

**Curriculum**  
for  
**Certificate Programme**  
in  
**FARM EQUIPMENT TECHNICIAN**  
for  
Maharaja Ranjit Singh Punjab Technical University,  
Bathinda (Punjab)



**Prepared By:**

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## FOREWORD

Rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In order to cope with the challenges of handling new materials, machines and technologies, we have to develop human resources having appropriate competencies. There is an increasing demand of skilled workforce in India in particular and the world over in general. Under the new circumstances, India faces a challenging task of meeting the technical manpower requirement, especially in the area of skilled workforce to cater to industrial needs. Efforts have to be made so that passouts from our technical institutions are acceptable at global level.

Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Technical institutions play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab to start the skill oriented integrated courses at certificate, diploma and degree level, as per the needs of the industry, are laudable.

In order to meet the future requirements of technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of technical programmes at various levels. The curricula for various programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of programme and various courses.

The success of any technical programme depends upon its effective implementation. However, best the curriculum document is designed, if it is not implemented properly, the output will not be as per expectations. In addition to acquisition of appropriate physical resources, availability of motivated, competent and qualified faculty is equally essential for effective implementation of the curricula.

It is expected that MRSPTU will carry out curriculum evaluation on a continuous basis to identify the new skill requirements. At the same time, it is expected that innovative methods of course offering will be used to develop desired skills and infuse the much needed dynamism in the system.

Dr. M.P. Poonia  
Director  
National Institute of  
Technical Teachers Training & Research  
Chandigarh

## **PREFACE**

Curriculum document is a comprehensive plan of an educational programme. It is through the curriculum that the educational objectives of a programme are achieved. It has to be ensured that the curriculum is dynamic, articulated, balanced, data based, feasible, and as per industrial needs. Curriculum Development Centre at NITTTR, Chandigarh has been extending services to technical education system of the states in northern region in developing and updating their curriculum on regular basis.

Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab assigned the project for developing the curriculum of some integrated programmes to this institute in the month of May 2016. A series of curriculum workshops were held during the months of June-July, 2016. This curriculum document is an outcome of the extensive discussions held with the representatives from various organizations, technical institutions and industry during the curriculum workshops. While developing the study and evaluation scheme and detailed contents, the following aspects have been kept in mind:

- Employment Opportunities of Certificate holders
- Job role of certificate holders
- Learning outcome of the Programme
- Mobility of students for their professional growth

We have taken cognizance of recommendation of experts both from industry and academic institutions and have adequately incorporated segments of Industrial Training in the curriculum. Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which units on Communication Skills have been introduced in both the semesters of the certificate course.

We hope that this curriculum document will prove useful in producing skilled manpower at desired level in the state of Punjab. The success of this outcome-based curriculum depends upon its effective implementation and it is expected that MRSPTU will make all efforts to create better facilities, develop linkages with the world-of-work and foster conducive and requisite learning environment as prescribed in the curriculum document.

Professor and Head  
Curriculum Development Centre  
NITTTR, Chandigarh

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Coordinator

## 1. SALIENT FEATURES OF THE PROGRAMME

1.	Sector	:	Mechanical
2.	Name of the Certificate Programme	:	Farm Equipment Technician
3.	Entry Qualification	:	Matriculation or equivalent NSQF Level as prescribed by MRSPTU, Bathinda
4.	Duration of the Programme	:	One Year
5.	Intake	:	30
6.	Pattern of the Programme	:	Semester Pattern
7.	NSQF Level	:	Level - III

## 2. **JOB ROLE AND JOB OPPORTUNITIES OF FARM EQUIPMENT TECHNICIAN**

### **a) Job Role**

“Farm Equipment Technician” Certificate holders service, maintain, and repair farm equipment as well as tractors. What typically was a general repairer’s job around the farm in the past has evolved into a specialized technical career.

Farmers have increasingly turned to farm equipment dealers to service and repair their equipment because the machinery has become far more complex. Modern equipment uses more electronics and hydraulics making it difficult to perform repairs without some specialized training.

The certificate holders in “Farm Equipment Technician” work mostly on equipment brought into the shop for repair and adjustment. During planting and harvesting seasons, they may travel to farms to make emergency repairs to minimize delays in farm operations. They repair and maintain engines and hydraulic, transmission, and electrical systems of farm equipment. They also perform routine maintenance checks on fuel, brake, and transmission systems to ensure peak performance, safety, and longevity of the equipment. Maintenance checks and comments from equipment operators usually make them alert to problems.

After locating the problem, they rely on their training and experience to use the best possible technique to solve the problem. If necessary, they may partially dismantle the components to examine parts for damage or excessive wear. Then, using tools, they repair, replace, clean, and lubricate parts, as necessary.

Some types of farm equipment use hydraulics to raise and lower movable parts, such as scoops or plows. When hydraulic components malfunction, they examine them for leaks, ruptured hoses, or worn gaskets on fluid reservoirs. Occasionally, the equipment requires extensive repairs, such as replacing a defective hydraulic pump.

They perform a variety of other repairs, diagnosing electrical problems and replacing defective components, or repairing undercarriages and track assemblies. Occasionally, they weld broken equipment frames and structural parts, using electric or gas welders.

When farm equipment breaks down at the farm, it may be too difficult or expensive to bring it into a repair shop, a certificate holder in “Farm Equipment Technician” visits the site. More experienced ones specialize in field service and often work outdoors spending much of their time away from the shop.

### **b) Job Opportunities**

A certificate holder in “Farm Equipment Technician” may specialize in a particular area such as fuel injection pumps, engine overhaul, hydraulic systems or in specific types of equipment. Employers who may hire them include:

- Agricultural Equipment Dealers
- Rental and Service companies
- Agricultural equipment Operators
- Agricultural equipment Manufacturers
- Self-employed

3. **LEARNING OUTCOMES OF CERTIFICATE PROGRAMME IN  
FARM EQUIPMENT TECHNICIAN**

At the end of the programme, the students will be able to:

- Diagnose and repair failures in mechanical, electrical and hydraulic systems of farm equipment.
- Inspect and test farm equipment and its sub systems as per manufacturer's specifications.
- Use latest diagnostic tools
- Perform scheduled maintenance
- Read and interpret drawings, circuits and catalogues.
- Prepare time and cost estimates.
- Prepare and interpret work orders
- Communicate effectively.
- Apply concepts of mathematics and science for problem solving

#### 4. STUDY AND EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN FARM EQUIPMENT TECHNICIAN

##### FIRST SEMESTER

CODE	UNITS	STUDY SCHEME		CREDITS	MARKS IN EVALUATION SCHEME							Total Marks	
		Total Hours			INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs		Tot
CMEE4-101	*Communication Skills	8	-	1	25	-	25	25	1	-	-	25	50
CMEE4-101P	*Communication Skills Lab.	-	24	1	-	25	25	-	-	50	3	50	75
CMEE4-102	General Engineering	48	-	3	25	-	25	25	2	-	-	25	50
CMEE4-102P	General Engineering Lab.	-	32	1	-	50	50	-	-	75	3	75	125
CMEE4-103	Farm Equipment - I	48	-	2	25	-	25	50	2	-	-	50	75
CMEE4-103P	Farm Equipment – I Lab.	-	128	4	-	75	75	-	-	100	4	100	175
CMEE4-104	Basic Technical Drawing	-	-	1	-	-	-	75	3	-	-	75	75
CMEE4-104P	Basic Technical Drawing	-	48	1	-	50	50	-	-	-	-	-	50
CMEE4-105	Workshop Practice	48	-	3	25	-	25	50	2	-	-	50	75
CMEE4-105P	Workshop Practice	-	128	4	-	75	75	-	-	100	4	100	175
CMEE4-106P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CMEE4-107P	+4 Weeks Industrial Training (during vacation)	-	-	4	-	-	-	-	-	100	3	100	100
<b>Total</b>		<b>152</b>	<b>408</b>	<b>27</b>	<b>100</b>	<b>300</b>	<b>400</b>	<b>225</b>	<b>-</b>	<b>425</b>	<b>-</b>	<b>650</b>	<b>1050</b>

\* Common with other certificate programmes

# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment, energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

+ **Industrial Training**

After examination of 1<sup>st</sup> Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4 weeks and will prepare a diary. The students will prepare a report at the end of training and will present it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.



**Total weeks per semester = 16, Total working days per week = 5, Total hours/day = 7**

**Total hours in a semester =  $16 \times 5 \times 7 = 560$**

**One credit is defined as one hour of lecture per week or two hours of practicals per week for one semester. Fractions in credits have been rounded to nearest integer.**

## SECOND SEMESTER

CODE	UNITS	STUDY SCHEME		CREDITS	MARKS IN EVALUATION SCHEME								Total Marks
		Total Hours			INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
CMEE4-208	*Basic Sciences	48	-	3	25	-	25	75	2	-	-	75	100
CMEE4-209	Farm Equipment - II	48	-	3	25	-	25	50	2	-	-	50	75
CMEE4-209P	Farm Equipment – II Lab.	-	160	5	-	100	100	-	-	100	4	100	200
CMEE4-210	Testing, Repair and Maintenance of Farm Equipment	48	-	3	25	-	25	50	2	-	-	50	75
CMEE4-210P	Testing, Repair and Maintenance of Farm Equipment Lab.	-	160	5	-	100	100	-	-	100	4	100	200
CMEE4-211	Work Order Process and Costing	48	-	3	25	-	25	75	2	-	-	75	100
CMEE4-212P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CMEE4-213P	+4 Weeks Industrial Training	-	-	4	-	-	-	-	-	100	3	100	100
<b>Total</b>		<b>192</b>	<b>368</b>	<b>28</b>	<b>100</b>	<b>225</b>	<b>325</b>	<b>250</b>	<b>-</b>	<b>300</b>	<b>-</b>	<b>550</b>	<b>875</b>

\* Common with other certificate programmes

# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment, energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

+ **Industrial Training**

After examination of 2<sup>nd</sup> Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4 weeks and will prepare a diary. The students will prepare a report at the end of training and will present it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.

## 5. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 25 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

- i. 5 Marks for general behavior and discipline  
(by Principal in consultation with all the trainers)
- ii. 5 Marks for attendance as per following:  
(by the trainers of the department)
  - a) 75% Nil
  - b) 75 - 80% 2 Marks
  - c) 80 - 85% 3 Marks
  - d) Above 85% 5 Marks
- iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:  
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)
  - a) 15 - National Level participation or inter-University competition
  - b) 10 - Participation in two of above activities
  - c) 5 - Participation in internal sports of the University

Note: There should be no marks for attendance in the internal sessional of different subjects.

