5.1 FARM MACHINERY

RATIONALE

The topics covered in the subject will enable the students to understand the basic principles, construction and working of farm machinery for different crops. This will also enable them to select appropriate machinery, use, repair and maintain the same. This knowledge will be highly useful in running an Agro Service Centre for Farm Machinery.

DETAILED CONTENTS

1. Introduction (3 hrs)
   Importance of farm mechanization. Classification of machinery & implements used on farm for raising crops.

2. Primary Tillage Equipment (5 hrs)
   Introduction to various primary tillage implements, functions, constructional details, adjustments and study of different plough viz. mould board plough, disc plough, rotary tiller/ rotavator and chisel plough.

3. Secondary Tillage Implements (7 hrs)
   Introduction to various secondary tillage implements. Study of cultivators & harrows, their types, functions & constructional details, clod crusher & planks.

4. Seeding and Planting Equipment (12 hrs)
   Introduction to various seeding and planting machinery for various crops. Study of components & functions of seed drills & planters; Concept of minimum tillage technology including zero till, strip till drill, raised bed planters and other conservation agriculture machinery.
   Calibration of seed drills and planters.

5. Interculture Tools/Weeding Tools (4 hrs)
   Introduction to various tools used for interculture, study of their functions and constructional details.

6. Fertilizer/Manure Application Equipment (4 hrs)
   Familiarization with the manure spreaders & granular fertilizer spreading equipment, study of their functions and importance.

7. Plant Protection and Plant Care (6 hrs)
   Familiarization with various type of dusters and sprayers. Study of their constructional
details, function & principle of operation. Study of various types of the nozzles used in the sprayers and calibration of sprayers.

8. Harvesting and Threshing Machinery (16 hrs)

Familiarization with harvesting machines for various crops e.g. hay/forage harvesters, vertical conveyer reapers, cotton pickers, corn harvester, potato diggers, ground nut diggers, sugarcane harvesters.

Fruits and vegetables harvesting.

Flail mowers

Constructional details & principles of working.

Study of power threshers including axial flow thresher - main components, function and constructional details. Safety requirements in threshing operations.

Introduction to combine harvesters and straw combines and study of their operation and power transmission system.

Losses during harvesting and threshing operations and their management.

9. Land Development Machinery (6 hrs)

Familiarization with various land development implements e.g. leveler including laser land leveler, land planer, scraper, ridger. Study of their functions and adaptability.

10. Miscellaneous Equipment (12 hrs)

Introduction to different equipment used for special operation e.g. puddlers, cage wheels, straw chopper, sub soiler, stubble stavers, straw field baler and densifiers. Introduction to various horticulture tools, post tool digger, tree pruners etc.

11. Economics of Equipment (7hrs)

Field capacities, field efficiency, cost analysis and selection of farm machinery, BIS Standards of Farm Machinery and Specifications.

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RATIONALE
This subject provides knowledge and develops skills on various machine operations viz capstan and turret Lathe, milling, grinding, gear manufacturing, broaching and automatic machines which is very essential for Mechanical diploma holders to work in manufacturing industries.

DETAILED CONTENTS
1. Capstan and Turret Lathe
   1.1 Concept of capstan and turret lathe
   1.2 Principal parts of capstan and turret lathe
   1.3 Turret indexing mechanism, Bar feeding mechanism
   1.4 Work holding devices – Jaw and collet chucks
   1.5 Tool holding devices – Slide tool holder, Knee tool holder, knurling tool holder, recessing tool holder, form tool holder, tap and die holder, Vsteady box tool holder, roller steady, box tool holder, bar stops.
   1.6 Introduction to turret tooling layout
   1.7 Comparison of capstan, turret and conventional lathe.

2. Milling
   2.1 Specification and working principle of milling machine
   2.2 Classification, brief description and applications of milling machines
   2.3 Details of column and knee type milling machine
   2.4 Milling machine accessories and attachment – Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, spiral milling attachment, slotting attachment and rack milling attachment.
   2.5 Milling methods - up milling and down milling
   2.6 Identification of different milling cutters and work mandrels
   2.7 Work holding devices
   2.8 Milling operations – face milling, angular milling, form milling, straddle milling and gang milling.
   2.9 Cutting speed and feed, simple numerical problems.
   2.10 Indexing on dividing heads, plain and universal dividing heads.

3. Grinding
   3.1 Purpose of grinding
   3.2 Various elements of grinding wheel – Abrasive, Grade, structure, Bond
   3.3 Common wheel shapes and types of wheel – built up wheels, mounted wheels and diamond wheels. Specification of grinding wheels as per BIS.
   3.4 Truing, dressing, balancing and mounting of wheel.
   3.5 Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
   3.6 Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centreless grinder, tool and cutter grinder.
   3.7 Selection of grinding wheel

4. Gear Manufacturing Processes
   4.1 Gear hobbing
   4.2 Gear shaping

5. Broaching
   5.1 Introduction
   5.2 Types of broaching machines – Single ram and duplex ram horizontal type,
vertical type pull up, pull down, push down.
5.3 Elements of broach tool, broach teeth details – nomenclature, types, tool material.

**PRACTICAL EXERCISES**
1. Exercise on Turrent/ Capstan Lathe to prepare a job of given dimensions
2. To produce a rectangular block by face milling and prepare a slot on one face.
3. Exercise on milling- slab milling, Gang milling and straddle milling
4. To produce a gear by indexing device on a milling machine
5. Preparing job on following machines:-
   a) Surface grinder
   b) Cylindrical grinder
6. Exercise on tool and cutter Grinder
   a) To grind Lathe tools
   b) To grind a drill bit
   c) To grind a milling cutter

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5.3 MECHANICS OF VEHICLE

RATIONALE

Understanding of basic mechanism and motions, power transmission, vehicle braking, vibrations and balancing are essential for diploma holder in automobile Engineering and hence this subject.

