of asking questions and getting quality information. Sample Design; Data Collection Methods, Survey Instruments and Field Procedures; Questionnaire Development, Field Procedures, Personal Interviewing, Telephone Interviewing, Data collection, Choice of Research Technique, nature and use of Secondary Data; Types of Secondary Data Sources, Statistical Sources, Data Presentation and Analysis: Tabulation, Data Presentation, and Data Analysis. Report Writing; Executive summary and abstract of a report. Conclusion and its basis. | 10% |
| Econometrics Basic concepts. Regression theory and multiple regression, Properties of statistical estimators, Inferences and hypothesis testing, Multi-collinearity, Heteroscedascity, Autocorrelation. | 5% |
| Project Planning Monitoring and Evaluation Introduction and significance of monitoring and evaluation, Aspect of project appraisal (economic vs financial analysis), Project Vs. Plans. Project Cycle, Costs and Benefits analysis, Net Present Value, IRR, BCR, Net benefit – Investment Ratio. | 5% |

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|---|---|--------------------------------|
| Post Name | : | Scientific Officer (SPS-08) |
| Major Field | : | Animal Nutrition |
| Discipline/Field of specialization | : | Animal Health / Nutrition (01) |
| Place of Posting / Location | : | BARDC, Quetta = 01 |
| Subject Description | | Subject % Weight |
| A: Classification of Feedstuffs and their Properties | | 25% |
| A1: Succulent roughages: pastures, fodders, tree leaves, root crops, silage. | | 5 |
| A2: Dry roughages: hay, straws and crops residues | | 3 |
| A3: Energy rich concentrates: cereal grains, mill by-products, molasses and roots | | 6 |
| A4: Protein rich concentrates: plants origin protein, animal origin proteins and non-protein nitrogenous compound | | 6 |
| A5: Minerals and vitamin supplements | | 5 |
| B: Nutrients of Feedstuffs | | 15% |
| B1: Nutrients categories (protein, energy, minerals, vitamins and water) | | 5 |
| B2: Nutrients importance and functions | | 3 |
| B3: Digestive tract physiology of monogastric, ruminants and non-ruminants | | 7 |
| C: Feed Manufacturing and Diet Formulation | | 20% |
| C1: Information needed for formulation of balanced feeds | | 3 |
| C2: Feed processing and feed mixing | | 5 |
| C3: Least cost feed formulation | | 2 |
| C4: Feed ingredient purchasing and storage | | 5 |
| C5: Measures for quality control | | 5 |
| D: Feed Evaluation | | 12% |
| D1: Physical | | 2 |
| D2: Chemical | | 4 |
| D3: Biological | | 6 |
| E: Feeding and Nutrition of Livestock and Poultry | | 8% |
| E1: Nutrient requirements of ruminants (young calves, heifers, dairy, breeding bulls) | | 5 |

| Post Name | : | Scientific Officer (SPS-08) |
|---|--|--|
| Major Field | : | Animal Breeding & Genetics (ABG) |
| Discipline/Field of specialization | : | Animal Husbandry (01), Animal Husbandry / DVM (01) |
| Place of Posting / Location | : | AZRI, Umerkot (01), MARC, Gilgit (01) |
| Sl. | Subject Description | Subject % Weight |
| 1 | i) Principles of Selection (Natural Selection ii) Artificial selection iii) Genetic effects of selection iv) System of selection for different kinds of gene action (selection for dominance gene, selection against dominance gene). | 10 |
| 2 | Selection progress over a period of time. | 10 |
| 3 | Genetic correlation among traits pleiotrophy. | 10 |
| 4 | i) Selection on the basis of individuality. ii) Selection on the basis of pedigree iii) Selection on the basis of progeny tests. iv) Probable breeding value v) Accuracy of selection | 40 (8 % of every topic) |
| 5 | Methods of selection i) Tandem method ii) Independent culling methods iii) Selection index | 5 |
| 6 | Inbreeding, crossbreeding, | 5 |
| 7 | Heterosis (Hybrid vigor) | 5 |
| 8 | Pure breeding, out crossing | 5 |
| 9 | Gene frequency. | 5 |
| 10 | Numbers of chromosomes in different breeds/species | 5 |

| Post Name | : | Scientific Officer (SPS-08) |
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| Major Field | : | Animal Reproduction (AR) |
| Discipline/Field of specialization | : | DVM, M.Sc. (Nutrition) / ABG / AR (02), DVM, M.Sc. AR (01) |
| Place of Posting / Location | : | LRI, Turbat = 01, AZRI, Bahawalpur = 01, ASI, NARC = 01 |
| Subject Description | | Subject % Weight |
| A. | Breeding soundness evaluation of buffalo/cattle bulls, buck/ram and camel | 5% |
| B. | Breeding soundness evaluation of buffalo/cows and goat/sheep and camel | 5% |
