

**STATE BOARD OF TECHNICAL EDUCATION, BIHAR**  
**Scheme of Teaching and Examinations for**  
**IV<sup>TH</sup> SEMESTER DIPLOMA IN AGRICULTURAL ENGINEERING**

(Effective from Session 2020-21 Batch)

**THEORY**

Sr. No.	SUBJECTS	SUBJECT CODE	TEACHING SCHEME Periods per Week	EXAMINATION – SCHEME							Credits
				Hours of Exam.	Teacher's Assessment (TA) Marks (A)	Class Test (CT) Marks (B)	End Semester Exam. (ESE) Marks (C)	Total Marks (A+B+C)	Pass Marks ESE	Pass Marks in the Subject	
1.	Soil Science & Soil Mechanics	2011401	03	03	10	20	70	100	28	40	03
2.	Machine Drawing	2011402	05	04	10	20	70	100	28	40	04
3.	Hydraulics & Fluid Mechanics	2011403	03	03	10	20	70	100	28	40	03
4.	Farm Power & tractor	2011404	03	03	10	20	70	100	28	40	03
5.	Workshop Technology	2011405	03	03	10	20	70	100	28	40	03
		<b>Total: - 17</b>					<b>350</b>	<b>500</b>			<b>16</b>

**PRACTICAL**

Sr. No.	SUBJECTS	SUBJECT CODE	TEACHING SCHEME Periods per Week	Hours of Exam.	EXAMINATION – SCHEME				Credits
					Practical (ESE)		Total Marks (A+B)	Pass Marks in the Subject	
					Internal (A)	External (B)			
6.	Farm Power & Tractor Lab	2011406	02 50% Physical 50% Virtual	04	15	35	50	20	01
7.	Workshop Technology Lab	2011407	04 50% Physical 50% Virtual	04	15	35	50	20	02
		<b>Total: - 06</b>					<b>100</b>		<b>03</b>

**TERM WORK**

Sr. No.	SUBJECTS	SUBJECT CODE	TEACHING SCHEME Periods per week	EXAMINATION – SCHEME				Credits	
				Marks of Internal Examiner (X)	Marks of External Examiner (Y)	Total Marks (X+Y)	Pass Marks in the Subject		
8.	Machine Drawing (TW)	2011408	02	15	35	50	20	01	
9.	Hydraulics & Fluid Mechanics (TW)	2011409	02	07	18	25	10	01	
10.	Soil Science & Soil Mechanics (TW)	2011410	02	07	18	25	10	01	
11.	Course Under Moocs /Swayam/ Others (TW)	2011411	04	15	35	50	20	02	
		<b>Total: - 10</b>					<b>150</b>		<b>05</b>
Total Periods per week Each of duration one Hours = 33							<b>Total Marks = 750</b>	<b>24</b>	

# SOIL SCIENCE AND SOIL MECHANICS

<b>Subject Code 2011401</b>	<b>Theory</b>			<b>No of Period in one session : 42</b>			<b>Credits  03</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
				<b>CT</b>	<b>:</b>	<b>20</b>	

**Rationale:**

Soil serves as the natural media for plant growth. The maintenance of Soil fertility is essential to cater the food needs for ever increasing population. It is essential for a diploma student to know about the modern scientific knowledge about physical and chemical properties of soil.

**Objective:**

The course is designed with following objectives:

- to know about soil and soil formation
- to know about physical properties of soil
- to know about soil constituents
- to know about problem soils and principles of their management
- to develop knowledge about engineering properties of soil

<b>Contents: Theory</b>		<b>Hrs</b>	<b>Marks</b>
<b>Unit -1</b>	<b><u>SOIL AND SOIL FORMATION:</u></b> 1.1 Rocks 1.2 Weathering of rocks 1.2.1 Physical weathering 1.2.2 Chemical weathering 1.2.3 Biological weathering	[04]	[06]
<b>Unit -2</b>	<b><u>SOIL CONSTITUENTS:</u></b> 2.1 Components of soil 2.1.1 Mineral matter 2.1.2 Organic matter 2.1.3 Soil water 2.1.4 Soil air	[04]	[06]
<b>Unit -3</b>	<b><u>PHYSICAL PROPERTIES OF SOIL:</u></b> 3.1 Soil texture 3.1.1 Soil texture in relation to soil classification 3.1.2 Effects of soil texture on crop production 3.2 Soil structure 3.2.1 Factors affecting soil structure 3.2.2 Type of soil structure 3.2.3 Effects of soil structure on other physical properties of soil. 3.3 Soil temperature 3.3.1 Importance of soil temperature 03.03.02 Factors affecting soil temperature 03.03.03 Control of soil temperature 03.04 Soil porosity 03.04.01 Factor affecting soil porosity 03.04.02 Importance of pore-space in Agriculture 3.5 Soil color 3.5.1 Colour producing compounds in soil 3.5.2 Importance of soil color in agriculture 03.06 Soil density	[07]	[10]
<b>Unit -4</b>	<b><u>SOIL MICRO ORGANISM:</u></b> 4.1 Classification of soil micro-organism 4.2 Beneficial function of soil micro-organism 4.3 Harmful effect of soil microorganism	[03]	[06]

