

Power Plant Engineering

Week 14

Assessments
Final Exam

Lecturer: Dr. Melaku Desta

This exam contains two parts:

- i. Multiple Choice Questions (40 Questions_2 marks each)
 - ii. Short Answer Questions (4 Questions_ 5 marks each)
- Total marks = 100
 - Attempt all questions
 - Time allotted: 90 minutes

Multiple Choice Questions

1. Which of the following is an example of a raw energy resource?
 - A. Electric energy
 - B. Solar radiation
 - C. Compressed air energy storage
 - D. Battery energy

2. In a direct energy conversion system, energy is converted from one form to another without_____.
 - A. Using a mechanical intermediary
 - B. Requiring any energy source
 - C. Generating heat as an intermediate form
 - D. Involving electromagnetic fields

Multiple Choice Questions

3. Which of the following devices is an example of a direct energy conversion system?
 - A. Steam turbine
 - B. Gas turbine
 - C. Fuel cell
 - D. Diesel engine

4. In indirect energy conversion power plants, the primary energy is first converted into_____.
 - A. Electrical energy directly
 - B. Thermal energy or mechanical energy
 - C. Nuclear energy
 - D. Gravitational potential energy

Multiple Choice Questions

5. Which of the following correctly matches the power plant with its energy conversion type?
- A. Photovoltaic system – Indirect conversion
 - B. Steam power plant – Direct conversion
 - C. Fuel cell – Indirect conversion
 - D. Gas turbine plant – Indirect conversion
6. The basic power cycle used in steam power plants is the_____.
- A. Otto cycle
 - B. Brayton cycle
 - C. Rankine cycle
 - D. Diesel cycle

Multiple Choice Questions

7. The main purpose of the reheat cycle in steam power plants is to_____.
- A. Increase boiler pressure
 - B. Improve thermal efficiency and reduce moisture at turbine exhaust
 - C. Decrease condenser pressure
 - D. Increase mass flow rate of steam
8. The regenerative cycle improves thermal efficiency primarily by_____.
- A. Superheating steam to a higher temperature
 - B. Using part of the turbine steam to preheat the feedwater
 - C. Operating at higher condenser pressures
 - D. Reducing the number of turbine stages

Multiple Choice Questions

9. The reheat–regenerative cycle combines the advantages of_____.
- A. Rankine and Otto cycles
 - B. Reheat and regenerative cycles
 - C. Carnot and Brayton cycles
 - D. Open and closed cycle
10. In a binary vapor cycle, two working fluids are used primarily to_____.
- A. Increase the compressor work
 - B. Utilize low-temperature heat sources more efficiently
 - C. Reduce the mass flow rate of steam
 - D. Operate the plant at a higher pressure

Multiple Choice Questions

11. Fuels are broadly classified based on their physical state as_____.
- A. Organic and inorganic fuels
 - B. Natural and artificial fuels
 - C. Solid, liquid, and gaseous fuels
 - D. Renewable and non-renewable fuels
12. The proximate analysis of coal gives information about_____.
- A. Carbon, hydrogen, and oxygen content
 - B. Moisture, volatile matter, ash, and fixed carbon
 - C. Calorific value and sulfur content
 - D. Ultimate composition and heating value

Multiple Choice Questions

13. Combustion stoichiometry deals with_____.
- A. Measurement of calorific value of fuels
 - B. Estimation of air required for complete combustion
 - C. Determination of ash content in coal
 - D. Analysis of products of incomplete combustion only
14. The adiabatic flame temperature of a fuel–air mixture depends primarily on_____.
- A. The calorific value and excess air used
 - B. The moisture content of fuel only
 - C. The ambient pressure alone
 - D. The rate of combustion only

Multiple Choice Questions

15. The bomb calorimeter is used for_____.
- A. Determining the ultimate analysis of fuel
 - B. Measuring the adiabatic flame temperature
 - C. Experimental determination of heating value of a fuel
 - D. Estimating air-fuel ratio for combustion
16. Boilers are generally classified according to_____.
- A. Fuel used, position of furnace, and method of water circulation
 - B. Type of turbine connected
 - C. Size of chimney
 - D. Efficiency of the condenser

Multiple Choice Questions

17. In a water-tube boiler_____.
- A. Hot gases pass through tubes and water surrounds them
 - B. Water flows inside tubes and hot gases flow outside the tubes
 - C. Both water and steam are mixed in the same chamber
 - D. Combustion takes place inside the tubes
18. Which of the following is a boiler mounting (essential fitting)?
- A. Economizer
 - B. Superheater
 - C. Safety valve
 - D. Air preheater