**UNIT – 1.1**  
**SUBJECT CODE: CMEE4-101**  
**COMMUNICATION SKILLS**

**LEARNING OUTCOMES:**

After undergoing this unit, the students will be able to:

- Speak confidently.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper perspective.
- Read various genres adopting different reading techniques.
- Respond to telephone calls effectively.

<b>Practical</b> <b>(24 Hours)</b>	<b>Theory</b> <b>(08 Hours)</b>
	Basics of Communication <ul style="list-style-type: none"> <li>• Process of communication</li> <li>• Types of communication - formal and informal, oral and written, verbal and non-verbal</li> <li>• Objectives of communication</li> <li>• Essentials of communication</li> <li>• Barriers to communication</li> </ul> <p style="text-align: right;">(1 hour)</p>
<ul style="list-style-type: none"> <li>• Looking up words in a dictionary (meaning and pronunciation)</li> </ul> <p style="text-align: right;">(2 hours)</p>	Functional Grammar and Vocabulary <ul style="list-style-type: none"> <li>• Parts of speech</li> <li>• Tenses</li> <li>• Correction of incorrect sentences</li> </ul> <p style="text-align: right;">(2 hours)</p>
<ul style="list-style-type: none"> <li>• Self and peer introduction</li> <li>• Greetings for different occasions</li> </ul> <p style="text-align: right;">(1 hour)</p>	Listening <ul style="list-style-type: none"> <li>• Meaning and process of listening</li> <li>• Importance of listening</li> <li>• Methods to improve listening skills</li> </ul> Speaking <ul style="list-style-type: none"> <li>• Importance</li> <li>• Methods to improve speaking</li> <li>• Manners and etiquettes</li> </ul> <p style="text-align: right;">(2 hours)</p>
<ul style="list-style-type: none"> <li>• Newspaper reading</li> </ul> <p style="text-align: right;">(1 hour)</p>	Reading <ul style="list-style-type: none"> <li>• Meaning</li> <li>• Techniques of reading: skimming, scanning, intensive and extensive reading</li> </ul> <p style="text-align: right;">(1 hour)</p>
<ul style="list-style-type: none"> <li>• Vocabulary enrichment and grammar exercises</li> </ul>	Functional Vocabulary <ul style="list-style-type: none"> <li>- One word substitution</li> </ul>

<ul style="list-style-type: none"> <li>• Exercises on sentence framing accurately (6 hours)</li> </ul>	<ul style="list-style-type: none"> <li>- Commonly used words which are often misspelt</li> <li>- Punctuation</li> <li>- Idioms and phrases</li> </ul> <p style="text-align: right;">(2 hours)</p>
<ul style="list-style-type: none"> <li>• Reading aloud articles and essays on current and social issues</li> <li>• Comprehension of short paragraph (5 hours)</li> </ul>	
<ul style="list-style-type: none"> <li>• Write a short technical report</li> <li>• Letter writing (3 hours)</li> </ul>	
<ul style="list-style-type: none"> <li>• Participate in oral discussion</li> <li>• Respond to telephonic calls effectively</li> <li>• Mock interview (6 hours)</li> </ul>	

**Means of Assessment**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

**UNIT - 1.2**  
**SUBJECT CODE: CMEE4-102**  
**GENERAL ENGINEERING**

**LEARNING OUTCOMES:**

After undergoing this unit, the students will be able to:

- Explain concept of electricity, electronics, computer, materials and mechanics.
- Identify and utilize various electrical accessories.
- Explain the working of cylinder and hydraulic valves
- Define basic terms related to electronics.
- Identify the material on the basis of its properties.
- Calculate forces, stress, acting on components.
- Operate computer system.

<b>Practical (32 hours)</b>	<b>Theory (48 hours)</b>
<ul style="list-style-type: none"> <li>• Practice in joining wires</li> <li>• Practice continuity test for fuse, jumper wire, circuit breaker.</li> <li>• Checking electrical circuits with test lamp.</li> <li>• Measuring current flow using multimeter (8 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to basic electricity, its principles, ground connections, Ohm's law, voltage, current, resistance, capacitor, power energy, frequency.</li> <li>• Study of conductor, insulators, capacitors, wires, shielding, length Vs resistance.</li> <li>• Resistance rating, fuse and circuit breaker, batteries and cells, sealed maintenance batteries(SMF)</li> <li>• Study of magnetic effects, heating effects, thermistors, relays, solenoid and transformers. (10 hrs)</li> </ul>
<ul style="list-style-type: none"> <li>• To measure the values of different resistors by using colour coding chart.</li> <li>• To observe semiconductor diodes in bias.</li> <li>• To familiarize with the microprocessors (6 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>• Basic electronics</li> <li>• Introduction of semiconductors, solid state devices-diodes, transistors, binary system, rectification</li> <li>• Introduction to microprocessor, sensors and remote control (4 hrs)</li> </ul>
<ul style="list-style-type: none"> <li>• Identify the parts of hydraulic/pneumatic servomotor from cut section/models</li> <li>• To study the working of single acting and double acting cylinder</li> <li>• To study the use of hydraulic valves</li> <li>• Practice making simple circuits (6 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to hydraulic and pneumatic system, Pascal law, pressure force, viscosity, different hydraulic fluids, gear pump, cylinder – single and double acting, directional control valves, relief valve, non-return valve, flow control valve, hydraulic steering unit, reciprocating air compressor, FRL unit (Filter, regular and lubricator) (10 hrs)</li> </ul>
<ul style="list-style-type: none"> <li>• To verify parallelogram law of forces</li> <li>• To draw stress-strain curve of ductile and brittle materials using UTM</li> <li>• To compare the hardness of various materials</li> </ul>	<ul style="list-style-type: none"> <li>• General mechanics – Force definition, type of forces, effect of angle on forces.</li> <li>• Power, torque, stress, strain, torsional stress, tensile and compressive stress, shear stress, factor of safety.</li> </ul>

<ul style="list-style-type: none"> <li>• Demonstrate different types of gears (8 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to gear system, type of gears, gear ratio.</li> <li>• Properties of material, ductility, brittleness, elasticity, malleability, hardness, toughness, conductivity, adhesive, cohesive.</li> <li>• Type of material- Ferrous and non ferrous material, mild steel, cast iron, steel, aluminum, alloys, copper, rubber, insulating material and sealing material. (16 hrs)</li> </ul>
<ul style="list-style-type: none"> <li>• Identify components of PC</li> <li>• To operate window operating system</li> <li>• To search the material related to farm equipment using internet</li> <li>• To communicate through email (4 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to computer, input devices, output devices, display unit, CPU, hardware, software, operation system, MS office, use of internet and email. (8 hrs)</li> </ul>

**Means of Assessment**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Report writing

**UNIT - 1.3**  
**SUBJECT CODE: CMEE4-103**  
**FARM EQUIPMENT - I**

**LEARNING OUTCOME:**

After undergoing this unit, the students will be able to:

- Identify different parts of a tractor.
- Carry out schedule maintenance as per maintenance manual.
- Conduct ring job, top overhaul and complete overhaul of engine.
- Repair transmission, steering, hydraulic, electrical and brake systems.
- Diagnose and repair defects of tractor.

<b>Practical</b>	<b>(128 hours)</b>	<b>Theory</b>	<b>(48 hours)</b>
<ul style="list-style-type: none"> <li>• Demonstration of tractor specification data; Identification of different major assemblies of tractor.</li> <li>• Cleaning and general maintenance of tractors.</li> </ul> <p style="text-align: right;">(6 hrs)</p>		<ul style="list-style-type: none"> <li>• Tractor Industry in India - leading manufacturers, trends, new product.</li> <li>• Study of tractors and different make (indigenous).</li> <li>• Maintenance schedule of tractor.</li> </ul> <p><b>Engine Basics:</b></p> <ul style="list-style-type: none"> <li>• Classification of engines, Principle and working of 2 and 4-stroke diesel engine (Compression ignition Engine, Engine output, compression pressure, Compression ratio.</li> </ul> <p style="text-align: right;">(4 hrs)</p>	
<p><b>Piston and Ring Job</b></p> <ul style="list-style-type: none"> <li>• Measurement of cylinder liner for ovality and taperness.</li> <li>• Practice and measurement of piston rings, piston and liner.</li> </ul> <p style="text-align: right;">(8 hrs)</p>		<p><b>Engine Components –</b></p> <ul style="list-style-type: none"> <li>• working principle and construction of cylinder heads and its parts</li> <li>• Description of Cylinder block, Cylinder block construction, types of cylinder blocks and cylinder liners. Description and functions of different types of pistons, piston rings and piston pins and materials used. Recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy.</li> </ul> <p style="text-align: right;">(5 hrs)</p>	
<p><b>Top overhaul</b></p> <ul style="list-style-type: none"> <li>• Remove cylinder head from engine.</li> <li>• Overhauling of cylinder head assembly with use of service manual for clearance and other parameters.</li> <li>• Overhauling of connecting rod assembly Practice on removing oil sump and oil pump</li> </ul> <p style="text-align: right;">(10 hrs)</p>		<ul style="list-style-type: none"> <li>• Description and function of connecting rod, importance of big-end split obliquity, Materials used for connecting rods big end and main bearings.</li> <li>• Shells piston pins and locking methods of piston pins. Recommended clearances for the cylinder liners and rings. Bearing failure and its causes-care and maintenance.</li> </ul> <p style="text-align: right;">(3 hrs)</p>	