<b>Unit -5</b>	<b><u>ESSENTIAL PLANT NUTRIENTS:</u></b> 5.1 Classification of nutrients 5.2 Role of nutrients 5.3 Deficiency symptoms of nutrients 5.4 Forms in which nutrients are taken by plants 5.5 Sources of plant nutrients in the soil	[04]	[06]
<b>Unit -6</b>	<b><u>PROBLEM SOILS:</u></b> 6.1 Acid soils and their management 6.2 Saline soils and their management 6.3 Alkali soils and their management	[05]	[08]
<b>Unit -7</b>	<b><u>BASIC DEFINITIONS:</u></b> 7.1 Soil mass 7.2 Water content 7.3 Density or unit weight of soil solids 7.4 Specific gravity 7.5 Void ratio 7.6 Porosity 7.7 Degree of saturation	[03]	[04]
<b>Unit -8</b>	<b><u>GRAIN SIZE DISTRIBUTION:</u></b> 8.1 Sieve analysis 8.2 Stock's law and hydrometer analysis (Basic concept only)	[02]	[04]
<b>Unit -9</b>	<b><u>ATTERBURG'S LIMITS:</u></b> 9.1 Types of Atterburg's limits 9.1.1 Methods of Determination of liquid limit 9.1.2 Methods of determination of plastic limit	[02]	[04]
<b>Unit -10</b>	<b><u>CLASSIFICATION OF SOILS:</u></b> 10.01 Descriptive idea Grain size classification and Indian standard soil classification	[02]	[04]
<b>Unit -11</b>	<b><u>SOIL PERMEABILITY:</u></b> 11.1 Darcy's law 11.2 Constant head permeo meter 11.3 Variable head permeo meter	[02]	[04]
<b>Unit -12</b>	<b><u>SOIL COMPACTION:</u></b> 12.1 Difference between compaction and consolidation 12.2 Factor affecting the soil compaction 12.3 Methods of soil compaction used in field by static and vibrating rollers	[02]	[04]
<b>Unit -13</b>	<b><u>BEARING CAPACITY OF SOIL:</u></b> 13.1 Factors affecting the bearing capacity of soil 13.2 Methods of determining bearing capacity of soil 13.3 Determination of bearing capacity by load test	[02]	[04]
<b>Total</b>		<b>42</b>	<b>70</b>

Reference books :-			
1	Soil Mechanics and Foundation	-	B.C. Punania Standard book house, New Delhi.
2	Soil Mechanics and Foundation Engineering	-	Bhagirath Lal Gupta Standard publishers Distributors, Delhi-6
3	Nature and Properties of Soil	-	N.C. Brady S. Chand & Company Ltd, New Delhi.
4	Text Book of Soil Science	-	T.D. Biswas & S.K. Mukherjee Tata McGraw Hill publishing company Ltd.

# MACHINE DRAWING

<b>Subject Code 2011402</b>	<b>Theory</b>			<b>No of Period in one session : 60</b>			<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			<b>04</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>05</b>	—	—	<b>TA</b>	<b>:</b>	<b>10</b>	
				<b>CT</b>	<b>:</b>	<b>20</b>	

**Rationale:**

Drawing is the language of engineers. Without the knowledge and skill of drawing an Agricultural Engineering Diploma Holder becomes handicapped in understanding the problems right from design state of machine components to the production.

This subject will develop the understanding of drawing, representation of machine parts. The subject will help a technician in understanding the functioning of different machine, which will help in maintenance, dismantling and assembly of machines used in agricultural farms, food processing, production process etc. This subject will develop the skill of communication through drawing which in turn will develop confidence.

**Objective:**

The students will be able to:

- Understand screw threads and its characteristics representation
- Understand the fastening types and its representation
- Understand the different types of joints used and its representation can get the ability to understand the different types of power coupling used in farm machinery and its representation
- Can develop the ability to represent the agricultural machine parts, machining components by free hand sketch
- Develop overall drawing and drafting skill in practical fields.

<b>Contents: Theory</b>		<b>Hrs</b>	<b>Marks</b>
<b>Unit -1</b>	Orthographic Projection.	[ 03 ]	[02]
<b>Unit -2</b>	Method of projection, 1 <sup>st</sup> angle and 3 <sup>rd</sup> angle projection.	[ 03 ]	[04]
<b>Unit -3</b>	Orthographic projection of simple models and from given isometric drawing of simple blocks and machine parts.	[ 06 ]	[06]
<b>Unit -4</b>	Isometric drawing.	[ 06 ]	[06]
<b>Unit -5</b>	Introduction of pictorial, drawing, construction of isometric scale, its use in isometric drawing.	[ 06 ]	[06]
<b>Unit -6</b>	Isometric drawing of simple blocks and m/c parts.	[ 06 ]	[06]
<b>Unit -7</b>	Conventions used in Machine Drawing.	[ 04 ]	[04]
<b>Unit -8</b>	Conventional representation of common features in mechanical drawing like screw threads, rolled sections bearings tension spring, gear and pinion as per IS:696	[ 04 ]	[04]
<b>Unit -9</b>	Conventional method of representation of full sectional and half sectional views of m/c parts as per IS:696	[ 04 ]	[06]
<b>Unit -10</b>	Free hand sketches of bolt and nuts. Locking devices, studs, rivet-heads, keys cottess and simple machine part.	[ 04 ]	[06]
<b>Unit -11</b>	Different joints like union joints, expansion joint, bush bearings.	[ 04 ]	[06]
<b>Unit -12</b>	Loose and fast, pulley & agricultural implements.	[ 04 ]	[06]
<b>Unit -13</b>	Dimensional and sectional drawing of bearing – pedestal bearing, Plummer block, foot step bearing. Machine parts – cotter joint, knuckle joint	[ 06 ]	[08]
<b>Total</b>		<b>60</b>	<b>70</b>