| C. | Semen collection techniques in buffalo/cattle bulls, buck/ram and camel | 7.5% |
| D. | Semen evaluation techniques in buffalo/cattle bulls, buck/ram and camel | 7.5% |
| E. | Computer assisted semen analysis (CASA) technique for buffalo/cattle bulls | 7.5% |
| F. | Semen preservation techniques in buffalo/cattle bulls, buck/ram and camel | 7.5% |
| G. | Artificial insemination techniques in buffalo, cows, goat, sheep and camel | 7.5% |
| H. | Manipulation/synchronization of estrous cycle, detection of estrus, timing of artificial insemination in buffalo, cows, goat and sheep | 7.5% |
| I. | Super ovulation, embryo collection, evaluation, micromanipulation, preservation and transfer in cows | 5% |
| J. | Transabdominal, vaginal and rectal examination of the reproductive tract of buffalo/cows and goat/sheep using manual and ultrasound techniques | 5% |
| K. | Monitoring and measuring fertility of the herd | 5% |
| L. | Management of pregnancy in buffalo/cows and goat/sheep | 5% |
| M. | Parturition and care of the neonate in buffalo/cows and goat/sheep | 5% |

| Post Name | : | Scientific Officer (SPS-08) |
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| Major Field | : | Meat Technology |
| Discipline/Field of specialization | : | DVM, M.Sc. AP (Meat Tech) (01) |
| Place of Posting / Location | : | ASI, NARC = 01 |
| Subject Description | | Subject % Weight |
| A: Introduction to meat technology | | 16% |
| A1: Meat animals (including poultry) and their status in Pakistan | | 4 |
| A2: Factors influencing growth and development of meat animals | | 4 |
| A3: Economic and nutritional value of beef, lamb and poultry meat | | 4 |
| A4: Grading of beef, lamb and poultry meat | | 4 |
| B: Slaughterhouse operations | | 16% |
| B1: Pre-slaughter care and handling of meat animals | | 4 |
| B2: Stunning and bleeding methods (Islamic, Kosher, Jhatka, others) | | 3 |
| B3: Meat carcass dressing and evaluation | | 3 |
| B4: Post-mortem changes in meat | | 3 |
| B5: Factors affecting quality of meat and poultry | | 3 |
| C: Quality Evaluation of meat and meat products | | 16% |
| C1: Physical tests (pH, temperature, water activity (aw) and water binding capacity | | 4 |
| C2: Meat texture measurement | | 4 |
| C3: Chemical analysis of meat and meat products (protein, fat, water, minerals, etc.) | | 4 |
| C4: Microbiological sampling and testing of meat and meat products | | 4 |
| D: Preservation and processing of beef, lamb, poultry and fish | | 20% |
| D1: Chilling and freezing of meat and meat products | | 4 |
| D2: Cured and smoked meat products | | 4 |
| D3: Canning of meat, fish and poultry | | 4 |
| D4: Dried meat, fish and poultry products | | 3 |
| D5: Preparation of sausages | | 2 |
| D6: Meat, poultry and fish by-products such as gelatin | | 3 |
| E: Regulation of meat trade | | 12% |
| E1: Food rules pertaining to meat in Pakistan | | 3 |
| E2: Codex alimentarius standards for meat, poultry and fish products | | 3 |
| E3: Meat packaging | | 3 |
| E4: Meat hygiene during transport | | 3 |

| Post Name | : | Scientific Officer (SPS-08) |
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| Major Field | : | Aquaculture & Fisheries |
| Discipline/Field of specialization | : | Fisheries (01) |
| Place of Posting / Location | : | MARC, Gilgit = 01 |
| Subject Description | | Subject % Weight |
| A: Significance of fish and fisheries | | 10% |
| A1: Fish as food | | 5% |
| A2: Total fish production in Pakistan and its export | | 5% |
| B. Hatchery Management of trout/Carps | | 25% |
| B1: Brood stock management | | 10% |
| B2: Induced breeding of trout/carps | | 10% |
| B3: Larval rearing | | 5% |
| C: Pond Management | | 40% |
| C1: Pond preparation and fish stocking | | 10% |
| C2: Fish feeding (Natural and artificial Diet) | | 10% |
| C3: Water quality management | | 10% |
| C4: Fish diseases and control | | 10% |
| D: Trout Culture | | 5% |
| D1: Troutculture in Northern areas of Pakistan | | 5% |

| Post Name | : | Scientific Officer (SPS-08) |
|---|---|--|
| Discipline/Field of specialization | : | Agri. Engineering / Energy in Agriculture (02) |
| Place of Posting / Location | : | AZRI, Umerkot = 01, AZRI, Bahawalpur = 01 |
| Subject Description | | Subject % Weight |