<p><b>Complete overhaul</b></p> <ul style="list-style-type: none"> <li>• Measure the clearance between crank pin and the connecting rod, main journal and main bearing. Assembling crank shaft, main bearings, connecting rods big end in the engine, fitting cylinder head. Setting valve timing.</li> </ul> <p style="text-align: right;">(10 hrs)</p>	<ul style="list-style-type: none"> <li>• Description of crankshaft and Camshafts. Types of their drives. Description of Overhead camshaft, importance of Cam lobes. Crankcase ventilation . Camshaft, Crank-shaft balancing, Firing order of the engine.</li> <li>• Description and function of the fly wheel and vibration damper. Timing mark.</li> </ul> <p style="text-align: right;">(3 hrs)</p>
<ul style="list-style-type: none"> <li>• Checking cooling system for overheating / under-cooling. Dismantling, cleaning, assembling and testing of water pumps, reverse flushing the system.</li> <li>• Checking of thermostat valve, pressure cap.</li> <li>• Adjusting the fan belt tension.</li> </ul> <p style="text-align: right;">(6 hrs)</p>	<ul style="list-style-type: none"> <li>• <b>Cooling systems:-</b> Purpose, types, Heat transfer method, effect of boiling point and pressure, coolant properties, preparation and recommended change of interval, use of antifreezer.</li> <li>• <b>Cooling system components,</b> water pump, function of thermostat, pressure cap, Recovery system and Thermo-switch. Function and types of Radiator.</li> </ul> <p style="text-align: right;">(3 hrs)</p>
<ul style="list-style-type: none"> <li>• Identification of lubrication oil flow circuit in an engine.</li> <li>• Overhauling oil pump, servicing of oil cooler and centrifugal oil filter.</li> <li>• Testing oil pressure.</li> </ul> <p style="text-align: right;">(6 hrs)</p>	<ul style="list-style-type: none"> <li>• <b>Lubrication system:</b> - purposes and characteristics of oil, type of lubricants, grade as per SAE, and their application, oil additives, type of lubrication system.</li> <li>• Lubrication system components- different type of Oil pump, Oil filters and oil cooler. Probable reasons for low / high oil pressure, high oil consumption and their remedies.</li> </ul> <p style="text-align: right;">(3 hrs)</p>
<ul style="list-style-type: none"> <li>• Servicing of air cleaner (Oil bath and dry type)</li> <li>• Checking and changing an air filter</li> <li>• Inspection of turbocharger</li> <li>• Checking of Exhaust Gas Recirculation and Exhaust system,</li> </ul> <p style="text-align: right;">(6 hrs)</p>	<ul style="list-style-type: none"> <li>• <b>Intake and exhaust systems –</b> Description of Diesel induction and Exhaust systems. Description and function of air compressor, Intercoolers, turbo charger.</li> <li>• <b>Intake system components-</b> Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material.</li> <li>• <b>Exhaust system components-</b> Description and function of Exhaust manifold, Exhaust pipe, Mufflers, Catalytic converters, Back-pressure, Exhaust Gas Recirculation (EGR).</li> </ul> <p style="text-align: right;">(3 hrs)</p>

<ul style="list-style-type: none"> <li>Practice in engine tune up in a vehicle – testing vacuum and compression of engine, adjusting tappets and setting injection timing in inline and rotary pumps. Repairing fuel leaks in pipe line and unions, Servicing and testing of fuel feed pump, fuel filters, checking operation of C.R.D.I. system.</li> <li>Overhauling and Testing of injectors. Bleeding fuel lines for Air locks, Checking idle speed, Obtaining and interpreting scan tool data.</li> <li>Fault finding and remedy, care and maintenance</li> </ul> <p style="text-align: right;">(10 hrs)</p>	<p><b>Diesel Fuel Systems:</b></p> <ul style="list-style-type: none"> <li>Diesel fuel characteristics, concept of Quiet diesel technology and Clean diesel technology, Fuel feed system used in Tractor’s description and layout.</li> <li>Diesel fuel system components,</li> <li>Description and function of Diesel fuel injection system, types of fuel injection pumps, type of drive, injectors-types and function.</li> <li>Governor and their types.</li> <li>Distributor-type injection pump, Glow plugs, Cummins and Detroit Diesel injection</li> <li>Diesel electronic control- Diesel electronic control systems (DEC), Common rail diesel injection system.</li> <li>Method of bleeding fuel supply system</li> </ul> <p style="text-align: right;">(4 hrs)</p>
<ul style="list-style-type: none"> <li>Dismantle clutch assembly. Inspect the parts of clutch. Relining of clutch plate and assemble. Coupling the clutch with flywheel and join the engine with gear box. Adjust clutch pedal free play.</li> <li>Dismantle different types of gear boxes and inspect the parts. Assemble the gear box. Overhauling transfer case and auxiliary gear box.</li> </ul> <p style="text-align: right;">(16 hrs)</p>	<ul style="list-style-type: none"> <li><b>Clutch:</b> types, construction and function. Components of clutch -driver and driven plates, torsion spring, cushion springs, operating fingers, clutch shaft, Slave cylinder and oil seal. Clutch release bearing and linkages.</li> </ul> <p><b>Manual transmissions:</b></p> <ul style="list-style-type: none"> <li>Function, description, types and their application. Gearbox layout.</li> <li>Components of tractor gear box. Principle of epicyclical gear box. Necessity of torque convertor, need of 4 x 4 wheel drive / Front wheel drive, Low and high gear ratio, universal joint and propeller shaft.</li> </ul> <p style="text-align: right;">(3 hrs)</p>
<ul style="list-style-type: none"> <li>Overhauling of differential. Servicing of reduction gear, rear axle wheel hub. Servicing of PTO (Power Take Off). Measure rpm of PTO shaft and speed of belt pulley.</li> </ul> <p style="text-align: right;">(10 hrs)</p>	<p><b>Final Drive and Drive Shafts:</b></p> <ul style="list-style-type: none"> <li>Differential carriers double reduction gearing, differential lock, crown wheel and pinion adjustments, function and types of power take off (PTO) mechanism. Types of front and rear axles. Common trouble and their remedies, care and maintenance.</li> </ul> <p style="text-align: right;">(3 hrs)</p>
<ul style="list-style-type: none"> <li>Checking, Layout of Mechanical steering system, Overhauling of steering gear box</li> </ul>	<p><b>Steering and Suspension Systems:</b></p> <ul style="list-style-type: none"> <li>Function and types of steering system.</li> </ul>

<p>of tractor. Remove front axle and spindle hub and steering linkage. Reassembling steering assembly and Test for correct function. Checking, inspect layout of different parts of Hydraulic steering system</p> <ul style="list-style-type: none"> <li>Practice on visual Inspection of chassis frame for crack, bent and twists. Greasing of steering system parts.</li> </ul> <p style="text-align: right;">(10 hrs)</p>	<p>Description, construction and function of mechanical steering system. Their movement and adjustment. Description, working and principle of hydraulic steering system. Different parts such as pump, distributor valves, pipe line and hoses etc.</p> <p style="text-align: right;">(3 hrs)</p>
<ul style="list-style-type: none"> <li>Remove wheels from tractor. Dismantle wheel for checking rims, tyres for wear and tubes for leaks. Repairing, derusting, painting.</li> <li>Fitting of tyres and tubes on rim and inflate to correct pressure. Balancing of Tractor wheels. Practice of tyre rotation.</li> <li>Fitting wheels on tractors. Tightening of wheel in correct sequence. Checking and adjusting tire pressure by use of air.</li> </ul> <p style="text-align: right;">(10 hrs)</p>	<p><b>Wheels and Tyres:</b></p> <ul style="list-style-type: none"> <li>Description, construction and function of Wheel. Rim sizes. Types and sizes of tyres. Solid, pneumatic and Radial. Ply rating.</li> <li>Tyre materials, Hysteresis and designations, Tyre information, Tyre tread designs, Tyre ratings for temperature and traction. Importance of in-Flatting tyres to correct pressure. Repair and maintenance of tyres and tubes. Storage of tyres.</li> <li>Descriptions Tirewear Patterns and causes. Nitrogen vs atmospheric air in tyres</li> </ul> <p style="text-align: right;">(3 hrs)</p>
<ul style="list-style-type: none"> <li>Overhauling brakes including cleaning and inspection of all components, relining shoes, setting and actuating shoe clearance. Inspection spring of both shoe and lever. Inspecting and setting parking brakes. Inspecting and setting hydraulic main brake including replacement of washer and oil seals. Overhauling serve mechanism (as applicable) inspecting piston and valves. Bleeding and adjustment of brakes. Fault tracing and remedy. Skimming of brake drum and disc plate.</li> </ul> <p style="text-align: right;">(10 hrs)</p>	<ul style="list-style-type: none"> <li><b>Braking Systems - Braking</b> Fundamentals Principles of braking, Drum and disc brakes, Lever/mechanical advantage, Hydraulic pressure and force, Brake fade.</li> <li><b>Braking systems - Brake type used on tractor - principles, Air brakes,</b></li> <li><b>Braking system Components-Park</b> brake system, Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder, divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, Applying brakes, Brake force, Brake light switch</li> <li><b>Drum brakes and components -Drum</b> brake system, Drum brake operation, Brake linings and shoes, Backing plate, Wheel cylinders</li> <li><b>Disc brakes and components -Disc</b> brake system, Disc brake operation, Disc</li> </ul>

	<p>brake rotors, Disc brake pads, Disc brake calipers, Proportioning valves, Proportioning valve operation, Brake friction materials.</p> <ul style="list-style-type: none"> <li>• <b>Wet Brake system and its parts.</b></li> </ul> <p style="text-align: right;">(4 hrs)</p>
<ul style="list-style-type: none"> <li>• Practice on removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator and fitting to vehicles.</li> <li>• Practice on removing starter motor vehicle and overhauling the starter motor, testing of starter motor. Servicing storage batteries and alternators, Tracing lighting circuit fault rectification.</li> </ul> <p style="text-align: right;">(10 hrs)</p>	<p><b>Tractor Electrical Maintenance:</b></p> <ul style="list-style-type: none"> <li>• Lighting arrangement in tractors (As applicable).</li> <li>• Description of charging circuit. Operation of alternator, regulator unit ignition warning lamp troubles and remedy in charging system. Fault finding in electrical system.</li> <li>• Description of <b>starter motor circuit</b>, common troubles and remedy in starter circuit. Description of lighting circuit. Charging and discharging of lead acid battery.</li> </ul> <p style="text-align: right;">(4 hrs)</p>

### Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Report writing
- Viva-voce
- Workshop job
- Assembly and disassembly

**UNIT 1.4**  
**SUBJECT CODE: CMEE4-104**  
**BASIC TECHNICAL DRAWING**

**LEARNING OUTCOMES:**

After undergoing this unit, students will be able to:

- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Read technical drawings for cost estimation and manufacturing/fabrication purpose.
- Read hydraulic and electrical circuits for diagnosing problems in farm machinery.