**Books Recommended:**

1.	Machine Drawing	-	N.D. Bhatt
2.	Machine Drawing	-	Parkinson
3.	Machine Drawing	-	R.B. Gupta
4.	Machine Drawing	-	Mittal & Agarwal
5.	A Text Book of Engineering Drawing	-	R.K. Dhawan
6.	Practical Agricultural Engineering	-	R.K. Ghosh and S. Swain

# HYDRAULICS & FLUID MECHANICS

<b>Subject Code 2011403</b>	<b>Theory</b>			<b>No of Period in one session: 42</b>			<b>Credits  03</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>100</b>	
	<b>03</b>	—	—	<b>TA</b>	<b>:</b>	<b>10</b>	
				<b>CT</b>	<b>:</b>	<b>20</b>	

**Rationale and Objective:**

A Diploma student of Agricultural Engineering has to perform his job related to fetch water in the field by different types. The knowledge of fluid characteristics and its related parameter is must for the students.

This course of Hydraulics and Fluid Mechanics is designed to cover the fluid properties, fluid statics and dynamics, its flow characteristics in closed condute and open channel with weirs and various aspect that are useful in project planning & execution work.

The curriculum has been divided into the following topics:

<b>Contents: Theory</b>		<b>Hrs</b>	<b>Marks</b>
<b>Unit -1</b>	<b><u>PROPERTIES OF FLUIDS:</u></b> Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Dynamic Viscosity, Kinematic Viscosity, Cohesion, Adhesion, Surface Tension, Capillarity, thermodynamic properties.	[03]	[03]
<b>Unit -2</b>	<b><u>MEASUREMENT OF PRESSURE:</u></b> Pressure, Pascal’s Law of Fluid Pressure at a point, Pressure head, Transmissibility of liquid pressure, Bramah’s process OR Hydraulic press, Atmospheric pressure, Negative pressure OR vacuum pressure, pressure gauge and manometers, the barometer, the one Reid barometer, the siphon barometer, the piezo meter-U- tube OR Double column manometer, Inverted U-tube manometer, Measurement of Suction pressure OR Negative pressure, Sensitive manometers, Single column, Inclined tube manometer, the bourdon gauge, the diaphragm pressure gauge, Micro manometer.	[04]	[08]
<b>Unit -3</b>	<b><u>HYDROSTATIC PRESSURE ON SURFACES:</u></b> Total pressure on a lamina immersed in a liquid, center of pressure, the hydrostatic paradox, pressure force on vertical and inclined laminae, pressure on curved surfaces, pressure on lock gates, pressures on a masonry dam, stability of dam, minimum bottom with required for a dam.	[03]	[05]
<b>Unit -4</b>	<b><u>BUOYANCY AND FLOATATION:</u></b> Buoyancy, Archimedes principle, Centre of buoyancy, body immersed in two different fluids, Meta Centre, Metacentric height, stable, unstable and neutral equilibrium.	[03]	[05]
<b>Unit -5</b>	<b><u>HYDROKINEMATICS:</u></b> Introduction, method of describing fluid motion, streamline, path line, streak line, stream tube, potential line, types of flow, laminar & turbulent, steady & unsteady flow, uniform and non-uniform flow, rotational and irrotational flow, various types of fluid movements. Reynolds number, Froud number and Webber number. Equation of continuity for one-dimensional steady flow.	[04]	[05]
<b>Unit -6</b>	<b><u>DYNAMICS OF FLUID FLOW:</u></b> Energy possessed by fluid body potential energy and potential head, pressure energy and pressure head, kinetic energy and kinetic head, the energy equation, Bernoulli’s theorem, Euler’s equation of motion, Inter conversion of potential pressure and kinetic heads, kinetic energy correction factor, momentum equation, rate of change of momentum, central volume, the venturi meter, the venturi head, pitot tube, orifice plate or orifice metre, the flow nozzle.	[03]	[08]
<b>Unit -7</b>	<b><u>ORIFICES AND MOUTH PIECES:</u></b> Orifices, small and large orifices, circular & rectangular orifices, sharp edge and bell mouthed orifices, Vena contracta, coefficient of orifices, coefficient of contraction, coefficient of velocity and coefficient of discharge, submerged orifice, large orifice, loss of head due to sudden enlargement, loss of head due to sudden contraction, mouth piece, convergent, divergent mouth piece.	[03]	[08]