| <p><u>ADVANCED POWER AND MACHINERY:</u> Development of Farm Machinery: History of tillage, systems of farming, developments during different centuries, design of plows, important inventions. Design of Machinery: Design process, creative design, theory of creativity, new designs, redesign of machines, role of companies in research and design, use of computers in machine design. Tractor mechanics: Mechanics of tractor operating on a yielding soil, dynamic weight transfer. Similitude in Tillage: Dimensional analysis, selection of variables, tillage tool models, soil bins, true and distorted models. Separation Techniques: Mechanism of separation (mechanical), pneumatic manual, electronic and fluid separation, size differences shape differences, density differences, seed sorter, sorting and separation of fruits and vegetables from stone and dirt, size grading, drag forces. Suspension velocities, separation of potatoes from stones and dirt, separation of animal waste from foreign material, separation in combine harvesters, conveyers and elevators. Metering Devices: Design parameters, fluid meter, metering systems used in agricultural machines (such as sprayers, planters, fertilizer spreaders) metering devise for silage, hay, manure, finely ground feed. Design and Development of Farm Machinery: Use of above principles and concepts in the design and development of tillage implements, planting and fertilizing equipment, plant protection equipment and harvesting machinery.</p> <p><u>Metallurgy and Workshop Practices:</u> Production and properties of common engineering materials: Ferrous metals, iron ores, properties and uses of pig iron, cast iron, wrought iron, steel, standard processes of manufacturing of Iron and steel, open hearth process, basic oxygen processes, production of ingots. Composition/ properties and uses of plastics, rubber, fibre glass and composite materials. Alloy steel and Irons: Effect of alloying elements, the AISI/SAE alloy steel and their identification, corrosion resistant steel, steel for high temperature services, alloy steel. Non-ferrous metals: Properties and uses of copper, aluminum, zinc, tin, nickel, and lead. Non-ferrous alloys, copper alloys. Aluminum alloys, zinc base alloys, nickel base alloys. Lead-tin alloys, iron-carbon equilibrium diagram. Heat treatment: Heat treatment theory and process, heat treatment of steel, annealing, hardening, tempering, normalizing, surface hardening, quenching, heat treatment equipment. Welding: Definition, types of welding process, survey of welding equipment. Arc welding; Current rating, welding materials, arc welding processes, inspection and testing of welded joints. Gas welding; Welding flames and materials, cutting of metals, gas welding processes. Foundry: Definition, importance, advantages and disadvantages of foundry, casting, hand moulding tools, characteristics of moulding sand, foundry cores, properties of core and, crucibles, handling and care, copula furnace, construction, zone of copula and its advantages. Safety and First Aid: Safety in the shop, mechanical and other accidents, safety devices, safety methods, first aid equipment and methods, care and order in the workshop.</p> | | 10% |
| Engineering Thermodynamics: | | 15% |

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| <p>Laws of perfect gases: The two laws of thermodynamics, the heating of gases, equations for different types of heating methods.</p> <p>Air cycles: Cycles of operation, air standard efficiency of a cycle, reversible process, reversible cycles, reversibility and efficiency, Carnot cycle, Otto cycle, diesel cycle, mean effective pressure. Entropy of gases: Entropy and heat, T-S diagrams, Carnot, Otto, diesel and dual combustion cycles on T-S diagrams. Air compressors: functions, compressor types, reciprocating and rotary compressors, single and multistage compressors, cylinder clearance, work done, compressor efficiency. Compound expansion: advantages of compound expansion, tandem type of two- cylinder compound engine, receiver type compound engine; combined indicator diagram for compound engine. Fuels: Combustion of fuels, properties of fuels – viscosity, pour point, flash point, calorific value, API gravity, conversion of volumetric analysis, analysis by weight, weight of carbon in burnt gases, weight of air required for complete combustion of fuel, weight of flue gases per pound of fuel burnt, weight of excess air supplied, method of analyzing flue gases, heat carried away by flue gases, volumetric analysis of a gas, air fuel ratio for I.C. Engine. Refrigeration: Co efficient of performance, units of refrigeration, air compression refrigeration, vapor compression refrigeration, refrigeration cycles, rating, quality of refrigerant and general considerations, components of refrigeration system, heat pumps.</p> | |