<b>Practical</b>	<b>(48 hrs)</b>	<b>Theory</b>
<ul style="list-style-type: none"> <li>• Practical demonstration with the help of blue prints/computer prints.</li> </ul> <p style="text-align: right;">(3 hrs)</p>		Engineering drawing and its importance
<ul style="list-style-type: none"> <li>• Drawing board, T-square, mini-drafter, set squares, protractor, drawing instrument box, pencils of different grades, erasing shield</li> <li>• Learn methods of folding of blue print/drawing prints as per BIS SP : 16-2003</li> <li>• Size of drawing sheets and designation of sheets.</li> <li>• Preparation of A3/A2 sheet for preparing drawings.</li> </ul> <p style="text-align: right;">(3 hrs)</p>		Introduction to drawing instruments
<ul style="list-style-type: none"> <li>• Practice construction of different types of lines (horizontal and vertical)</li> </ul> <p style="text-align: right;">(3hrs)</p>		<ul style="list-style-type: none"> <li>• Fundamentals of engineering drawings</li> <li>• Types of lines</li> </ul>
<ul style="list-style-type: none"> <li>• Practice construction of elements dimensioning with the help of a view of an object.</li> <li>• Practice dimensioning of a diameter, radius, angles, holes, chamfers, undercut, functional dimensions, non functional dimensions.</li> </ul> <p style="text-align: right;">(6 hrs)</p>		<ul style="list-style-type: none"> <li>• Dimensioning Definition, size dimension, location dimensions, dimensioning line, extension line, leader line, termination of dimension line unidirectional and aligned dimensioning systems.</li> </ul>
<ul style="list-style-type: none"> <li>• Practice of free hand sketch of an object in orthographic and isometric views.</li> </ul> <p style="text-align: right;">(6 hrs)</p>		<ul style="list-style-type: none"> <li>• Introduction of isometric and orthographic views.</li> </ul>
<ul style="list-style-type: none"> <li>• Free hand sketching of cone, pentagonal prism and hexagonal pyramid, piston, connecting rod, gears</li> </ul> <p style="text-align: right;">(6 hrs)</p>		<ul style="list-style-type: none"> <li>• Introduction to solids: cube cone, cylinder, prism and pyramid, piston, connecting rod, gears</li> </ul>

<ul style="list-style-type: none"> <li>Practice the construction of views of the nuts, bolts and washers (9 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>Types of threads, nuts, bolts and washers. Study of other fasteners used in farm equipment machinery</li> </ul>
<ul style="list-style-type: none"> <li>Practice of sign convention of D.C. A.C. Positive, Negative, Single Phase, Three Phase, AC/DC, 3-Phase, Neutral line, earthing, fuse.</li> <li>Reading, drawing and identifying electric circuit parts (6 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>Conventions used for Electrical and electronic components.</li> </ul>
<ul style="list-style-type: none"> <li>Reading, drawing and identifying hydraulic circuit parts like brake system and steering system etc. (6 hrs)</li> </ul>	<ul style="list-style-type: none"> <li>Conventions used for hydraulic and hydraulic components</li> </ul>

Note : Theory part should be covered along with drawing practicals.

**Means of Assessment**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Sketching
- Drawing

**UNIT – 1.5**  
**SUBJECT CODE: CMEE4-105**  
**WORKSHOP PRACTICE**

**LEARNING OUTCOMES:**

After undergoing this unit, the students will be able to:

- Follow general workshop safety rules and environment precautions
- Identify, select and use appropriate hand cutting tools and carry out simple fitting operations like filing, chipping, hacksawing, threading, tapping, grinding, drilling, turning and boring operations
- Identify, select and use appropriate electrical tools and instruments, measure electrical parameters (like voltage, current, resistance, earth resistance, insulation, continuity)
- Identify electronic components like transistors, resistors, capacitors, diodes, solenoid, relays and sensors.
- Identify, select and use appropriate tools, equipment, consumables and carry out soldering, arc and gas welding operations.
- Identify and use specialised tools like torque wrench, pneumatic tools, hydraulic jack and measuring instruments.

<b>Practical</b> <b>(128 Hours)</b>	<b>Theory</b> <b>(48 Hours)</b>
<p><b>Safety</b></p> <ul style="list-style-type: none"> <li>• Finalization with safety precautions and safety equipment that may be used in mechanical workshop</li> <li>• Identification of common engineering materials.</li> <li>• Demonstration of physical properties of material viz. hardness, ductility, surface finish, toughness etc.</li> </ul> <p style="text-align: right;">(20 hours)</p>	<p><b>Safety</b></p> <ul style="list-style-type: none"> <li>• Importance of safety precautions in a workshop</li> <li>• Introduction to SI units, common workshop hand tools. Spanners, socket set, allen head keys, wrenches, pliers, pipe and chain wrenches, screw drivers.</li> <li>• Properties and application of materials used in agri-equipment.</li> </ul> <p style="text-align: right;">(6 hours)</p>
<p><b>Fitting</b></p> <ul style="list-style-type: none"> <li>• Familiarization with tools, equipment and measuring instruments used in fitting. Practice marking / layout as per specifications used in filing, chipping, hacksawing, threading, tapping, grinding, drilling, turning and boring operations.</li> <li>• Practice filing, chipping, hacksawing, threading, tapping, grinding, drilling, turning and boring operations.</li> </ul> <p style="text-align: right;">(40 hours)</p>	<p><b>Fitting</b></p> <ul style="list-style-type: none"> <li>• Study different types of tools, equipment and measuring instruments used in filing, chipping, hacksawing, threading, tapping, grinding, drilling, turning and boring operations. Their specifications, functions, working and uses; care and maintenance.</li> </ul> <p style="text-align: right;">(12 hours)</p>
<p><b>Electrical</b></p> <ul style="list-style-type: none"> <li>• Familiarization with electrical tools; practice wire joint, verification of Ohm's law, identification of phase and neutral</li> </ul>	<p><b>Electrical</b></p> <ul style="list-style-type: none"> <li>• Study electrical terms such as AC and DC supply. Series and parallel circuits, Concept of single phase and three phase</li> </ul>

<p>of AC supply, measurement of voltage, current, resistance, power, frequency and energy consumed in an electrical circuit, selection of wires and cables as per load, measurement of earth resistance. insulation and continuity test, detection of current leakage, short circuit.</p> <ul style="list-style-type: none"> <li>• Identification and usage of different types of cables for A.C. and D.C. circuits</li> </ul> <p style="text-align: right;">(16 hours)</p>	<p>supply, Safety precautions to be observed while working on electricity. Study of measuring Instruments such as voltmeter, ammeter, ohm meter, watt meter, energy meter and frequency meter. Earthing and its importance, insulation and continuity test.</p> <ul style="list-style-type: none"> <li>• Battery charging, study different types of cables for A.C. and D.C. circuits.</li> </ul> <p style="text-align: right;">(8 hours)</p>
<p><b>Welding</b></p> <ul style="list-style-type: none"> <li>• Familiarization with tools, equipment, instruments and consumables used for soldering, arc welding and gas welding.</li> <li>• Practice soldering operations.</li> <li>• Practice for arc and gas welding to join different types of weld joints.</li> </ul> <p style="text-align: right;">(24 hours)</p>	<p><b>Welding</b></p> <ul style="list-style-type: none"> <li>• Introduction to soldering, arc welding and gas welding techniques. Advantages and applications of these welding operations. Equipment and tools used in soldering, arc welding and gas welding. Consumables used, safety precautions, care and maintenance of equipment and tools used in welding shop.</li> </ul> <p style="text-align: right;">(12 hours)</p>
<p><b>Diagnostic Tools</b></p> <ul style="list-style-type: none"> <li>• Identification and usage of different types of diagnostic tools: Dial Gauge and Magnetic Stand, Torque Wrench, Tachometers, IR Thermometer, Piston Topping Gauge, Cylinder Liner Bore Gauge, Micrometer, Vernier Calliper, Engine Compression Tester, Soundscope, Multimeter and Battery Hygrometer.</li> </ul> <p style="text-align: right;">(28 hours)</p>	<p><b>Diagnostic Tools</b></p> <ul style="list-style-type: none"> <li>• Study of different types of diagnostic tools: Dial Gauge and Magnetic Stand, Torque Wrench, Tachometers, IR Thermometer, Piston Topping Gauge, Cylinder Liner Bore Gauge, Micrometer, Vernier Calliper, Engine Compression Tester, Soundscope, Multimeter and Battery Hygrometer.</li> </ul> <p style="text-align: right;">(10 hours)</p>

### Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Report writing
- Viva-voce
- Workshop job



**SUBJECT CODE: CMEE4-107**  
**INDUSTRIAL TRAINING – I (140 hrs)**

4 weeks on- the- job training in some industrial unit.

The purpose of the industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through first hand experience to enable them to use and apply institute based knowledge and skills to perform industrial activities.
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks has been provided in the study and evaluation scheme of 1<sup>st</sup> semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

- |    |                            |     |
|----|----------------------------|-----|
| a) | Punctuality and regularity | 20% |
| b) | Industrial training report | 50% |
| c) | Presentation and viva-voce | 30% |

**UNIT – 2.1**  
**SUBJECT CODE: CMEE4-208**  
**BASIC SCIENCES**

**LEARNING OUTCOMES:**

After undergoing this unit, the students will be able to:

- Apply the basic principles of Maths in solving the basic problems of the trade.
- Apply the basic principles of physics in solving the basic problems of the trade.

<b>Practical</b>	<b>Theory (48 Hours)</b>
	<p><b>Mathematics</b></p> <ul style="list-style-type: none"> <li>• Basic Algebra – algebraic formula. Simultaneous equation – quadratic equations (4 hours)</li> <li>• Simultaneous linear equation in two variables (3 hours)</li> <li>• Arithmetic and geometric progression, sum of n-terms, simple calculations. (3 hours)</li> <li>• Mensuration – Find the area of regular objects like triangle, rectangle, square and circle; volumes of cube, cuboid, sphere cylinder (6 hours)</li> <li>• Trigonometry - Concept of angle, measurement of angle in degrees, grades and radians and their conversions, T-Ratios of Allied angles (3 hours)</li> <li>• Co-ordinate Geometry - Cartesian and polar coordinates, conversion from cartesian to polar coordinates (2 hours)</li> <li>• Concept of Differentiation and Integration (3 hours)</li> </ul>
	<p><b>Physics</b></p> <ul style="list-style-type: none"> <li>• FPS, CGS, SI units, dimensions and conversions (2 hours)</li> <li>• Force, speed, velocity and acceleration – Definition, units and simple problems (3 hours)</li> <li>• Stress and strain, modulus of elasticity (2 hours)</li> <li>• Heat and temperature, its units and specific heat of solids, liquids and gases</li> </ul>

	<p style="text-align: right;">(4 hours)</p> <ul style="list-style-type: none"> <li>• Electricity and its uses, basic electricity terms and their units, D.C. and A.C., positive and negative terminals, use of switches and fuses, conductors and insulators</li> </ul> <p style="text-align: right;">(5 hours)</p> <ul style="list-style-type: none"> <li>• Work, Power and Energy-Definition, units and simple problems</li> </ul> <p style="text-align: right;">(4 hours)</p> <ul style="list-style-type: none"> <li>• Concept of force, Inertia, Newton's First law of motion; momentum and Newton's second law of motion; Impulse; Newton's third law of motion.</li> </ul> <p style="text-align: right;">(2 hours)</p> <ul style="list-style-type: none"> <li>• Friction and Lubrication</li> </ul> <p style="text-align: right;">(1 hour)</p> <ul style="list-style-type: none"> <li>• Law of conservation of energy</li> </ul> <p style="text-align: right;">(1 hour)</p>
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**Means of Assessment**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making

**UNIT - 2.2**  
**SUBJECT CODE: CMEE4-209**  
**FARM EQUIPMENT - II**

**LEARNING OUTCOME:**

After undergoing this unit, the students will be able to:

- Recommend farm equipment based upon operation requirement.
- Repair of tillage, levelling, planting, seeding, harvesting, processing and threshing equipment's.
- Repair and overhaul of centrifugal and submersible pumps.