<b>Unit -8</b>	<b><u>NOTCHES &amp; WEIRS:</u></b> Difference between notch and weir, Nappe or vein, crest or sill of a notch, classification of weirs, rectangular weir, triangular weir, trapezoidal weir, weir with end contraction. Submerged weir – Anicut raised weir, barrage, broad crested weir, ogee weir, Cipolletti weir.	[03]	[05]
<b>Unit -9</b>	<b><u>FLOW THROUGH PIPES:</u></b> Laws of fluid friction, loss of head due to pipe friction, Darcy-Weisbach formula, Hydraulic gradient, Total energy line, pipes in series, pipes in parallel, Dupuit's equation, loss of head in tapering pipe with nozzle.	[06]	[08]
<b>Unit -10</b>	<b><u>FLOW THROUGH OPEN CHANNELS:</u></b> Types of channels: Rectangular, trapezoidal and circular channels; Opened covered channels, steady and unsteady flow in a channel. Chezy's formula, Kutter's formula, Manning formula, Hydraulic mean depth or radius, most efficient section, Specific energy head, Critical depth, critical velocity, Hydraulic jump or standing wave. Condition on which the hydraulic jump will occur. Back water curve, Channel with mild, steep, critical slope.	[06]	[08]
<b>Unit -11</b>	<b><u>PUMPS:</u></b> Pumps and its types, Centrifugal pump, method of converting the kinetic energy of water leaving the impeller into pressure energy, the volute chamber, the vortex or the whirlpool chamber, guide blades minimum speed to start the pump, loss of head due to reduced or increased flow. Principles of similarity applied to centrifugal pumps. Characteristics curves.	[04]	[07]
<b>Total</b>		<b>42</b>	<b>70</b>

**Books Recommended:**

1	Fluid Mechanics & Hydraulics	-	Dr. Jagdish Lal Metropolitan Book Co. Pvt. Ltd., New Delhi
2	Hydraulics Fluid Mechanics & Fluid Machines	-	S. Ramanathan Dhanpat Rai Publishing Company, New Delhi – 110 002
3	A Text Book of Hydraulics & Fluid Mechanics	-	R.S. Khurmi S. Chand & Co., Ram Nagar, New Delhi
4	A Text Book of Fluid Mechanics & Hydraulics	-	R.K. Bansal Laxmi Publication, New Delhi
5	Tube Well & Pumps	-	Dr. A.M. Michel Water Technology Centre, ICAR, New Delhi
6.	Open Channel Flow	-	V.T. Chaw Mc Graw Hill Co.

# FARM POWER AND TRACTOR

<b>Subject Code 2011404</b>	<b>Theory</b>			<b>No of Period in one session: 42</b>			<b>Credits  03</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>100</b>	
	<b>03</b>	—	—	<b>TA</b>	<b>:</b>	<b>70</b>	
				<b>CT</b>	<b>:</b>	<b>10</b>	

## **Rationale & Objective:**

A Diploma holder technician in Agricultural Engineering must know the operations control, maintenance and repairing idea of different sources of power used in Agricultural sector. For proper utilization of agricultural machinery, processing equipment's in agricultural FARM and FIRM with safety for stationary & mobile engines, this course is designed with following contents:

- Idea of conventional animal, human, coal, fuel and non-conventional solar and wind power sources of energy used in agricultural sector
- Scope of mechanization, its availability and suitability in Indian condition. Principle of operation of different engines
- Different Engines system
- Different engine components, different control devices repair, maintenance & safety devices of engines
- Power estimation and power losses
- Introduction of mobile engines and tractors

<b>Contents: Theory</b>		<b>Hrs</b>	<b>Marks</b>
<b>Unit -1</b>	<b><u>INTRODUCTION OF ENERGY SOURCES:</u></b> - Different sources of energy. - Sources of Farm Power in conventional system with animal, human, fossil fuel. - Sources of Farm Power with non-conventional system like solar, wind and biogas.	[03]	[04]
<b>Unit -2</b>	<b><u>SCOPE OF MECHANIZATION IN INDIAN CONDITION FROM SUTABILITY &amp; AVAILABILITY POINT OF VIEW:</u></b> - Farm Mechanization, its advantages and disadvantages. - Hurdles in farm mechanization in Indian condition with availability & suitability of power sources.	[04]	[04]
<b>Unit -3</b>	<b><u>PRINCIPLES AND COMPONENTS OF INTERNAL COMBUSTION ENGINE:</u></b> - Principles of different cycles; auto cycle; Diesel cycle, theoretical and actual cycles of engine working. - Difference in Compression Ignition and Spark Ignition engines. - Stationary and moving components of I.C. engine and its material of construction.	[04]	[06]
<b>Unit -4</b>	<b><u>TWO &amp; FOUR STROKES CYCLE ENGINES:</u></b> - Principles and operation of two stroke cycles engines. - Difference in two strokes and four strokes engine principles, power calculation.	[04]	[07]
<b>Unit -5</b>	<b><u>VALVE SYSTEM AND VALVE TIMING:</u></b> - Arrangement of valves in engine - Function of valves - Valve timing and its diagram - Valve clearances and its importance and adjustment of valve clearance.	[03]	[06]
<b>Unit -6</b>	<b><u>FUEL SUPPLY SYSTEM:</u></b> - Petrol Supply System - Diesel Supply System - Properties of fuel - Fuel filter and its working	[03]	[07]
<b>Unit -7</b>	<b><u>FUEL INJECTION SYSTEM:</u></b> - Fuel Injection Pump - Methods of fuel injection pump - Injector – Nozzel, construction and working.	[03]	[06]

