M.Tech Even Semester Examination, May, 2025

Agricultural Engineering

(2nd Semester)

Course No: 2AG-153A

(Renewable Sources of Energy and Utilization)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

Note:

1. Attempt any five questions taking one from each unit.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

1. (a) Compare the Conventional & Non Conventional energy sources. 7

   (b) Explain the different types of biomass. Write its advantages and disadvantages. 3.5+3.5

2. (a) Explain the biodiesel process with flow diagram. Write its advantages. 3.5+3.5

   (b) Explain the cost economics. 7

UNIT-II

3. (a) Explain the updraft gasifier with neat sketch. Write its advantages and application. 3.5+3.5

(b) Explain the screw press briquetting machine with neat sketch. Write its advantages and application. 3.5+3.5

4. (a) Explain the downdraft gasifier with neat sketch. Write its advantages and application. 3.5+3.5

(b) Explain the piston press briquetting machine with neat sketch. Write its advantages and application. 3.5+3.5

UNIT-III

5. What is biogas? Write its uses. Explain the KVIC biogas plant with neat sketch. 2+2+10

6. (a) What are factors to be considered in selecting the site for biogas plant. 7

(b) Calculate (1) volume of biogas digester suitable for the output of 5 cows, and (2) power available from the digester. If the retention time is 20 days, temperature 30 0C, dry matter consumed per day = 2 kg, biogas yield is 0.24 m^3/kg, efficiency of burner is 60%, methane proportion is 0.8, heat of combustion of methane is 28 MJ/m^3 and density of dry matter is 50 kg/m^3. 7

UNIT-IV

7. (a) Explain the working principle of a box type solar cooker. Explain its construction and working. 3.5+3.5

(b) Determine the local solar time and declination at a location latitude 23° 15´ N, longitude 77° 30´E at 12.30 IST on June 20. Equation of time correction is given from standard table or chart = -(1´01´´). 7

8. (a) Explain the working principle of a flat plate solar water heater. Explain its construction and working. 3.5+3.5

(b) Calculate the day length at location (latitude Φ=28°35´N, longitude=77°12´E) on December 10. 7

UNIT-V

9. Design of Biogas Plant for a village consisting of 100 families, each family consisting of 5 persons (adults). Two children are equivalent to one person. Village survey report gives the following information's about cattles.

	No.
Cows	110
Oxes	130
Bufflao	50
Pig	5

A community biogas plant is to be designed only for cooking and house lighting.

Gas required for cooking/person/day= 0.227 m^3

Gas required for lighting 100 C.P. lamp per hour = 0.126 m^3

Each family is allotted 2 lamps, which would burn 2 hours daily, 14

10. Compare the following: 14

(i) Updraft gasifier and down draft gasifier

(ii) Floating type and fixed type biogas plant

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