<b>Practical</b> <b>(160 hours)</b>	<b>Theory</b> <b>(48 hours)</b>
<ul style="list-style-type: none"> <li>• Introduction to the different farm equipment's available in the lab and their practical applications.  (6 hours)</li> </ul>	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Status of farm power in India, sources of farm power, Farm mechanization and its importance in the advancement of agriculture engineering/ technology, Categorization of farm machinery and equipment.  (3 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operation and maintenance of scraper, leveler and post hole digger.  (12 hours)</li> </ul>	<p><b>Shaping and Levelling Equipment:</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, working principle, construction, material adjustment, mode of operation, specifications of scraper, riddger, leveller, bund former, post hole digger.  (4 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operation and maintenance of Mould Board Plough, Disc Plough, Cultivator, Disc Harrow, rotary power tillers and their repair.  (24 hours)</li> </ul>	<p><b>Ploughing and Tillage Equipment:</b></p> <ul style="list-style-type: none"> <li>• Primary tillage: Introduction, types, working, principle, construction, mode of operation, specifications of mould board plough, disc plough.</li> <li>• Secondary tillage: Introduction, types, working principle, construction, mode of operation, specifications of Cultivator, disc harrow, rotary power tillers.  (6 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operation and maintenance of front loader and laser leveller.  (6 hours)</li> </ul>	<p><b>Equipment for Land Development</b></p> <ul style="list-style-type: none"> <li>• Mechanical working of soil, mechanical methods land grading, shaping &amp; levelling, planning of operation, earth moving equipment's like front loader, computerized land leveller and laser lever.  (3 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operation and maintenance of seed cum fertilizer drill. Performing the different measurements using metering devices  (16 hours)</li> </ul>	<p><b>Seeding Equipment</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, working principle, construction, material adjustment, mode of operation, specifications of Indigenous plough, furrow opener, calibration of seed cum fertilizer drill, specification of different types of metering devices.  (4 hours)</li> </ul>

<ul style="list-style-type: none"> <li>• Operation and maintenance of Potato planters (semi auto and automatic), Sugarcane planter and Paddy trans-planter (16 hours)</li> </ul>	<p><b>Planting Equipment</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, working, construction, material adjustment, operation, maintenance, specifications of: Potato planters (semi auto and automatic), Sugarcane planter, Multi-crop planter, Paddy trans-planter. Safety precautions in handling this equipment. (4 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operation and maintenance of Reaper and Harvesting Combine, Self-operated combine &amp; tractor operated. (24 hours)</li> </ul>	<p><b>Harvesting Equipment:</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, working, construction, material adjustment, operation, maintenance, repair &amp; specifications of Reaper and Harvesting Combine: Self operated combine &amp; tractor operated, track combine. (8 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operation and maintenance of wheat thresher. (16 hours)</li> </ul>	<p><b>Threshing Equipment:</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, working, construction, material adjustment, operation, and specifications of: wheat thresher, groundnut decorticator. (4 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operation and maintenance of sugarcane crusher, and rice huller. (16 hours)</li> </ul>	<p><b>Processing Equipment</b></p> <ul style="list-style-type: none"> <li>• Introduction, type, working, construction, material adjustment, and operation, specification of: chaff cutter, hammer mill, sugarcane crusher, and rice huller. (5 hours)</li> </ul>
<ul style="list-style-type: none"> <li>• Operate and maintain centrifugal, submersible pump, sprinkler and drip irrigation. (24 hours)</li> </ul>	<p><b>Pumps:</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, working, construction, operation, installation (Location, foundation, grouting), power requirement, troubleshooting, piping. Specifications of: Reciprocating (single and double acting), Centrifugal, Submersible pump, Introduction to Sprinkler and Drip irrigation. (7 hours)</li> </ul>

### Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Report writing
- Viva-voce
- Workshop job

<b>UNIT: 2.3</b>	
<b>SUBJECT CODE: CMEE4-210</b>	
<b>TESTING, REPAIR AND MAINTENANCE OF FARM EQUIPMENT</b>	
<b>LEARNING OUTCOMES</b>	
After undergoing this unit, the students will be able to:	
<ul style="list-style-type: none"> <li>• Drive Tractor and related farm equipment</li> <li>• Diagnose and repair various faults in tractor and other farm equipment</li> <li>• Know and recommend how to match PTO driven implement with tractor</li> <li>• Test and Evaluate performance of tractor and other farm equipment as per manufacturer specifications</li> </ul>	
<b>Practical</b>	<b>Theory</b>
<b>(160 hours)</b>	<b>(48 hours)</b>
<ul style="list-style-type: none"> <li>• Driving Combine Harvester</li> <li>• Identification of various parts and aggregates.</li> <li>• Common faults and remedies.</li> <li>• Maintenance procedures (Demonstration)</li> </ul> <p style="text-align: right;">(20 hours)</p>	<ul style="list-style-type: none"> <li>• Function of various aggregates of combine harvester. Types of harvester. Common complaints and remedies. Safety and Environmental aspects</li> </ul> <p style="text-align: right;">(6 hours)</p>
<ul style="list-style-type: none"> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely</li> <li>• Driving Practice</li> </ul> <p style="text-align: right;">(12 hours)</p>	<ul style="list-style-type: none"> <li>• Rotavator – function and usage. Parts and aggregates. Blade Shaft RPM calculation. Selection criteria</li> </ul> <p style="text-align: right;">(2 hours)</p>
<ul style="list-style-type: none"> <li>• Identification of various parts.</li> <li>• RPM calculation</li> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely</li> <li>• Driving Practice</li> </ul> <p style="text-align: right;">(10 hours)</p>	<ul style="list-style-type: none"> <li>• Potato Planter/Potato Digger – function and aggregates</li> </ul> <p style="text-align: right;">(4 hours)</p>
<ul style="list-style-type: none"> <li>• Identification of various parts.</li> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely</li> <li>• Driving Practice</li> </ul> <p style="text-align: right;">(10 hours)</p>	<ul style="list-style-type: none"> <li>• Tiller, Harrow, MB Plough – Function and usage</li> </ul> <p style="text-align: right;">(4 hours)</p>
<ul style="list-style-type: none"> <li>• Identification of various parts.</li> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely</li> <li>• Driving Practice</li> </ul> <p style="text-align: right;">(12 hours)</p>	<ul style="list-style-type: none"> <li>• Seeding Equipment – function and usage</li> <li>• PTO RPM calculation</li> </ul> <p style="text-align: right;">(4 hours)</p>
<ul style="list-style-type: none"> <li>• Installation in Field with Motor/Tractor – Ensure matching for optimum performance</li> <li>• Identification of various parts.</li> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely</li> </ul> <p style="text-align: right;">(12 hours)</p>	<ul style="list-style-type: none"> <li>• Irrigation Pumps: Types of Pumps, Performance parameters, Testing and Evaluation, testing parameters and procedure</li> </ul> <p style="text-align: right;">(6 hours)</p>
<ul style="list-style-type: none"> <li>• Identification of various parts.</li> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely</li> <li>• Driving Practice</li> </ul> <p style="text-align: right;">(16 hours)</p>	<ul style="list-style-type: none"> <li>• Thresher/Straw Reaper – function and usage, PTO RPM calculation, Pulley size calculation</li> </ul> <p style="text-align: right;">(2 hours)</p>

<ul style="list-style-type: none"> <li>• Identification of various parts.</li> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely</li> <li>• Driving and Usage Practice</li> </ul> <p style="text-align: right;">(10hours)</p>	<ul style="list-style-type: none"> <li>• Sprinklers, Sprayers and Drip Irrigation</li> </ul> <p style="text-align: right;">(2 hours)</p>
<ul style="list-style-type: none"> <li>• Identification of various parts.</li> <li>• Common faults and remedies</li> <li>• Attaching with Tractor Safely (Demonstration)</li> </ul> <p style="text-align: right;">(8 hours)</p>	<ul style="list-style-type: none"> <li>• Dozer and Loader – function and usage.</li> </ul> <p style="text-align: right;">(2 hours)</p>
<ul style="list-style-type: none"> <li>• Measuring Voltage/Current, use multimeter, fixing and joining wires, fixing two pin, three pin shoes, making extension wires, use of insulation tape</li> </ul> <p style="text-align: right;">(14 hours)</p>	<ul style="list-style-type: none"> <li>• Farm Electrical Basics – Types of Motors and their repair, Troubleshooting electrical breakdown. How to work safely with electricity</li> </ul> <p style="text-align: right;">(6 hours)</p>
<ul style="list-style-type: none"> <li>• Illustration of Working principle of hydraulic jack. Identification of various parts of air compressor, hydraulic pump. Joining hydraulic and pneumatic pipes without leak – use of Teflon tape and sealant</li> </ul> <p style="text-align: right;">(16 hours)</p>	<ul style="list-style-type: none"> <li>• Common Defects in Hydraulics and Pneumatics – Causes and Remedies</li> </ul> <p style="text-align: right;">(4 hours)</p>
<ul style="list-style-type: none"> <li>• Broken stud removal, use of anti-rust fluid, dismantling of rusted and seized parts</li> </ul> <p style="text-align: right;">(10 hours)</p>	<ul style="list-style-type: none"> <li>• Fixing rusted and seized parts</li> </ul> <p style="text-align: right;">( 2 hours)</p>
<ul style="list-style-type: none"> <li>• Use of thread lock and gasket sealant</li> </ul> <p style="text-align: right;">(2 hours)</p>	<ul style="list-style-type: none"> <li>• Use of thread lock and sealing fluids</li> </ul> <p style="text-align: right;">(2 hours)</p>
<ul style="list-style-type: none"> <li>• Required RPM calculation, Voltage and Ampere output checking using Clamp meter</li> </ul> <p style="text-align: right;">(8 hours)</p>	<ul style="list-style-type: none"> <li>• Tractor operated genset – specifications, function and usage. RPM calculation.</li> </ul> <p style="text-align: right;">(2 hours)</p>

### Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Report writing
- Viva-voce
- Assembly and disassembly

**UNIT - 2.4**  
**SUBJECT CODE: CMEE4-211**  
**WORK ORDER PROCESS AND COSTING**

**LEARNING OUTCOME:**

After undergoing this unit, the students will be able to:

- Prepare cost and time estimate for various job works related to farm equipment's.
- Prepare work orders related to repair of farm equipment's.
- Use various techniques to improve the service business.