| <p>Instrumentation and Measurements:</p> <p>Basic terminology and concepts related to instruments, instrument behavior application of instrumentation, functional elements of instruments, basic terms related to instrumentation, such as threshold, resolution, accuracy, precision, sensitivity, response and error of instrument, uncertainty analysis, and least square techniques, static and dynamic characteristics of instrumentation, signal conditioning and recording devices. Principles and theory of electrical instruments: potentiometer, wheat stone bridge, strain analysis; strain measurement; strain gauges, types and their applications.</p> <p>Displacement, velocity and acceleration measurement: sensors and transducers, displacement measurement sensors; potentiometer, LVDT, capacitance sensors, piezoelectric sensors, velocity and acceleration sensors. Force and Torque Measurements: Force Measurements; Load cells. Torque measurements; torque cells. Pressure Measurement: Gauge, vacuum and absolute pressure, pressure measuring devices. Measurement of Temperature: Resistance thermometers, thermocouples and radiation methods. Fundamentals of mechatronics: Introduction to electronics and sensors used in agricultural machinery, interfacing the machine and computers for response, controls and data logging, computer simulation of mechanical system.</p> | 10% |
| <p>Boiler Engineering and Power Plants:</p> <p>Boiler Engineering: Introduction, types, construction, mounting, accessories steam cycle, steam nozzles, supersaturated expansion in nozzles, heat drop in saturated and supersaturated expansion, steam injector, steam turbine, work done, velocity diagram, work done in blading, velocity compounding, pressure compounding, impulse turbine, heat account for boiler and turbine, amount of fuel burnt, acceptance tests, analysis and calorific value of fuel, analysis of flue gases, amount of steam produced, pressure and quality of steam, design of boiler and pressure control system devices. Properties of steam, enthalpy of water, dryness fraction, enthalpy of wet steam, use of steam tables, super heated steam, internal energy of steam.</p> <p>Power Plants: Steam Plants: Introduction, general layout of modern steam plants, steam generators, engines and auxiliary components, back pressure and pass out turbines, deviation of actual cycle from ideal, turbine pump and condenser.</p> <p>Gas Turbine and Power Plants: Introduction, the gas turbine cycle, modification in basic cycle, isentropic efficiency of compressors and turbines, intercooling and reheating, explosion type gas turbine with solar heating, development and improvement in gas turbine. Jet propulsion plant, comparison of steam and gas power plants.</p> | 10% |
| <p>Energy Resources and Management:</p> <p>Introduction: Overview of various types of energy sources (renewable and Non-renewable) and its use in the country. Energy management/audit with reference to: fertilizer (organic/inorganic), chemical controls, irrigation, mechanization, post harvest system and food consumption. Technological alternative for efficient energy management in agriculture.</p> <p>Energy reclamation from agricultural crops/wastes: Energy from biomass production. Biogas, various types of biogas plants. Design, installation, operation and management of biogas plants.</p> <p>Solar Energy: Solar system, solar radiation, basic earth-sun angles, time derived solar angles, estimation of solar radiation, radiation measurements, solar radiation collectors, various uses of solar energy in domestic/agriculture, solar energy conservation.</p> <p>Wind energy: Wind energy potential in the country. Application of wind energy (domestic / agriculture). Importance of vertical and horizontal axis for wind mills, wind operated pumps for water lifting.</p> | 15% |
| <p>Farm Power:</p> <p>Objective: Providing instructions relating components of I.C. engine, tractor components and its mechanics</p> <p>Contents:</p> <p>Introduction: History of engine development, engine cycles, principles of operation, types of engines.</p> <p>Principal parts of engine: Functions, construction, cylinder, cylinder heads, liner, crank case, piston, connecting rod, crank shaft, clutch, flywheel, valves and their operation, valve mechanism.</p> <p>Fuels and combustion: Types of engine fuels, fuel tests and their significance, gasoline tests, antiknock test, octane number, volatility, Reid vapor pressure, Sulphur content, gun content, heat values, gasoline additives.</p> | 15% |

