

Indian Forest Services (Main)
Examination-2025

DJSM-B-AGRE

AGRICULTURAL ENGINEERING
Paper – II

Time Allowed : Three Hours

Maximum Marks : 200

Question Paper Specific Instructions

Please read each of the following instructions carefully before attempting questions :

*There are **EIGHT** questions in all, out of which **FIVE** are to be attempted.*

*Questions no. **1** and **5** are **compulsory**. Out of the remaining **SIX** questions, **THREE** are to be attempted selecting at least **ONE** question from each of the two Sections A and B.*

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

All questions carry equal marks. The number of marks carried by a question/part is indicated against it.

*Answers must be written in **ENGLISH** only.*

Unless otherwise mentioned, symbols and notations have their usual standard meanings. Assume suitable data, if necessary and indicate the same clearly.

Neat sketches may be drawn, wherever required.

(Main) Services? (Main)
SECTION A
 Examination-2023

- Q1.** (a) Define indicated thermal efficiency and relative efficiency of an IC engine. Why is relative efficiency preferred as a measure of engine performance? 8
- (b) (i) Define depreciation and list the different methods employed in calculating depreciation. Also, indicate which method is common for farm machines. 4
- (ii) A disk harrow with a draft of 18 N is required to be pulled at a speed of 4 km/h in a firm untilled field by a tractor having maximum PTO power rating of 40 kW.
 Calculate the actual PTO power needed to pull the harrow, if the tractive and transmission coefficient for a 2-wheel drive tractor for the untilled firm soil is 0.75. 4
- (c) Enlist the reasons for lubricating the different moving parts of IC engine. Also, state what you understand by 'Multigrade' lubricating oil. 8
- (d) What is Solar Constant? Write about the instruments that are used to measure solar energy. 8
- (e) Define the following : 8
- (i) Cetane number
- (ii) Volumetric efficiency of IC engine
- (iii) Firing order in multicylinder engine
- (iv) Compression ratio
- Q2.** (a) Write short notes on the following : 5×3=15
- (i) Pressurised radiator cap
- (ii) Nozzles of agricultural sprayers
- (iii) Accessories of tractor drawn mouldboard plough
- (iv) Gasification of biomass
- (v) Valve timing diagram of a 4-stroke cycle IC engine
- (b) Write down the functions of a Carburettor. Explain with the help of a sketch the principle and working of a simple Float-type Carburettor. 15
- (c) Discuss the different types of solar energy collectors and their applications. 10

- Q3.** (a) What type of governor is generally used in tractors manufactured in India ? Explain its working principle and operation with the help of a suitable diagram. 15
- (b) (i) What types of disc harrow fall under the category of 'Double Action' disc harrow ? Explain their working with a line sketch. 5
- (ii) A tractor weighing 28.5 kN with a front wheel reaction of 9.0 kN, is in static position on a horizontal surface. The wheelbase is 2.08 m. Calculate the horizontal distance from the rear axle centreline to the centre of gravity. Also, calculate the rear wheel reaction and explain with reason if it is a 2-wheel drive or a 4-wheel drive tractor. 10
- (c) Write down the classification of Induction Motors. List the factors that should be considered for selecting the right type of motor. 10
- Q4.** (a) Classify the digester of a biogas plant on the basis of construction as well as on the basis of gas storage. Also, discuss the utilization of biogas for different applications. 15
- (b) (i) Write down the functions of Fuel Injection Pump of a tractor engine. Discuss the importance of fuel viscosity in fuel injection system. 8
- (ii) What is Atomization ? Discuss the main fluid properties that affect droplet size in agricultural spraying. 7
- (c) Classify implements on the basis of how they are attached to a wheel-type Agricultural Tractor and discuss each. 10

SECTION B

- Q5.** (a) Write short notes on the following : 8
- (i) Specific Humidity
 - (ii) Dew Point (DP) Temperature
 - (iii) Wet Bulb (WB) Temperature
 - (iv) Decortication of Oilseeds
- (b) Explain different types of food packaging materials with their characteristics. 8
- (c) Define Fineness Modulus. 8
 Using fineness modulus, determine the average particle size with the following data :
- | IS Sieve Size | 100 | 70 | 50 | 40 | 20 | 15 | PAN |
|--|-----|-----|-----|------|------|------|-----|
| Percentage (%) of particles retained on each sieve | 2.3 | 3.5 | 6.0 | 25.2 | 42.8 | 19.2 | 1.0 |
- (d) Define electrical amplifying elements and discuss their voltage amplification, current amplification and gain. 8
- (e) Explain in ascending order the data storage hierarchy in a computer. 8
- Q6.** (a) With the help of a line diagram, discuss Vertical Cone Rice Whitener. Also, discuss its advantages and disadvantages. 15
- (b) 5000 kg of apples are to be cooled from 25°C to 10°C in 24 hours. Specific heat of apple is 3.25 kJ/kg°C. The heat of respiration in 24 hours is 3400 kJ per tonne of apples. Due to different sources, the infiltration of heat is 4100 kJ per tonne of apples during 24 hours. The lighting load is 150 W. Calculate the refrigeration capacity [tonne of refrigeration (TR)] of machine required.
 Note : 1 TR = 3.5 kW = 210 kJ/min. 10
- (c) Write the principle of operation of the following transducer elements and mention their input and output variables : 8
- (i) Bourdon gauge
 - (ii) Venturimeter/Orifice meter
 - (iii) Piezo-electric device
 - (iv) Solar cell
- (d) Write the algorithm and flowchart to find the sum of two numbers. 7

- Q7.** (a) Discuss various advantages and limitations of ice cream ingredients such as milk fat, milk-solids-not-fat, sugar, stabilizer, emulsifier, total solids, flavour and colour. 15
- (b) A bucket elevator is installed to be used up to a height of 25 m for vertically lifting foodgrains (750 kg/m^3). Each bucket has a volume of 3500 cc and spaced 40 cm apart on a belt. The centre-to-centre distance between head and foot wheel is 25.30 metres. The head pulley is 30 cm in diameter and rotates on a shaft of 5 cm diameter. The belt and the empty buckets weigh on an average 5 kg per metre length. Assume degree of lifting as 80% and coefficient of friction as 0.4 at the axle of the pulley.
Find the speed and power required to lift 4 tonnes of foodgrains (750 kg/m^3) per hour. 10
- (c) What is Data ? Describe the procedure of data processing to obtain information for decision-making. 8
- (d) With a neat sketch, explain the cistern-type manometer used for measuring static pressure. 7
- Q8.** (a) What are the objectives of the Tempering-Degerming (TD) method in corn dry milling ? Describe the basic operations involved in the TD method. 15
- (b) Describe the various steps in modern wheat flour milling. 15
- (c) Define Shrikhand. Discuss the standardised method of preparation of Shrikhand. 10

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