<b>Practical</b>	<b>Theory (48 hours)</b>
	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Definition of estimation, cost accounting, purpose of estimating and costing, advantages of costing, difference between costing and cost accounting, methods of costing, functions of cost estimating, estimating procedures. Case study on costing.</li> </ul> <p style="text-align: right;">(6 hours)</p>
	<p><b>Estimation of Material cost</b></p> <ul style="list-style-type: none"> <li>• Review of basic formulae for computation of area and volume of standard 3-d objects, Estimation of volume, weight and cost of materials for various products</li> </ul> <p style="text-align: right;">(8 hours)</p>
	<p><b>Estimation of Machine Shop Processes</b></p> <ul style="list-style-type: none"> <li>• Set up time, operation time, handling time, machining time, tear down time, allowances: personal, fatigue and tool allowances. Various machining operations- turning, milling, drilling, boring, tapping, shaping, grinding and planning</li> </ul> <p style="text-align: right;">(8 hours)</p>
	<p><b>Estimation of Other Shops</b></p> <ul style="list-style-type: none"> <li>• Estimation of cost of different products produced in foundry, forging and welding shops</li> </ul> <p style="text-align: right;">(2 hours)</p>
	<p><b>Work Order Process</b></p> <ul style="list-style-type: none"> <li>• Standard time for various jobs, labour value as per standard time.</li> <li>• Prepare, interpret work orders and their cost and time estimate: complaint reports, observation, action taken, parts, lubricant required.</li> </ul> <p style="text-align: right;">(8 hours)</p>
	<p><b>Post Repair Process</b></p> <ul style="list-style-type: none"> <li>• Explanation of jobs done and repair charges. Inspect the machinery and</li> </ul>



	<p>suggest other repairs along with their cost and time estimate</p> <p>(6 hours)</p>
	<p><b>Service Marketing</b></p> <ul style="list-style-type: none"> <li>• Different ways to improve service business: post repair follow-ups, service camps and customer data base analysis, spare parts business promotion</li> </ul> <p>(6 hours)</p>
	<p><b>Profit and Loss Calculation</b></p> <ul style="list-style-type: none"> <li>• Calculate profit percentage, taxes, fixed and variable cost, profit loss of setting a repairing workshop. Government incentives for farm marketing.</li> </ul> <p>(4 hours)</p>

**Means of Assessment**

- Assignments and quiz/class tests
- Mid-term and end-term written tests

**SUBJECT CODE: CMEE4-213**  
**INDUSTRIAL TRAINING – II (140 hrs)**

The purpose of the industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through firsthand experience to enable them to use and apply institute based knowledge and skills to perform industrial activities.
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one-year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks has been provided in the study and evaluation scheme of 2<sup>nd</sup> semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

- |    |                            |     |
|----|----------------------------|-----|
| a) | Punctuality and regularity | 20% |
| b) | Industrial training report | 50% |
| c) | Presentation and viva-voce | 30% |

## 7. RESOURCE REQUIREMENTS

### 7.1 LIST OF TOOLS AND EQUIPMENT

#### A) TRAINEES TOOL KIT PER 4 TRAINEES FOR 30 TRAINEES +1 INSTRUCTOR

Sr. No.	Name of Item	Quantity(Nos.)
1.	Allen Key set of 12 pieces (2mm to 14mm)	8
2.	Caliper inside 15 cm Spring	8
3.	Calipers outside 15 cm spring	8
4.	Center Punch 10 mm. Dia. X 100 mm.	8
5.	Dividers 15 cm Spring	8
6.	Electrician Screw Driver 250mm	8
7.	Hammer ball peen 0.5 kg with handle	8
8.	Hands file 20 cm. Second cut flat	8
9.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	8
10.	Pliers combination 20 cm.	8
11.	Screw driver 20cm.X 9mm. Blade	8
12.	Screw driver 30 cm. X 9 mm. Blade	8
13.	Scriber 15 cm	8
14.	Spanner D.E. set of 12 pieces (6mm to 32mm)	8
15.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	8
16.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	8
17.	Steel rule 30 cm inch and metric	8
18.	Steel tool box with lock and key (folding type) 400x200x150 mm	8
19.	Wire cutter and stripper	8
20.	Digital Multimeter	8

#### B) TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sr. No.	Name of Item	Quantity(Nos.)
1.	AC alternator slip ring puller	1
2.	Adjustable spanner (pipe wrench 350 mm)	2
3.	Air blow gun with standard accessories	2
4.	Air impact wrench with standard accessories	4
5.	Air ratchet with standard accessories	4
6.	Allen Key set of 12 pieces (2mm to 14mm)	2
7.	Alternator for tractor – different type	2
8.	Ammeter 300A/ 60A DC with external shunt	4
9.	Angle plate adjustable 250x150x175	1
10.	Angle plate size 200x100x200mm	2
11.	Anvil 50 Kgs with Stand	1
12.	Arbor press hand operated 2 ton capacity	1

13.	Auto Electrical test bench	1
14.	Battery –charger 12 Amp.	2
15.	Belt Tensioner gauge	1
16.	Blow Lamp 1 litre	2
17.	Caliper inside 15 cm Spring	4
18.	Calipers outside 15 cm spring	4
19.	Car Jet washer with standard accessories	1
20.	Chain Pulley Block-3 ton capacity with tripod stand	1
21.	Chaser hard W/V 9 to 40 T.P.I. set of 11 external.	1 set
22.	Chaser, hand W/W 9 to 40 T.P.I. set of 11 internal.	1 set
23.	Chisel 10 cm flat	4
24.	Chisels cross cut 200 mm X 6mm	4
25.	Circlip pliers Expanding and contracting type 15cm and 20cm each	4
26.	Clamps C 100mm	2
27.	Clamps C 150mm	2
28.	Clamps C 200mm	2
29.	Cleaning tray 45x30 cm.(S.S.)	4
30.	Clutches, different types such as cone type, disc type	1 each
31.	Compression testing gauge suitable for diesel Engine	2
32.	Connecting rod alignment fixture	1
33.	Copper bit soldering iron 0.25 Kg	4
34.	Cut section model of fuel filter	1
35.	Cylinder bore gauge capacity 20 to 160 mm	4
36.	Cylinder liner- Dry & wet liner, press fit & slidefit liner	1 each
37.	Depth micrometer 0-25mm	4
38.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)	4
39.	Different type of Engine Bearing model	1 set
40.	Different type of piston model	1each
41.	Dividers 15 cm Spring	4
42.	Drift Punch Copper 15 Cm	4
43.	Drift, copper 10 x 15 1/2 mm	2
44.	Drill point angle gauge	1
45.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4
46.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
47.	Electric testing screw driver	2
48.	Engineer's square 15 cm. Blade	2
49.	Engineers stethoscope	1
50.	Equipment puncture, in box,	1
51.	Feeler gauge 20 blades (metric)	2
52.	File flat 20 cm bastard	4
53.	File, half round 20 cm second cut	4
54.	File, Square 20 cm second cut	4
55.	File, Square 30 cm round	4

56.	File, triangular 15 cm second cut	4
57.	Files assorted sizes and types including safe edge file (20 Nos)	2 set
58.	Flat File 25 cm second cut	4
59.	Flat File 35 cm bastard	4
60.	Fuel feed pump for diesel	2
61.	Fuel injection pump (Diesel) inline	1
62.	Glow plug tester	2
63.	CI surface plate 1600 x 1000 mm with stand and cover (CI/Granite)	1
64.	Grease Gun	2
65.	Grover – 3, 4, 6mm.	1 Each
66.	Growler	2
67.	Hacksaw frame adjustable 20-30 cm	10
68.	Hammer Ball Peen 0.75 Kg	4
69.	Hammer Chipping 0.25 Kg	4
70.	Hammer copper 1 Kg with handle	4
71.	Hammer Mallet	4
72.	Hammer Plastic	4
73.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2
74.	Hand reamers adjustable 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	2sets
75.	Hand Shear Universal 250mm	2
76.	Hand vice – 37 mm	2
77.	High rate discharge tester (cell tester)	1
78.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
79.	Hydraulic jack HI-LIFT type -3 ton capacity,	1
80.	Injector – Multi hole type, Pintle type	4 each
81.	Injector cleaning unit	1
82.	Injector testing set (Hand tester)	1
83.	Insulated Screw driver 20 cm x 9mm blade	4
84.	Insulated Screw driver 30 cm x 9mm blade	4
85.	Left cut snips 250mm	4
86.	Lifting jack screw type 3 ton, 5ton	1 each
87.	Magneto spanner set with 8 spanners	1 set
88.	Magnifying glass 75mm	2
89.	Marking out table 90X60X90 cm.	1
90.	Multimeter digital 3.5” display	4
91.	Oil can 0.5/0.25 liter capacity	2
92.	Oil pump for dismantling and assembling.	2
93.	Oil Stone 15 cm x 5 cm x 2.5 cm	1
94.	Outside micrometer 0 to 25 mm	4
95.	Outside micrometer 25 to 50 mm	4
96.	Outside micrometer 50 to 75 mm	1