<b>Unit -8</b>	<b><u>LUBRICATING SYSTEM:</u></b> - Need of lubrication - Properties of good lubricants - Types of lubricants used - Types of lubricating systems	[03]	[06]
<b>Unit -9</b>	<b><u>COOLING SYSTEM:</u></b> - Need of cooling - Air cooling - Water cooling - Thermo siphon and forced circulation cooling system	[03]	[06]
<b>Unit -10</b>	<b><u>PRE AIR CLEANER &amp; AIR CLEANER:</u></b> - Need of Pre Air Cleaner & Air Cleaner - Types of Air Cleaners - Their construction, working & maintenance	[03]	[04]
<b>Unit -11</b>	<b><u>GOVERNING SYSTEM:</u></b> - Governing Hit and Miss System, throttle system, centrifugal pneumatic governor. - Governor hunting and governor regulation.	[03]	[04]
<b>Unit -12</b>	<b><u>MOBILE ENGINE AND TRACTORS:</u></b> - Need of mobile engines - Transmission & control of tractor systems	[03]	[06]
<b>Unit -13</b>	<b><u>POWER TILLER AND ITS COMPONENTS:</u></b> - Walking type farm operation through power tiller. - Different system of power tiller and its controlling units. - Its advantages & disadvantages and suitability.	[03]	[04]
<b>Total</b>		<b>42</b>	<b>70</b>

**Books Recommended:**

1	Farm Gas Engines and Tractors	-	R. Jones Fred Tata McGraw Hill publishing company Ltd.
2	Principles of Agricultural Engineering, Vol. - I	-	A.M. Michel & T.P. Ojha Jain Brothers, New Delhi
3	Practical Agricultural Engineering Vol. - I & II	-	Ghosh and Swain Naya Prakash 206, Bidhar Sarani, Kolkata
4	Tractors and Their Power Units	-	E.L. Barger, J.B. Liljedahl, W.M. Carleton, E.G. Mokibben Wiley Eastern Private Ltd., New Delhi
5	Farm Tractors Repair & Maintenance	-	S.C. Jain & C.M. Rai Standard Publisher Distributors, New Delhi
6	Tractor and Automobile	-	V. Redichev MIR Publication
7	Basic Automobile Engineering	-	C.P. Nokra Dhanpat Rai Publishing Company, New Delhi
8	Elements of Agricultural Engineering, Vol. - I & II	-	Jagdiswar Sahay Agro Book Agency, New Area, Jakkanpur, Patna – 1



# WORKSHOP TECHNOLOGY

<b>Subject Code 2011405</b>	<b>Theory</b>			<b>No of Period in one session: 42</b>			<b>Credits  03</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
				<b>CT</b>	<b>:</b>	<b>20</b>	

**Rationale:**

Workshop technology deals with different processes by which component of a machine or equipment's are made, objectives of Agricultural Engineering Diploma holders will have to deal with different types of machines and tractors, so they are supposed to know different processes in workshop. Keeping this in view, this subject has been included in the curriculum.

