

Course No: FMPE- 234
Sem: III (New)

Titles: Farm Power and Automotive Engines
Credit: 2 (1+1)

Theory:

Sources of farm power -conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. Indicator diagram. Study of engine components their construction, operating principles and functions. Study of engine stroke and comparison of 2 stroke and 4 stroke engine cycle and CI and SI engines. Study of engine valve systems, valve mechanism, valve timing diagram and valve clearance adjustment. Study of importance of air cleaning system. Study of types of air cleaners. Study of fuel supply system. Study of Fuel, properties of fuels, calculation of air fuel ration. Study of tests on fuel for SI and CI engines. Study of detonation and knocking in IC engine. Study of carburetion system, carburetors and their main components. Study of fuel injection system-injection pump, their types, working principles. Fuel injector nozzles, their types and working principles. Engine governing- need of governor, governor types. Study of lubrication system- need, types, functional components. Study of lubricants- Physical properties, additives and their application. Engine cooling system- need, cooling methods and main functional components Additives in the coolant and properties. Study of ignition system of SI engines. Study of electrical system including battery, starting motor, battery charging, cut-out etc.

Practical:

Introduction to different systems of IC engine; Engine parts and functions, working principles etc; Valve system – study, construction and adjustments;
Air cleaning system; Fuel supply system of SI engine; Diesel injection system & timing; Cooling system, governor; Lubricating system & adjustments; Ignition system; electrical system; Calculation on diff. horse power and cylinder pressure , specific fuel consumption and power requirement & efficiencies, air fuel ratio etc.

Lesson Plan

Lecture, No.	Topic	Book/Art.No./Page No.
1	Sources of Farm power, Conventional & non Conventional energy	M: 1.1-1.7 S:2.1-2.6
2-3	Classification of tractors, Otto cycle & diesel cycle, their efficiencies Causes for deviation from Ideal & PV diagram, & their problems, Air cycles.	L:1-8 L:37:45 M-2.1, J-1.1
4	Principle & working of four stroke & two-stroke cycle engine	J-1.3
5	IC engine components, operating principle, their function and their construction	J-1.2
6	Valve and valve mechanism, Valve arrangement, Firing order, firing interval, power balance and firing order of engines, valve timing diagram	S: 3.9 J: 4.2-4.5 J: 5.11.5
7	Intake & exhaust system, types of air cleaners	J:9.1-9.8
8-9	Fuel system : Fuel supply in petrol engine- Carburetor & it's working principle Fuel supply system of diesel engine, fuel filter, injector nozzles, their types and working principles. Fuel injection system, Combustion chamber,	M: 88-90 S:5.3 J-6.3 to 6.4 (75-83), 6.51-6.53 S:5.5-5.6
10	Cooling system: Cooling methods and main functional components	J-8.1-8.3
11	Lubrication system- needs, types, functional components. Splash & forced feed system. Combination of both, oil filters & other accessories.	J: 7.6-7.8
12	Ignition systems: Battery ignition & its components Magneto ignition, other methods of ignition	S: 8.1-8.6
13	Engine principles of governor Introductions of Principles of governor Classifications of governing system, hit & miss & throttle leave system. (Centrifugal governor, pneumatic & hydraulic governor) Governor regulations & governor hunting.	S: 6.1-6.5 M: Fig 3.20
14	Electrical system including battery chemical activity, battery charging, starting motor, cut-out etc. (in brief)	J:20.1.1-20.1.07 20.2.1- 20.2.2.1,20.2.2.2 ; 2.2.3-2.2.4 2.3.2-2.3.4
15	Fuel properties & qualities of fuel, tests on fuel for SI and CI engine, Detonation of IC engine	L-Pg 54-75 S-5.1
16	Properties of coolants, anti freeze material, anti corrosion materials, Types of lubricants, Oil tests Physical properties, additives and their application.	L: Pg.175-178 S:Pg.111-112 J-7.4-7.5

Teaching shedule theory with weightages (%)

Unit	Lecture, No.	Topic	Weightage %
I	1	Sources of Farm power, Conventional & non Conventional energy	15
	2-3	Otto cycle & diesel cycle, their efficiencies Causes for deviation from Ideal & PV diagram, & their problems, Air cycles.	
II	4	Principle & working of four stroke & two-stroke cycle engine	30
	5	IC engine components, operating principle, their function and their construction	
	6	Valve and valve mechanism, Valve arrangement, Firing order, firing interval, power balance and firing order of engines, valve timing diagram	
III	7	Intake & exhaust system, types of air cleaners	20
	8-10	Fuel properties & qualities of fuel, tests on fuel for SI and CI engine, Detonation of IC engine	
		Fuel system :Fuel supply in petrol engine- Carburetor & it's working principle	
		Fuel supply system of diesel engine, fuel filter, injector nozzles, their types and working principles. Fuel injection system, Combustion chamber,	
	11	Engine principles of governor Introductions of Principles of governor Classifications of governing system, hit & miss & throttle leave system. (Centrifugal governor, pneumatic & hydraulic governor) Governor regulations & governor hunting.	
IV	12	Properties of coolants, anti freeze material, anti corrosion materials,	20
		Cooling system: Cooling methods and main functional components	
	13-14	Types of lubricants, Oil tests Physical properties, additives and their application.	
		Lubrication system- needs, types, functional components. Splash & forced feed system. Combination of both, oil filters & other accessories.	
V	15-16	Ignition systems: Battery ignition & its components Magneto ignition, other methods of ignition Electrical system including battery chemical activity, battery charging, starting motor, cut-out etc. (in brief)	15

Practical Exercises

Ex. no	Title
1	To study working principle of two and four stroke engines
2-4	Dismantling and assembling of diesel engine
5	To study valve operating system, FI & FO valve timing diagram, valve clearance adjustment.
6	To study intake and exhaust of IC engine
7	To study fuel system of Spark Ignition engine
8	To study fuel system of Compression Ignition engine
9	To study cooling system of tractor
10	To study lubrication system of tractor engine
11	To study ignition system of IC engine
12	To study diff. types of governors and methods of governing
13	To study electrical system of tractor.
14-15	To study engine terminology, Calculation on diff. horse power and cylinder pressure specific fuel consumption and power requirement & efficiencies, air fuel ratio
16	To study the physical properties of oil, fuel

Suggested reading

Text Book:

1. Elements of Agril. Engineering by Dr. Jagdiswar Sahay-(S) fourth edition 2004
2. Farm tractor maintenance & repair by SC. Jain & C R.Rai (J) second Reprint, 1999
3. Principles of Agril. Engineering Vol-I By AM Michael and TP Ojha (M)-2nd Edn.
4. Tractor and their power unit by JB Liljedahl & et al. (L) (4 authors books 1st Edn.1997)

Reference Book :

1. Farm machines and Equipment by C. P. Nakra, Dhankpat Rai & Sons (N) Edition 1990.
2. Fundamentals of IC Engines by Paul W. Gill, James H. Smith Eugene Ziury-(G) (revised 4thEdn)