DETAILED CONTENTS

1. Simple Mechanism (4 hrs)
   1.1. Definition of link, kinematic pair, kinematic chain, mechanism, inversion and machines
   1.2. Simple examples of mechanism with lower pairs, four bar chain, slider crank chain, double slider crank chain, higher pairs

2. Motion of Various Types (8 hrs)
   2.1. Displacement, velocity and acceleration of piston.
   2.2. Angular velocity and angular acceleration of connecting rod. Calculations of piston effort and crank effort at different angles
   2.3. Turning moment diagrams with reference to internal combustion engines. Fly wheel - its types, weight and moment of inertia
   2.4. Fluctuation of energy for fly wheel
   2.5. Speed control by governor

3. Power Transmission (8 hrs)
   3.1. Flat belt, V belt and chain drives
   3.2. Ratio of tension on two sides of the belt with and without centrifugal tension
   3.3. Horse power transmitted and condition for maximum horsepower transmitted
   3.4. Velocity ratios transmitted by belts
   3.5. Gear nomenclature and types of gear- simple, compound and epicyclic gear box.

4. Vehicle in Motion (6 hrs)
4.1. Air resistance, grade resistance, and rolling resistance

4.2. Tractive effort, traction, Inertia load, Draw bar pull and power required to propel a vehicle.

4.3. Calculations of acceleration and tractive effort required in case of rear wheel drive and four wheel drive.

4.4. Centrifugal force and its effect on vehicle stability on banked and unbanked road

4.5. Aerodynamics of vehicle

5. Vehicle Braking (8 hrs)

5.1. Braking friction and limits of braking.

5.2. Retardation and Braking force, calculations in case of front wheel, rear wheel and all wheel braking.

5.3. Weight transfer during braking and its effect

5.4. Braking efficiency, stopping distance and stopping time

6. Balancing (4 hrs)

6.1. Static and dynamic balancing, simple numerical problems related to static balancing

7. Vibrations (4 hrs)


LISTS OF PRACTICALS:

1. Study of mechanism.

2. Study of speed governors.

3. Study of gears, belts and pulleys.

4. Study of vehicle brakes.

5. Study of balancing machine.
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RATIONALE
This subject imparts the practical skill and knowledge related to vehicle repair and maintenance to the students. Practicals such as overhauling of different vehicle systems are kept in this subject. Practicals related to special auto machines, engine reconditioning F.I. Pump calibration etc. are included in this subject. So that students gain knowledge to start their own work.

(PRACTICALS)
1. Study of layout of Auto shop and Garage.
2. Study and operations of the auto shop equipment.
3. Study and uses of vehicle tools.
4. Prepare measurement sheet for cylinder, piston, connecting road and crank shaft.
5. Cylinder Liner removing and fitting, Boring the cylinder by boring machine and Lapping and honing of the cylinder.
7. Repairing of cylinder block surface, Boring of main journal, cam shaft journal by line boring machine.
8. Checking of twist and bend with the help of connecting rod alignment machine and rectifying the defects.
9. Inspection of crank shaft for bend, taper and ovality of main journal and crank pins, Grinding of crank shaft by crank shaft grinder.
10. Overhauling and testing of F.I. pump with the help of F.I. pump calibration machine.
17. Complete overhaul of Propeller shaft “U” joints and Centre bearing.
20. Complete tune up of Engine by tuning equipment.
22. Repairing. Servicing and testing of Radiator.

Note - Visit to Nearby Auto Workshop for conducting those practical
RATIONALE
Students are required to supervise and handle specialized machines and equipments like CNC machines. This subject aims at development of knowledge and skill about CNC machines tools, equipment and use of high tech. machines

DETAILED CONTENTS
1. Automation
   1.1 Definition
   1.2 Types of Automation
   1.3 Need of Automation
   1.4 Advantages of Automation

2. Introduction to Numerical Control
   Computer applications in manufacturing, basic concepts of NC, CNC, DNC and adaptive control, advantages and application of CNC machines in industry

3. Components of CNC System
   Machine control unit, NC control and PLC control system, introduction to C axis and special constructional requirements of CNC machines, machine bed, slide ways, bolt, screw and nut assembly, lubrication and cooling system, spindle and spindle motors, axis drive motors, automatic tool changers, multiple pallets, swarf removal mechanisms and safety provision

4. Part Programming
   Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rotational components, part programming using canned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation

5. Common Problems in CNC Machines
   Common problems in mechanical, electrical, pneumatic, electronic and PC components of CNC machines, diagnostic study of common problems and remedies, use of on-time fault finding diagnosis tools in CNC machines

6. Other Automation Equipment
   CNC turning centres, CNC vertical and horizontal machining centre, CAM, introduction to flexible manufacturing system (FMS) and robotics

LIST OF PRACTICALS
1. Study the constructional details of CNC lathe.
2. Study the constructional details and working of following:-
   - Automatic tool changer and tool setter
   - Multiple pallets
   - Swarf removal system
   - Safety devices
3. Develop a part programme for following lathe operations:
   - Plain turning and facing operations
   - Taper turning operations (internal and external)
   - Thread cutting operations (internal and external)
4. Preparation of preventive maintenance schedule for CNC machine.
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