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| <p>pump.</p> <p>Ignition system: Types of ignition, spark, magneto and compression ignition, induction coils, distributor, spark plug, contact-breaker points, condenser, trouble shooting.</p> <p>Cooling system: Types, principle of operation, parts of air/water cooling system, line diagram, radiator, thermostat, water pump, fan, engine heating, repair and maintenance, types of coolants.</p> <p>Lubrication system: Types, principle of operation, components of lubrication systems, line diagram, types of lubricants, trouble shooting.</p> <p>Electrical System: A.C. and D.C. voltage, alternator/dynamo, battery, battery charging and maintenance, self starter, electrical gauges and controls, line diagram, repair and maintenance.</p> <p>Intake and exhaust system: Air intake system, air cleaner, super charger, turbo charger, inter-cooling, and construction of intake and exhaust manifolds, mufflers, flue gases.</p> <p>Mechanics of the Farm Tractor Chassis: Force Analysis, Soil reaction, Draw bar pull, Stability of tractors, Tipping and lateral stability</p> <p>Clutch and Brakes: Transmission, Differentials, Power take-off, Pulley drives, Power lift and hydraulic controls. Tractors tests and performance</p> <p>Farm Management: Farm planning for efficient use of resources and attainment of business goals and farm accounting.</p> | |
| <p><u>Machine Design:</u></p> <p>Objectives:</p> <p>Discussion of design and loading of Power Transformers and Induction motors is introduced and electrical equipment installation; commissioning, testing and troubleshooting practices are discussed.</p> <p>Contents:</p> <p>Introduction: Meaning of Mechanical Engineering Design, Phases of design, Design considerations, Safety and product reliability, Codes and standards, evaluation and presentation</p> <p>Design of Simple Machine Components: Design of shafts, torsion of circular shafts, horsepower transmitted by the shafts, design of clutches, bearings, gears, flange couplings, pulleys and connecting rod</p> <p>Design of Fasteners and Connections: Different types of fasteners. Thread standards and definitions, Mechanics of power screws. Bolts strength and selection of units, Bolt preload, torque requirement, Bolted, riveted and welded joints loaded in shear, Keys pins, and retainers</p> <p>Elements of Rotary Power Transmission: Belts, Stresses in belts, Chain and sprocket drives, Gears drives, Flexible shafts, Bearings</p> | 10% |
| <p><u>Farm Structures & Materials:</u></p> <p>Objectives:</p> <ul style="list-style-type: none"> • To develop ability of students to understand and carry out specified farm structure • To familiarize about the characteristics of material used in agricultural engineering related structured <p>Contents:</p> <p>Heat flow through Walls Insulation: Rate of heat transmission through building materials, conductance, combined conductance coefficient, Equation for heat flow through non-homogenous walls, combined ceiling and roof coefficient.</p> <p>Ventilation: Air flow and quantity of moisture, Air flow required in heat transfer, Estimating Air flow required to prevent condensation, Air flow required to maintain prescribed chemical composition, Heat balance equation, Exposure ratio, Ventilating systems, Ventilation by Wind forces, Stack ventilation Systems, Construction practices, Forced draft systems.</p> <p>Dairy Building: Functional planning, Environment, Sanitation, Space requirements for animals and traffic, arrangement of space, Other considerations, Milking Parlors, Pen vs Stall Barns, Storage or feed, Milk and manure etc, Insulation and ventilation.</p> <p>Poultry Housing: Functional planning, Production practices, Environment, Space requirements, Arrangement or space, Insulation and ventilation, other considerations.</p> <p>Storage of Fruits and Vegetable Crops: Condition for storage, Refrigerated vs Common Storage, Economic aspects of storage, Characteristics of Common storage, Refrigerated storage, Refrigerating Load, Modified Atmosphere Storage, Types of Evaporators, Coil Temperature vs Relative Humidity and Equipment capacity, Air movement, Storage management.</p> <p>Storage of Grains: Destructive agents, Respiration of grains, Indices of quality, Moisture and Temperature changes in stored grains, Moisture properties of grains, Functional requirements, Conditioning moist grains, Storage structure, Equipment for grain handling and processing.</p> | 15% |

