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**Question Paper Code: RA201**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

Professional Elective

Agricultural Engineering

R21AGV201– BIOCHEMICAL AND THERMOCHEMICAL CONVERSION OF BIOMASS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which micro organism is commonly used in the anaerobic digestion of biomass? CO2- U  
(a) Yeast                      (b) Cyanobacteria              (c) coli                      (d) Methanogens
2. What are energy crops? CO1- U  
(a) Crops grown to remove insects              (b) Crops grown to be used in generating energy  
(c) Crops grown to feed people              (d) Crops that produce energy
3. The temperature range of incinerator is \_\_\_\_\_ CO2- U  
a) 900-1100 °C              b) 800-1000 °C              c) 1200-1500 °C              d) 600-700 °C
4. What is the volatile matter in biomass? CO1- U  
(a) The content in biomass that remains after heating  
(b) The content in biomass that is driven off as gas by heating  
(c) The biomass that is being heated  
(d) The moisture content in biomass
5. The main products of pyrolysis are: CO2- U  
(a) Gas, char, and bio-oil              (b) CO<sub>2</sub>, N<sub>2</sub>, and H<sub>2</sub>O              (c) Only biochar              (d) Only syngas

6. Which of the following best indicates the steps of anaerobic digestion? CO1- U
- (a) Waste water feed → biogas storage → generator → biogas  
 (b) Waste water feed → digester → biogas → biogas storage → generator  
 (c) Generator → waste water feed → digester → biogas → biogas storage  
 (d) Waste water feed → biogas → digester → biogas storage → generator
7. The efficiency of a wood-burning stove can be improved by: CO2- U
- (a) Reducing excess air supply (b) Increasing excess air supply indefinitely  
 (c) Using only dry wood (d) Both (a) and (c)
8. The heat transfer medium in a thermic fluid heater is usually CO2- U
- (a) Steam (b) Hot oil (c) Compressed air (d) Molten metal
9. The temperature range of bubbling fluidized bed gasifier is \_\_\_\_\_ CO2- U
- (a) Between 700 and 900 degree Celsius (b) Less than 500 degree Celsius  
 (c) Above 1000 degree Celsius (d) Between 100 and 200 degree Celsius
10. A waste heat boiler generates: CO2- U
- (a) High-pressure water (b) Steam using heat from exhaust gases  
 (c) Steam using electrical heaters (d) Hot oil for industrial processes

PART – B (5 x 2= 10 Marks)

11. Identify a biomass type suitable for pelletizing and justify your choice. CO3 -App
12. List any two factors that affect biogas production. CO1 -U
13. State the three requirements for combustion. CO2 -U
14. Illustrate the flowchart of Direct Combustion System. CO2- U
15. Differentiate between sensible heat recovery and latent heat recovery. CO2 -U

PART – C (5 x 16= 80 Marks)

16. (a) Apply the concept of renewable and non-renewable energy classification to evaluate energy planning for a smart city project. CO3 -App (16)  
 What types of energy would you include, and why?  
 Or  
 (b) Suggest a suitable biomass supply chain plan including harvesting/collection, transportation, and processing, keeping in mind efficiency and cost-effectiveness. CO3 -App (16)

17. (a) Define landfills and describe the process of landfill gas generation and its energy recovery potential. CO1 -U (16)
- Or
- (b) Explain in detail about production of biogas using fixed dome biogas plant with neat sketch. CO1- U (16)
18. (a) Explain the concept of thermochemical degradation of biomass and describe the different stages with suitable examples. CO2 -U (16)
- Or
- (b) Explain the operating principle and applications of single pot chulhas and double pot chulhas with suitable sketches. CO2 -U (16)
19. (a) A village wants to make use of coconut shells instead of burning them in the open. Suggest how an updraft gasifier can be useful. CO4-App (16)
- Or
- (b) A farmer wants to use crop residues to produce biochar for soil improvement. Which type of pyrolysis would you recommend and why? Explain the process conditions involved. CO4-App (16)
20. (a) Explain the construction and working of a heat pipe, advantages and applications? CO2 -U (16)
- Or
- (b) Write about the classification of cogeneration systems. Explain in detail the working of a topping cycle cogeneration system. CO2- U (16)