<b>Contents: Theory</b>		<b>Hrs</b>	<b>Marks</b>
<b>Unit -1</b>	<p><b><u>ENGINEERING MATERIAL:</u></b></p> <p>1.1 Classification of materials</p> <p>1.2 Properties of materials</p> <p>1.3 Crystal structure, unit cell &amp; space lattice, metallic, space lattice, effect of grain size on properties of metals cooling curves for metals and alloys.</p> <p>1.4 Brief ideas about ferrous metals and alloys</p> <p>1.5 Brief ideas about non-ferrous metals and their alloys</p> <p>1.6 Miscellaneous materials e.g., plastic, glass, plywood, packing materials, abrasive materials, belt materials, lubricating materials, their properties and uses.</p>	[08]	[10]
<b>Unit -2</b>	<p><b><u>HEAT TREATMENT OF STEEL:</u></b></p> <p>2.1 Definition, objectives, iron-carbon equilibrium diagram</p> <p>2.2 Different Heat treatment processes</p> <p>2.3 Defects due to heat treatment of steel</p>	[03]	[10]
<b>Unit -3</b>	<p><b><u>GENERAL PROCESSES:</u></b></p> <p>3.1 Welding, definition, types of electrodes, fluxes welding defects, gas cutting</p> <p>3.2 Soldering, Definition, types of solder, soldering Iron</p> <p>3.3 Brazing, definition, types of brazing, Atal's, fluxes</p>	[04]	[08]
<b>Unit -4</b>	<p><b><u>INTRODUCTION:</u></b></p> <p>4.1 Introduction</p> <p>4.2 Safety measures in workshop</p> <p>4.3 Indian factory acts on safety</p> <p>4.4 Different types of carpentry tools and processes</p> <p>4.5 Brief ideas about Band saw etc., wooden lathe circular saw, wood planner etc.</p>	[05]	[08]
<b>Unit -5</b>	<p><b><u>BLACKSMITHY SHOP:</u></b></p> <p>5.1 Introduction</p> <p>5.2 Different tools and their uses</p> <p>5.3 Different forging operations</p> <p>5.4 Defects of forging</p> <p>5.5 Brief ideas about power hacksaw etc.</p>	[06]	[06]
<b>Unit -6</b>	<p><b><u>ESTIMATING &amp; COSTING:</u></b></p> <p>6.1 Introduction of Estimating &amp; Costing</p> <p>6.2 Elements &amp; Cost</p>	[02]	[06]
<b>Unit -7</b>	<p><b><u>ESTIMATION OF MACHINING TIME IN MACHINE SHOP:</u></b></p> <p>7.1 Introduction length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances.</p> <p>7.2 Estimation of machining time for different Lathe operations.</p> <p>7.3 Estimation of machining time for shaping, slotting and planning operations.</p>	[04]	[08]
<b>Unit -8</b>	<p><b><u>ESTIMATION IN WLEDING SHOP:</u></b></p> <p>8.1 Introduction, types of welding, types of welding joints, edge preparation, welding techniques.</p> <p>8.2 Gas welding and gas cutting, arc welding, estimation of welding cost.</p>	[06]	[08]
<b>Unit -9</b>	<p><b><u>ESTIMATION OF SHEET METAL SHOP:</u></b></p> <p>9.1 Introduction, different operations, sheet metal joints.</p> <p>9.2 Allowances for sheet metal, operations &amp; joints, estimate of cost.</p>	[04]	[06]
<b>Total</b>		<b>42</b>	<b>70</b>

**Books Recommended:**

1	Mechanical Estimates & Costing	-	S.C. Jain Dhanpat Rai & Sons, Delhi – 6
2	Introduction to Estimating & Costing	-	GBS Narang and V. Kumar Khanna publishers, Delhi - 6
3	Mechanical Estimates and Costs	-	T.K. Bagga & S.C. Sharma Khanna publishers, Delhi – 6
4	Estimates & Cost	-	C.K. Singh & M.I. Khanna

## FARM POWER AND TRACTOR LAB

<b>Subject Code 2011406</b>	<b>Practical</b>			<b>No of Period in one session: 24</b>			<b>Credits  01</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	—	—	<b>02</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
				<b>External</b>	<b>:</b>	<b>35</b>	

**Rationale:**

A Diploma holder in Agricultural Engineering student has to operate the different machinery with I.C. Engine power source for stationary & moving process.

**Objective:**

The present practical course is designed to familiarize the different components of the I.C. engine as well as to provide well practice over the different control units of the stationary and moving engine operation with safety.

At least **Eight** experiments to be done from the following list of experiments:

<b>Contents: Practical</b>		<b>Hrs</b>	<b>Marks</b>
<b>Unit -1</b>	- Familiarization with different engine parts viz. stationary, reciprocating and rotating.	[ 02]	
<b>Unit -2</b>	- Study of two stroke and four stroke cycle engines.	[ 02]	
<b>Unit -3</b>	- Study of valves and valves arrangement. Determination of valve timing and firing orders of multi-cylinder engine	[ 02]	
<b>Unit -4</b>	- Familiarization with carburetors adjustment and air supply system.	[ 02]	
<b>Unit -5</b>	- Diesel fuel supply system, injector adjustments and air bleeding	[ 02]	
<b>Unit -6</b>	- Study of cooling system in stationary engines and moving engines like tractor.	[ 02]	
<b>Unit -7</b>	- Study of lubricating system.	[ 02]	
<b>Unit -8</b>	- Study of operation of power tillers.	[ 02]	
<b>Unit -9</b>	- Familiarization with different controls on the tractor and indicators with traffic signals.	[ 02]	
<b>Unit -10</b>	- Tractor driving practice in different gears without implements.	[ 02]	
<b>Unit -11</b>	- Tractor driving practice, certain limited area in specified by Instructor viz. L-shape, S-shape, Circle, 8-shape etc.	[ 02]	
<b>Unit -12</b>	- Study about periodic trouble shooting	[ 02]	
<b>Total</b>		<b>24</b>	

**Books Recommended:**

1	Farm Gas Engines and tractors	-	R. Jones Fred Tata McGraw Hill publishing company Ltd.
2	Principles of Agricultural Engineering, Vol. - I	-	A.M. Michel & T.P. Ojha Jain Brothers, New Delhi
3	Practical Agricultural Engineering Vol. - I & II	-	Ghosh and Swain Naya Prakash 206, Bidhan Sarani, Kolkata
4	Tractors and Their Power Units	-	E.L. Barger, J.B. Liljedahl, W.M. Carleton, E.G. Mokibben Wiley Eastern Private Ltd., New Delhi
5	Farm Tractors Repair & Maintenance	-	S.C. Jain & C.M. Rai Standard Publisher Distributors, New Delhi
6	Tractor and Automobile	-	V. Redichev MIR Publication
7	Basic Automobile Engineering	-	C.P. Nokra Dhanpat Rai Publishing Company, New Delhi
8	Elements of Agricultural Engineering, Vol. I & II	-	Jagdiswar Sahay Agro Book Agency, New Area, Jakkanpur, Patna – 1