| Post Name | : | Scientific Officer (SPS-08) |
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| Discipline/Field of specialization | : | Agri. Engineering / Food Engineering / Postharvest Engineering (03) |
| Place of Posting / Location | : | ABEI, NARC = 03 |
| Subject Description | | Subject % Weight |
| <p><u>ADVANCED POWER AND MACHINERY:</u> Development of Farm Machinery: History of tillage, systems of farming, developments during different centuries, design of plows, important inventions. Design of Machinery: Design process, creative design, theory of creativity, new designs, redesign of machines, role of companies in research and design, use of computers in machine design. Tractor mechanics: Mechanics of tractor operating on a yielding soil, dynamic weight transfer. Similitude in Tillage: Dimensional analysis, selection of variables, tillage tool models, soil bins, true and distorted models. Separation Techniques: Mechanism of separation (mechanical), pneumatic manual, electronic and fluid separation, size differences shape differences, density differences, seed sorter, sorting and separation of fruits and vegetables from stone and dirt, size grading, drag forces. Suspension velocities, separation of potatoes from stones and dirt, separation of animal waste from foreign material, separation in combine harvesters, conveyers and elevators. Metering Devices: Design parameters, fluid meter, metering systems used in agricultural machines (such as sprayers, planters, fertilizer spreaders) metering device for silage, hay, manure, finely ground feed.</p> | | 15% |

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| <p>machinery.</p> <p>Metallurgy and Workshop Practices: Production and properties of common engineering materials: Ferrous metals, iron ores, properties and uses of pig iron, cast iron, wrought iron, steel, standard processes of manufacturing of Iron and steel, open hearth process, basic oxygen processes, production of ingots. Composition/properties and uses of plastics, rubber, fibre glass and composite materials. Alloy steel and Irons: Effect of alloying elements, the AISI/SAE alloy steel and their identification, corrosion resistant steel, steel for high temperature services, alloy steel.</p> <p>Non-ferrous metals: Properties and uses of copper, aluminum, zinc, tin, nickel, and lead. Non-ferrous alloys, copper alloys. Aluminum alloys, zinc base alloys, nickel base alloys. Lead-tin alloys, iron-carbon equilibrium diagram. Heat treatment: Heat treatment theory and process, heat treatment of steel, annealing, hardening, tempering, normalizing, surface hardening, quenching, heat treatment equipment. Welding: Definition, types of welding process, survey of welding equipment. Arc welding; Current rating, welding materials, arc welding processes, inspection and testing of welded joints. Gas welding; Welding flames and materials, cutting of metals, gas welding processes. Foundry: Definition, importance, advantages and disadvantages of foundry, casting, hand moulding tools, characteristics of moulding sand, foundry cores, properties of core and, crucibles, handling and care, copula furnace, construction, zone of copula and its advantages. Safety and First Aid: Safety in the shop, mechanical and other accidents, safety devices, safety methods, first aid equipment and methods, care and order in the workshop.</p> | 10% |
| <p>Engineering Thermodynamics:</p> <p>Heating and expansion of gases; Units of heat, gases and vapors, constant volume and constant pressure, P-V diagram, specific heat of gases, internal energy of gas, law of conservation of energy, methods of heating and expanding gases and vapors, work done by gas in expanding.</p> <p>Laws of perfect gases: The two laws of thermodynamics, the heating of gases, equations for different types of heating methods. Air cycles: Cycles of operation, air standard efficiency of a cycle, reversible process, reversible cycles, reversibility and efficiency, Carnot cycle, Otto cycle, diesel cycle, mean effective pressure. Entropy of gases: Entropy and heat, T-S diagrams, Carnot, Otto, diesel and dual combustion cycles on T-S diagrams. Air compressors: functions, compressor types, reciprocating and rotary compressors, single and multistage compressors, cylinder clearance, work done, compressor efficiency. Compound expansion: advantages of compound expansion, tandem type of two- cylinder compound engine, receiver type compound engine; combined indicator diagram for