97.	Outside micrometer 75 to 100 mm	1
98.	Outside micrometer 100 to 125 mm	2
99.	Pipe cutting tool	2
100.	Pipe flaring tool	2
101.	Piston ring compressor	2
102.	Piston Ring expander and remover.	2
103.	Piston Ring groove cleaner.	1
104.	Pliers combination 20 cm.	2
105.	Pliers flat nose 15 cm	2
106.	Pliers round nose 15 cm	2
107.	Pliers side cutting 15 cm	2
108.	Poker	2
109.	Portable electric drill Machine 12 mm	1
110.	Power Supply 0-12 V, lamp	1
111.	Prick Punch 15 cm	4
112.	Punch Letter 4mm	2 set
113.	Radiator cut section-cross flow	1
114.	Radiator cut section-down flow	1
115.	Radiator pressure cap	2
116.	Rear axle assembly-gear box steering box assembly of the diesel engine tractor	2 set
117.	Ridger.	2
118.	Right cut snips 250mm	4
119.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm	4
120.	Scraper flat 25 cm	2
121.	Scraper half round 25 cm	2
122.	Scraper Triangular 25 cm	2
123.	Scriber 15 cm	2
124.	Scriber with scribing black universal	2
125.	Set of stock and dies - Metric	2 sets
126.	Shear Tin Man's 450 mm x 600mm	4
127.	Sheet Metal Gauge	2
128.	Shear Tinmans 300mm	4
129.	Shovel	2
130.	Soldering Copper Hatchet type 500gms	4
131.	Solid Parallels in pairs (Different size) in Metric	2
132.	Spanner Clyburn 15 cm	1
133.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
134.	Spanner T. flocks for screwing up and up-screwing inaccessible positions	2
135.	Spanner, adjustable 15cm.	2
136.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	2
137.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	2
138.	Spark lighter	2

139.	Spirit level 2V 250, 05 metre	2
140.	Spring tension tester	1
141.	Stake grooving.	2
142.	Stake, hatchet.	2
143.	Starter motor for tractor –different type	2
144.	Steel measuring tape 10 meter in a case	4
145.	Steel rule 15 cm inch and metric	4
146.	Steel rule 30 cm inch and metric	4
147.	Steel wire Brush 50mmx150mm	5
148.	Stone, carborandum 15 x 5 x 4 cm smooth and rough.	1each
149.	Straight edge gauge 2 ft.	2
150.	Straight edge gauge 4 ft.	2
151.	Stud extractor set of 3	2 sets
152.	Stud remover with socket handle	1
153.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	2
154.	Tachometer (Counting type) 6000 rpm	2
155.	Taps and Dies complete sets (5 types)	1 set
156.	Taps and wrenches -Metric	2 sets
157.	Telescope gauge	4
158.	Temperature gauge 0-100 deg c	2
159.	Thermostat	2
160.	Thread pitch gauge metric, BSW	1
161.	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
162.	Trammel 30 cm	2
163.	Turbocharger cut sectional view	1
164.	Tyre pressure gauge with holding nipple	2
165.	Universal puller for removing pulleys, bearings	1
166.	V' Block 75 x 38 mm pair with Clamps	2
167.	Vacuum gauge to read 0 to 760 mm of Hg.	2
168.	Valve Lifter	1
169.	Valve spring compressor universal.	1
170.	Vernier caliper 0-300 mm with least count 0.01mm (digital)	4
171.	Vice grip pliers	2
172.	Water pump for dismantling and assembling	2
173.	Wing compass 25 cm	2
174.	Wire Gauge (metric)	4
175.	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	4

**C) GENERAL INSTALLATION / MACHINERIES**

<b>Sr. No.</b>	<b>Name of Item</b>	<b>Quantity</b>
1.	3 furrow disc plough with scrapersyk	1
2.	9 tine cultivator-spring loaded mounted type	1
3.	Arbor press hand operated 2 ton capacity	1
4.	Automotive exhaust 5 gas analyzer (petrol & Diesel) or Diesel Smoke meter	1
5.	Wheat thresher	1
6.	Bench lever shears 250mm Blade x 3mm Capacity	1
7.	Centrifugal Pump with electric motor	1
8.	Chisel Plough- 5/7 tone	1
9.	Disc Harrow (14 Mounted type) off set	1
10.	Disc Harrow 8x8 trailed type	1
11.	Disc Plough 2 Bottom reversible l	1
12.	Discrete Component Trainer / Basic Electronics Trainer	1
13.	Drilling machine bench to drill up to 12mm dia along with accessories	1
14.	Electric motor 3 Phase 10 H.P.	1
15.	Gas Welding Table 1220mm x760mm	2
16.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth	1
17.	High capacity multi crop thresher	1
18.	Knapsack /foot sprayer	1 each
19.	Laser Leveler complete with transmitter, receiver, control box, survey equipment, 700 meter range	1
20.	Leveler/spike Leveler 3 meter width	1
21.	Liquid penetrant Inspection kit	1 set
22.	Mould Board Plough-Augur type	1
23.	P.T.O. operated rotary lawn mower	1
24.	Pneumatic rivet gun	2
25.	Lathe Machine	1
26.	Prime movers Engine (Stationery type)	2.
27.	Rotavator – 5.5’ cutting Width	1
28.	Spring tension tester	1
29.	Straw reaper	1
30.	Submersible Pump complete unit	1
31.	Tractor PTO operated aero blast spray	1
32.	Tractor 60 HP power steering	1
33.	Tractor Diesel Engine 4 stroke for Dismantling and assembling with swiveling stand	2
34.	Tractor operated potato digger	1
35.	Tractor operated two rows Semi /automatic potato planter	1
36.	Tractor operator Front mounted dozer with Hydraulic single cylinder	1



37.	<p>Sprinkler type and drip irrigation systems complete sets. Pipes(Different materiel &amp; Sizes) Such as :- PVC, HDPE, QRC &amp; Poly Tubing Dripper(Different materiel &amp; Sizes) Jets, Foggers &amp; Mister * Sprinkler( Mini, Micro, angular and circular type ) * Lawn sprinkler and garden pop-ups * Accessories and fitting for spray pop-ups * Low volume &amp; High volume rain gun range 15 to 30 meter die * Accessories and fitting for rain gun * Compression Fittings (Elbow, Elbow Treaded, Joiner, Tee, End Cap, adopter Male.) * HDPE fittings (Elbow, Elbow Treaded, Joiner, Tee, End Cap, adopter Male.) * PVC Fittings (Elbow, Elbow Treaded, Joiner, Tee, End Cap, adopter Male.) * PVC Control valve different sizes * Air Release Valve different sizes * Butterfly / G.M. Gate Valves different sizes * Fertigation Tank 30 to 160 Litres * Fertigation Equipment Pump 30 to 160 Litres * Filters (Primary filter) Sand, Hydro cyclone, Screen, Plastic/metal &amp; Disc and Drip line * Poly joiner , reducer, Tee, Elbow ,End stop different sizes * Grommet hole plug different sizes * Pressure gauge * Three way cock for gauge * PVC valve box different sizes * Water meter, Brase pressure regulator and irrigation drum * Jain spanner repair tool kit &amp; Drip line binder * Single phase electric motor 3 HP high speed (Booster )</p>	As desired
38.	Tractor Operator post hole digger	1
39.	Tractor Operator Seed cum fertilizer drill cum planter	1
40.	Tractor trailer with hydraulic system	1
41.	Trolley type portable air compressor single cylinder with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm	1
42.	Potable Weighing machine 10 Kg.	1
43.	Welding plant Oxy-Acetylene complete ( high pressure)	1
44.	Welding Transformer ( 150-300 Amps)	1
45.	Infrared thermometer	1
46.	AC/DC clampmeter (1000 Amp)	1
47.	Electric feed pump	1
48.	Tractor splitting kit (one rail and roller jack)	1
49.	Telescoping magnet (1 Kg)	1
50.	Seal pusher	1
51.	Multipurpose bearing pusher and remover	1 each

**D) WORKSHOP FURNITURE**

<b>Sr. No.</b>	<b>Name of Item</b>	<b>Quantity</b>
1.	Book shelf (glass panel) 6½ ‘ x 3’ x 1½’	As required
2.	Computer Chair	1+1
3.	Computer Table	1+1
4.	Desktop computer and related MS office software	1+1
5.	Discussion Table 8’ x 4’ x 2½ ‘	2
6.	Fire Extinguishers, first- aid box	As required
7.	Internet connection with all accessories	As required
8.	Laser printer	1
9.	LCD projector/ LED /LCD TV (42”)	1
10.	Multimedia DVD for Automotive application/subjects	As required
11.	Online UPS 2KVA	1
12.	Stools	31
13.	Storage Rack 6½ ‘ x 3’ x 1½’	As required
14.	Storage shelf 6½ ‘ x 3’ x 1½’	As required.
15.	Suitable class room furniture	As required
16.	Suitable Work Tables with vices	As required
17.	Tool Cabinet - 6½ ‘ x 3’ x 1½’	4
18.	Trainees locker 6½ ‘ x 3’ x 1½’ (to accommodate 30 Lockers)	2 Nos.

**E) BASIC TECHNICAL DRAWING**

<b>Sr. No.</b>	<b>Name of Item</b>	<b>Quantity</b>
1.	Draughtsman drawing instrument box	30+1 Set
2.	Set square celluloid 45 <sup>0</sup> (250 X 1.5 mm)	30+1 Set
3.	Set square celluloid 30 <sup>0</sup> -60 <sup>0</sup> (250 X 1.5 mm)	30+1 Set
4.	Mini drafter	30+1 Set
5.	Drawing board (700mm x500 mm) IS: 1444	30+1 Set

**F) GENERAL MACHINERY SHOP OUTFIT**

<b>Sr. No.</b>	<b>Name of Item</b>	<b>Quantity</b>
1.	Draughtsman table	30 Nos.
2.	Draughtsman stool	30 Nos.
3.	Computer Latest version compatible for running Auto CAD software, preloaded with windows and 20” colour Monitor.	15 Nos.
4.	Plotter (Max. A3 size) (Max. A0 size)	1 No.
5.	Laser Jet printer latest model	1 No.
6.	UPS - 5 KVA	2 Nos.
7.	Computer table	15 Nos.
8.	Computer chairs	30 Nos.