# WORKSHOP TECHNOLOGY LAB

<b>Subject Code 2011407</b>	<b>Practical</b>			<b>No of Period in one session: 50</b>			<b>Credits  02</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	—	—	<b>04</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
				<b>External</b>	<b>:</b>	<b>35</b>	

<b>Contents: Practical</b>		<b>Hrs.</b>	<b>Marks</b>
<b>Unit -1</b>	- Turning, Knurling, Facing, Drilling, Threading, Tapping, Boring on a job on lathe m/c.	[ 08 ]	
<b>Unit -2</b>	- Step turning on lathe.	[ 04 ]	
<b>Unit -3</b>	- Working of different carpentry m/c e.g., band saw m/c, circular saw m/c, planner m/c and grinding, shaping m/c.	[ 08 ]	
<b>Unit -4</b>	- Electric welding and gas welding, different joints, grill gate, garden chair, joining of two parts.	[ 10 ]	
<b>Unit -5</b>	- Different operation in sheet metal shop, making of mug, <b>Furmel</b> , bucket, milk container, tray.	[ 10 ]	
<b>Unit -6</b>	- Black Smithy shop – different operation, making of ring, khurpi, screwdriver.	[ 05 ]	
<b>Unit -7</b>	- Estimation of machining time in different lathe operation e.g. step turning, facing, chamfering, knurling, threading.	[ 05 ]	
<b>Total</b>		<b>50</b>	

Each student has to make two jobs on lathe, two jobs in Black Smithy shop, two jobs in welding shop, one job in sheet metal shop and one job in wooden lathe – total eight jobs.

### **Books Recommended:**

<b>S.N.</b>	<b>Book's Name</b>	<b>Write's Name</b>	<b>Publisher's Name</b>
1	Mechanical Estimates and costing	S.C.Jain	Dhanpat Rai & Sons, Delhi-6
2	Introduction to Estimating and costing	GBS Narang and V.Kumar	Khanna Publishers Delhi-6
3	Mechanical Estimates and costing	T.K.Bagga & S.C.Sharma	Khanna Publishers, Delhi-6
4	Estimates and Cost	C.K.Singh & M.I.Khanna	

# MACHINE DRAWING - TW

<b>Subject Code 2011408</b>	<b>Term Work</b>			<b>No of Period in one session : 25</b>			<b>Credits  01</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>50</b>	
	—	—	<b>02</b>	<b>External</b>	<b>:</b>	<b>15</b>	
						<b>35</b>	

**Rationale:**

Drawing is the language of engineers. Without the knowledge and skill of drawing an Agricultural Engineering Diploma Holder becomes handicapped in understanding the problems right from design state of machine components to the production.

This subject will develop the understanding of drawing, representation of machine parts. The subject will help a technician in understanding the functioning of different machine parts which will help in maintenance, dismantling and assembly of machines parts from machinery & food process machines parts during its production process too. This subject will develop confidence and will improve the ability of concept.

**Objective:**

The students will be able to:

- Understand screw threads and its characteristics representation
- Understand the fastening types and its representation
- Understand the different types of joints used and its representation
- Can get the ability to understand the different types of power coupling used in farm machinery and its representation
- Can develop the ability to represent the agricultural machinery components by free hand sketch
- Develop drafting skill and be able to apply the knowledge & skill of drawing in practical field.

<b>Contents : Term Work</b>		<b>Hrs</b>	<b>Marks</b>
<b>Unit -1</b>	- Orthographic Drawing, 1 <sup>st</sup> angle projection	[05]	
<b>Unit -2</b>	- Isometric drawing of related agriculture implements	[05]	
<b>Unit -3</b>	- Line and Block diagram of: (a) Transmission system of a four wheel tractor. (b) Lubricating system (forced fee circulation system) of tractor and hydraulic control system of tractor.	[05]	
<b>Unit -4</b>	- Free hand sketching of: (a) Universal and muff coupling (b) Crank shaft (c) Splined shaft (d) Screw jack (e) Cultivator (f) Cage wheel (g) Rotary paddy thresher (h) Wheel HUB (i) Disc plough (j) Disc Harrow	[10]	
<b>Total</b>		<b>25</b>	

**Books Recommended: -**

1	Machine Drawing	-	N.D. Bhatt
2	Machine Drawing	-	Parkinson
3	Machine Drawing	-	R.B. Gupta
4	Machine Drawing	-	Mittal & Agarwal
5	A Text Book of Engineering Drawing	-	R.K. Dhawan
6	Practical Agricultural Engineering	-	R.K. Ghosh and S. Swain

## HYDRAULICS & FLUID MECHANICS - TW

<b>Subject Code 2011409</b>	<b>Term Work</b>			<b>No of Period in one session: 24</b>			<b>Credits  01</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>07</b>	
	—	—	<b>02</b>	<b>External</b>	<b>:</b>	<b>18</b>	

**Rationale:**

Diploma Holder in Agricultural Engineering Diploma Student has to work related to Irrigation & Drainage Engineering where use of different aspects of instrument is must. In view of the following objective this sessional course has been designed.