compound engine. Fuels: Combustion of fuels, properties of fuels – viscosity, pour point, flash point, calorific value, API gravity, conversion of volumetric analysis, analysis by weight, weight of carbon in burnt gases, weight of air required for complete combustion of fuel, weight of flue gases per pound of fuel burnt, weight of excess air supplied, method of analyzing flue gases, heat carried away by flue gases, volumetric analysis of a gas, air fuel ratio for I.C. Engine. Refrigeration: Co efficient of performance, units of refrigeration, air compression refrigeration, vapor compression refrigeration, refrigeration cycles, rating, quality of refrigerant and general considerations, components of refrigeration system, heat pumps.</p> | 15% |
| <p>Instrumentation and Measurements:</p> <p>Basic terminology and concepts related to instruments, instrument behavior application of instrumentation, functional elements of instruments, basic terms related to instrumentation, such as threshold, resolution, accuracy, precision, sensitivity, response and error of instrument, uncertainty analysis, and least square techniques, static and dynamic characteristics of instrumentation, signal conditioning and recording devices. Principles and theory of electrical instruments: potentiometer, wheat stone bridge, strain analysis; strain measurement; strain gauges, types and their applications.</p> <p>Displacement, velocity and acceleration measurement: sensors and transducers, displacement measurement sensors; potentiometer, LVDT, capacitance sensors, piezoelectric sensors, velocity and acceleration sensors. Force and Torque Measurements: Force Measurements; Load cells. Torque measurements; torque cells. Pressure Measurement: Gauge, vacuum and absolute pressure, pressure measuring devices. Measurement of Temperature: Resistance thermometers, thermocouples and radiation methods. Fundamentals of mechatronics: Introduction to electronics and sensors used in agricultural machinery, interfacing the machine and computers for response, controls and data logging, computer simulation of mechanical system.</p> | 15% |
| <p>Agricultural Processing Engineering:</p> <p>Introduction: industrial processes, value addition, structure and composition of food grains and fruits, engineering properties of agricultural materials - physical, mechanical and thermal properties. Pumps: types of pumps used in the industries, pump selection, pump laws and performance, viscosity effects. Fans: Classification as to type and design of fans, fan theory, fan performance, factors affecting fan selection, general performance and laws, fans in series and parallel, compression effect. Material handling and transportation equipment: Belt conveyors, chain conveyors, bucket elevators, pneumatic conveyors, gravity conveyors, augers, and trailer/trucks. Cleaning, Sorting and grading: Grade factors, washing types and methods of washing, sorting fruits and vegetables, types of sorters, cleaning and sorting, grading, nuts and seeds, types of grain cleaners/sorters, aerodynamics of small Practicals, types of separators, machine vision and its applications in grading. Size reduction: Size reduction and screen analysis of solid foods. Types of size reduction mills; fineness modulus, value of ground feed, size relationships, energy requirements, size reduction procedures, reducing devices, performance and characteristics of size reduction devices, mixing and types of mixers. Drying: Drying and dehydration, moisture content determinations; primary methods, equilibrium moisture content, drying processes, constant rate period, falling rate period, falling rate drying mechanism, dynamics of equilibrium moisture</p> | 15% |

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| <p>Objective: Providing instructions relating components of I.C. engine, tractor components and its mechanics</p> <p>Contents: Introduction: History of engine development, engine cycles, principles of operation, types of engines. Principal parts of engine: Functions, construction, cylinder, cylinder heads, liner, crank case, piston, connecting rod, crank shaft, clutch, flywheel, valves and their operation, valve mechanism. Fuels and combustion: Types of engine fuels, fuel tests and their significance, gasoline tests, antiknock test, octane number, volatility, Reid vapour pressure, sulphur content, gun content, heat values, gasoline additives. Engine emissions and their analysis. Fuel System: major components of fuel systems (petrol / diesel), carburettor, fuel injection pump, injector/nozzles, electronic fuel injection, governing system, trouble shooting, calibration of fuel injection pump. Ignition system: Types of ignition, spark, magneto and compression ignition, induction coils, distributor, spark plug, contact-breaker points, condenser, trouble shooting. Cooling system: Types, principle of operation, parts of air/water cooling system, line diagram, radiator, thermostat, water pump, fan, engine heating, repair and maintenance, types of coolants. Lubrication system: Types, principle of operation, components of lubrication systems, line diagram, types of lubricants, trouble shooting. Electrical System: A.C. and D.C. voltage, alternator/dynamo, battery, battery charging and maintenance, self starter, electrical gauges and controls, line diagram, repair and maintenance. Intake and exhaust system: Air intake system, air cleaner, supper charger, turbo charger, inter-cooling, and construction of intake and exhaust manifolds, mufflers, flue gases. Mechanics of the Farm Tractor Chassis: Force Analysis, Soil reaction, Draw bar pull, Stability of tractors, Tipping and lateral stability Clutch and Brakes: Transmission, Differentials, Power take-off, Pulley drives, Power lift and hydraulic controls. Tractors tests and performance Farm Management: Farm planning for efficient use of resources and attainment of business goals and farm accounting.</p> | |
| <p>Post Harvest Engineering: Introduction: Importance of cereal grains and other food products, food preservation, the food cycle, important factors of food production. Properties of Cereals: Cereal grains and their structure, physical properties, biochemical properties. Factors Affecting Grain Stability: Physical factors, biological factors, chemical factors, thermal factors. Post harvest Losses: Forms and measurement of post harvest losses, measures to control losses. Pre-storage handling of Food Products: Physiological maturity, harvesting, threshing, collection, transportation, and receiving system. Drying and Aeration: principle of drying, solar drying, artificial drying, types of dryers, components of dryers, factors affecting drying rate, natural aeration, artificial aeration, methods of aeration, air conditioning/refrigeration. Storage: Basic requirements for a storage structure, classification of storage structure, types of Public storage structures, storage structure design, temporary and permanent storage facilities, Non-conventional storage facilities, considerations in selecting type of storage structure, problems in grain storage, stored grain pests, control methods. Grades and Standards: Importance of grades and standards, food quality, establishing grades and standards, assessing the grade, grade factors and their importance, grading equipment, representative sampling, WTO and its regulation regarding quality control.</p> <p>Farm Structures & Materials: Objectives:</p> <ul style="list-style-type: none"> To develop ability of students to understand and carry out specified farm structure To familiarize about the characteristics of material used in agricultural engineering related structured <p>Contents: Heat flow through Walls Insulation: Rate of heat transmission through building materials, conductance, combined conductance coefficient, Equation for heat flow through non-homogenous walls, combined ceiling and roof coefficient. Ventilation: Air flow and quantity of moisture, Air flow required in heat transfer, Estimating Air flow required to prevent condensation, Air flow required to maintain prescribed chemical composition, Heat balance equation, Exposure ratio, Ventilating systems, Ventilation by Wind forces, Stack ventilation Systems, Construction practices, Forced draft systems. Dairy Building: Functional planning, Environment, Sanitation, Space requirements for animals and traffic, arrangement of space, Other considerations, Milking Parlors, Pen vs Stall Barns, Storage or feed, Milk and manure etc, Insulation and ventilation. Poultry Housing: Functional planning, Production practices, Environment, Space requirements, Arrangement or space, Insulation and ventilation, other considerations. Storage of Fruits and Vegetable Crops: Condition for storage, Refrigerated vs Common Storage, Economic aspects of storage, Characteristics of Common storage, Refrigerated storage, Refrigerating Load, Modified Atmosphere Storage, Types of Evaporators, Coil Temperature vs Relative Humidity and Equipment capacity, Air</p> | 15% |