## 7.2 LIST OF CONSUMABLES

<b>Sr. No.</b>	<b>Name of Item</b>	<b>Quantity</b>
1.	Automatic Transmission oils	As required
2.	Battery- Lead Acid (Automotive)	As required
3.	Brake fluids	As required
4.	Chalk, Prussian blue.	As required
5.	Chemical compound for fasteners (Loctite)	As required
6.	Diesel	As required
7.	Different type gasket material and sealant	As required
8.	Different type of oil seal	As required
9.	Drill Twist (assorted)	As required
10.	Emery paper - 36-60 grit , 80-120	As required
11.	Engine coolant	As required
12.	Engine oil	As required
13.	Gear oils	As required
14.	Hacksaw blade (consumable)	As required
15.	Hand rubber gloves tested for 5000 V	5 pair
16.	Holdes, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks, thimble and other consumables	As required
17.	Hydrometer	8
18.	Lapping abrasives	As required
19.	Leather Apron	5
20.	Petrol	As required
21.	Power steering oil	As required
22.	Radiator Coolants	As required
23.	Safety glasses	As required
24.	Steel wire Brush 50mmx150mm	5
25.	Engine Spare Parts	As per req.
26.	Field crops like wheat, Soya bean, paddy etc.	As desired
27.	Gloves for Welding (Leather and Asbestos)	5 sets
28.	Cotton Jute	As required
29.	Electrodes	As required
30.	Safety goggles	8

### 7.3 LIST OF RECOMMENDED BOOKS

1. Farm Power, Machinery and Surveying by Ali Irshad; Kitab Mahal, Allahabad.
2. Pesticide Application Equipment by Bindra D.S. and Harcharan Singh; Oxford and I.B.H. Publication Co.
3. Centrifugal Pumps by Church, A and Jagdish Lal
4. Farm Machinery by Culpin C.; Crosley Rockwood and Sons Hd. London.
5. Pump Operation and Maintenance by Hicks; Mc-Graw -Hills, New Delhi.
6. Tractor Engine Maintenance and Repair by Jain, S.C. and Rai C.R.; Tata Mc-Graw-Hills Publishing Co. Ltd., New Delhi.
7. Farm Machines and Equipments by Nakra C.P.; Dhanpat Rai and Sons, 1682 Nai Sarak, Delhi.
8. Royal Tractor Mechanic by Ramesh; Royal Book Depot (Regd.) Mairhran Gate; Jullunder.
9. Guide to Tractor Operations and Maintenance by Rao, E.G.K; Asia Publishing house, Bombay-1964.
10. Fundamental of Agricultural Tractors by Sharma AP; Metropolitan, Delh.
16. Farm Machinery and equipment by Smith P.H.; Mc-Graw-Hill Book Co., Inc. New York.
17. Farm Machinery by Stone and Gulvin; John Willey and Sons, Inc. London.
18. Fundamentals of Machine Operation (FMO) Tractors by John Deere Service Training Deptt. F.John Dade Road, Moline, Illinois 61265.
19. Shakti Chalit Thresheron Ka Prachalan Aur Rakh-Rakhav (Hindi) by Verma M.R., Bhardwaj, K.C. Patra, S.L.; CIAE, Bhopal.
20. Tractor Tantral Auam Anurakshan (Hindi) by Bhardwaj K.C. Verma M.R., Patra S.K.; CIAE, Bhopal.
21. Tractor Prachalan, Anurakshan Auam Utapnna Hone Wale Desh Tatna Nirakram (Hindi) by Saxena B.B. Sidduque S.Z.; CIAE, Bhopal.
22. Power Tiller Prachalan Anurakshan Auam chalit Yantra (Hindi) by Varshney A.C. Nargang; CIAE, Bhopal.
23. Power Tillers and Matching Implements by Pandey, M.M. Bohra C.P. Maheshwari, R.C. & Tomar, S.S. ; CIAE, Bhopal.
24. Motorcycle Scooter Thntra Ani Mantri (Marathi) by Apte M.S.; Yantra Vigyan Prakashan, 264/3, Shaniwar Peth, Pune.
25. Elements of Agricultural Engineering by Jagdishwar Sahay; Standard Publishes-Distributors-Delhi
30. Principal of Agricultural Engg. Vol-I by A.M. Michel and T.P Ojha; Jain Brothers, New Delhi
31. Principal of Agricultural Engg. Vol-II by A.M. Michel and T.P Ojha; Jain Brothers, New Delhi

32. Farm Machinery Design (Principles and Problems by D N Sharma and S. Mukesh; Jain Brothers, New Delhi.
33. Objectives and Solved Problems in Farm Power and Machinery Engineering by R Suresh; Standard Publishers Distributors
34. Farm Tractor : Maintenance and Repair – 2012 by Jain S.C. and C.R. Rai; Standard Publishers Distributors (2012)
35. Farm Machinery An Approach by S. C. Jain
36. Principles of Farm Machinery by Kepner; C.B.S.
37. Hydraulic Machinery by Abdullah; Dhanpat Rai and Sons, Delhi.
38. Farm mechanism and Farm Machinery and Power by O.P. Singhal; Orient Offset Printers
39. Mechanical Estimating and Costing by B.P.Sinha; Tata McGraw Hill, New Delhi
40. Mechanical Estimating and Costing by TTTI, Madras; Tata McGraw Hill, New Delhi
41. Production Engineering, Estimating and Costing by M Adithan and BS Pabla; Konark Publishers, New Delhi
42. Agricultural Engineering Question Bank by Jain Brothers
43. Tractor Engines: Maintenance and Repair by Jain S.C. and C.R. Rai; McGraw Hill Publishing Co. Ltd.
44. MES – Agriculture – Repair, Maintenance and Field Operation of Tillage Equipment, NIMI, Chennai
45. MES – Agriculture – Repair, Maintenance of Spraying and Dusting Equipment, NIMI, Chennai
46. MES – Agriculture – Repair, Maintenance of Combine Harvester, NIMI, Chennai
47. MES – Agriculture – Repair, Maintenance of Harvesting Equipment, NIMI, Chennai
48. MES – Agriculture – Repair, Maintenance of Soil Forming Equipment, NIMI, Chennai
49. MES – Agriculture – Repair, Maintenance of Irrigation Equipment, NIMI, Chennai
50. MES – Agriculture – Repair, Maintenance of Full Operation of Seed Drill, NIMI, Chennai
51. Teaching Aids:
  - Cutway section charts and flow diagram charts of engine, Tractors, power tiller, combine mopeds, sprayer, dusters and electric motor.
  - Cut way section model of engine starter, electric motor, sprayer, mopeds, power tiller and tractor.
  - Video Films and slides.

## **8. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION AND EVALUATION**

Since this skill development course is tailor made i.e. designed to meet the requirement of selected group of students for developing desired competencies in the given trade, it is pertinent for trainers to understand the design philosophy and arrange teaching-learning process using appropriate strategies. The following points may be considered by the trainer at the time of planning the training programme and subsequently during the implementation and evaluation stages:

1. There are multiple competencies in each unit. The course curriculum also includes a core unit on developing effective communication and entrepreneurial qualities. Each unit has specific competencies which trainees are expected to acquire at the end of the each unit. In order to achieve these competencies, the curriculum describes the practice tasks/exercises and related theoretical knowledge. Time has been allocated for both of these components.
2. The curriculum is designed for contact period of 35 hours per week but can be increased/changed as per convenience of the trainees and the trainer.
3. The trainer will assess the attainment of each specific learning outcome of the individual learner and will maintain record whether the trainee has achieved desired level i.e. Yes/No. In case of 'No' the trainee will work further to learn and attain the desired skills till s/he earns 'Yes'.
4. Each learning outcome will be assessed/tested by the trainee as per acceptable norms and record will be maintained for final certification. The final assessment of skills attained through practice jobs and acquisition of relevant knowledge should preferably be carried out appropriately.
5. The examiner will set an objective type question paper for theory examinations of each unit under final assessment. Preferably the question paper should aim at testing the understanding of basic principles and concepts by students and their applications.
6. The final assessment of practical skills development should not be limited to testing a few units, but should spread over to all the acquired skills in an integrated manner. It should ultimately assess the ability of the student to accomplish the desired learning outcomes of the programme.

## 9. LIST OF CONTRIBUTORS/EXPERTS

- a) Following experts participated in the workshop to design curriculum of certificate programme in “Farm Equipment Technician” with NSQF alignment for MRSPTU, Bathinda on 1-2 September, 2016 at NITTTR, Chandigarh.

1.	Prof. Saurabh Prakash, Professor & Head, Department of Engineering and Technology, PSSCIVE, Bhopal
2.	Prof. Pardeep Gupta, Professor, Mechanical Engineering Department, SLIET, Longowal, Punjab
3.	Prof. Anuj Bansal, Associate Professor, Mechanical Engineering Department, SLIET, Longowal, Punjab
4.	Prof. Sunil Kumar, Associate Professor, Mechanical Engineering Department, SLIET, Longowal, Punjab
5.	Shri Sandeep Singh, Regional Manager, TAFE Limited, Ludhiana, Punjab
6.	Shri HS Kalra, Ex-Principal, Govt. ITI, Sector-28, Chandigarh
7.	Shri PS Viridi, Consultant, H.No. 398, Phase-1, Mohali, Punjab
8.	Dr. BS Pabla, Professor & Head, IMCO, NITTTR, Chandigarh
9.	Prof. Rama Chhabra, Associate Professor, IMCO, NITTTR, Chandigarh
10.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh
	<b>Coordinator</b>

- b) Following experts participated in the workshop to review curriculum of certificate programme in “Farm Equipment Technician” for MRSPTU, Bathinda held on 6 January, 2017 at NITTTR, Chandigarh.

1.	Dr. Ashok Kumar Goel, Director, College Development Council, MRSPTU Campus, Bathinda, Punjab
2.	Dr. Balraj Singh, Director, PIT, Rajpura
3.	Shri HS Kalra, Ex-Principal, Govt. Industrial Training Institute, Sector-28, Chandigarh
4.	Shri GS Sethi, Consultant, IndiaCan, A-301, Rishi App, Sector 70, Mohali
5.	Shri Asheesh Kumar Saini, Centre Head, IL&FS, IIS, Ropar
6.	Shri Jasvir Singh Tiwana, Associate Professor, GZSCCET, Bathinda
7.	Shri Sikander Singh Sidhu, Assistant Professor, GZSCCET, Bathinda
8.	Shri J Ghosh Roy, Aryabhat Polytechnic, Delhi
9.	Shri Jagdeep Singh, Central Tool Room, A-5, Phase-5, Focal Point, Ludhiana
10.	Shri Rakesh Goel, Estate Officer, NITTTR, Chandigarh
11.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh
	<b>Coordinator</b>