**Objective:**

To familiarize and know the use of the instruments related to Hydraulics & Fluid Mechanics.

Students have to get the study of **FIVE** of the following assignments for practical concept.

<b>Contents: Term Work</b>		<b>Hrs.</b>	<b>Marks</b>
<b>Unit -1</b>	- Study of piezometer and pressure gauges used in hydraulics.	[ 02 ]	
<b>Unit -2</b>	- Study of Bernauli's experiment.	[ 02 ]	
<b>Unit -3</b>	- Study of Venturimeter and its uses.	[ 02 ]	
<b>Unit -4</b>	- Study of notches & mouth pieces.	[ 02 ]	
<b>Unit -5</b>	- Study of pilot tube	[ 02 ]	
<b>Unit -6</b>	- Study of manometer	[ 02 ]	
<b>Unit -7</b>	- Study of Centrifugal pump & its characteristics	[ 03 ]	
<b>Unit -8</b>	- Study of Reciprocating pump	[ 03 ]	
<b>Unit -9</b>	- Study of head losses in pipes due to bends, sudden contraction	[ 03 ]	
<b>Unit -10</b>	- Study of measurement of hydraulic flow and discharge	[ 03 ]	
<b>Total</b>		<b>24</b>	

**Books Recommended:**

1	Fluid Mechanics & Hydraulics	-	Dr. Jagdish Lal Metropolitan Book Co. Pvt. Ltd., New Delhi
2	Hydraulics Fluid Mechanics & Fluid Machines	-	S. Ramanrutham Dhanpat Rai Publishing Company, New Delhi – 110 002
3	A Text Book of Hydraulics & Fluid Mechanics	-	R.S. Khurmi S. Chand & Co., Ram Nagar, New Delhi
4	A Text Book of Fluid Mechanics & Hydraulics	-	R.K. Bansal Laxmi Publication, New Delhi
5	Tube Well & Pumps	-	Dr. A.M. Michel Water Technology Centre, ICAR, New Delhi
6	Open Channel Flow	-	V.T. Chaw Mc Graw Hill Co.

## SOIL SCIENCE & SOIL MECHANICS -TW

<b>Subject Code 2011410</b>	<b>Term Work</b>			<b>No of Period in one session: 24</b>			<b>Credits  01</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>07</b>	
	—	—	<b>02</b>	<b>External</b>	<b>:</b>	<b>18</b>	

**Rationale:**

An Agricultural Engineering Diploma student is required to know about soil structure and texture. He has to apply

engineering and technology in agricultural operation in a better way to improve productivity.

**Objective:**

The course is designed with following objectives:

- to understand about soil science and soil mechanics and its relation with crop production
- to know about soil pH, soil classification, method of sample taking etc.
- to develop skill about engineering properties of soil.

At least **Seven** sessional units must be carried out by the students.

<b>Contents: Term Work</b>		<b>Hrs.</b>	<b>Marks</b>
<b>Unit -1</b>	- Study about soil classification.	[ 02 ]	
<b>Unit -2</b>	- Study about texture and structure of soil.	[ 02 ]	
<b>Unit -3</b>	- Study about essential plant nutrients.	[ 02 ]	
<b>Unit -4</b>	-- Study about acid and alkali soils and principles of their management.	[ 02 ]	
<b>Unit -5</b>	- Study about soil compaction.	[ 02 ]	
<b>Unit -6</b>	- Study about soil sample taking methods from the field.	[ 02 ]	
<b>Unit -7</b>	- Study about soil pH and its determination by pH meter.	[ 02 ]	
<b>Unit -8</b>	- Study about determination of N:P:K of given soil sample.	[ 02 ]	
<b>Unit -9</b>	Study about determination of moisture content of given soil sample.	[ 02 ]	
<b>Unit -10</b>	-- Study about determination of grain size distribution of given soil sample by Sieve Analysis.	[ 02 ]	
<b>Unit -11</b>	- Study about determination of liquid limit of given soil sample.	[ 02 ]	
<b>Unit -12</b>	-- Study about determination of field density and void ratio of soil by the help of core cutter.	[ 02 ]	
<b>Total</b>		<b>24</b>	

**Books Recommended:**

1	Soil Mechanics and Foundation	-	B.C.Punania Standard book house, New Delhi.
2	Soil Mechanics and Foundation Engineering	-	Bhagirath Lal Gupta Standard publishers Distributors, Delhi
3	Nature and Properties of Soil	-	N.C. Brady S. Chand & Company Ltd, New Delhi.
4	Text Book of Soil Science	-	T.D. Biswas & S.K. Mukherjee Tata McGraw Hill publishing company Ltd.

## COURSE UNDER MOOCS / SWAYAM / OTHERS (TW)

Subject Code 2011411	Term Work			No of Period in one session:			Credits 02
	No. of Periods Per Week			Full Marks			
	L	T	P/S	Internal	:	15	
	—	—	04	External	:	35	