Multiple Choice Questions

19. The boiler efficiency is defined as_____.
- A. Ratio of feedwater mass to steam mass
 - B. Ratio of heat supplied to the fuel to heat absorbed by steam
 - C. Ratio of heat absorbed by steam to heat supplied by fuel
 - D. Ratio of power output to fuel input
20. The boiler draught is primarily used to_____.
- A. Regulate the flow of water into the boiler
 - B. Maintain steam pressure in the boiler drum
 - C. Supply required air for combustion and remove flue gases
 - D. Measure the amount of fuel burned

Multiple Choice Questions

21. In fuel-bed combustion, the fuel_____.
- A. Is suspended and burned in a stream of air
 - B. Burns while resting on a grate with air supplied from below
 - C. Is completely mixed with air before ignition
 - D. Is atomized before entering the furnace
22. The main purpose of using a mechanical stoker in a boiler is to_____.
- A. Atomize liquid fuels for complete combustion
 - B. Feed solid fuel automatically and uniformly to the furnace
 - C. Supply secondary air to the combustion chamber
 - D. Increase the boiler pressure

Multiple Choice Questions

23. In pulverized coal firing, the coal is_____.
- A. Burned in lump form on a grate
 - B. Mixed with oil and sprayed into the furnace
 - C. Ground into fine particles and blown into the combustion chamber with air
 - D. Fed by mechanical stokers onto the fuel bed
24. In an impulse turbine, the steam expands—
- A. In both fixed and moving blades
 - B. Only in the moving blades
 - C. Only in the nozzle before striking the blades
 - D. In the condenser after leaving the blades

Multiple Choice Questions

25. In a reaction turbine, the pressure drop of steam occurs_____.

- A. Only in the nozzle
- B. Only in the moving blades
- C. Partly in the fixed and partly in the moving blades
- D. Only in the condenser

26. The blade or diagram efficiency of an impulse turbine is maximum when the ratio of blade speed to steam velocity (u/V_1) is approximately_____.

- A. 0.25
- B. 0.5
- C. 0.75
- D. 1.0

Multiple Choice Questions

27. The axial thrust on the rotor of a reaction turbine is primarily due to_____.
- A. Change in steam velocity
 - B. Pressure difference across the moving blades
 - C. Friction losses in bearings
 - D. Centrifugal force on rotating blades
28. The governing of a steam turbine is necessary to_____.
- A. Maintain constant boiler pressure
 - B. Control the speed of the turbine under varying load
 - C. Improve the quality of exhaust steam
 - D. Reduce friction losses in bearings

Multiple Choice Questions

29. In a diesel engine, combustion of fuel takes place_____.
- A. At constant volume
 - B. At constant pressure
 - C. At constant temperature
 - D. During both compression and expansion
30. The main advantage of an internal combustion engine power plant over a steam power plant is_____.
- A. Lower fuel cost
 - B. Higher overall efficiency and quicker starting
 - C. Lower maintenance requirements
 - D. Capability to use low-grade fuels

Multiple Choice Questions

31. Supercharging in diesel engines is used to_____.
- A. Reduce exhaust emissions
 - B. Increase the mass of air supplied per cycle to improve power output
 - C. Decrease the compression ratio
 - D. Cool the engine cylinder
32. A regenerative gas turbine cycle differs from a simple gas turbine cycle by_____.
- A. Using intercooling between compressors
 - B. Reheating the air after combustion
 - C. Using exhaust gases to preheat the compressed air before combustion
 - D. Expanding the gases in multiple turbines

Multiple Choice Questions

33. In a photovoltaic (PV) power generation system, solar energy is directly converted into_____.

- A. Chemical energy
- B. Thermal energy
- C. Electrical energy
- D. Mechanical energy

34. In hydro-power generation, the primary energy conversion process involves_____.

- A. Chemical energy to electrical energy
- B. Mechanical energy of falling water to electrical energy
- C. Thermal energy to mechanical energy
- D. Potential energy to chemical energy

Multiple Choice Questions

35. The main source of energy in geothermal power generation is_____.
- A. Solar radiation
 - B. Heat from nuclear fission reactions
 - C. Heat from within the Earth's crust
 - D. Ocean tidal energy
36. The power output of a wind turbine depends most strongly on_____.
- A. Wind speed
 - B. Air temperature
 - C. Tower height only
 - D. Rotor color and material

Multiple Choice Questions

37. In biomass power generation, the main source of energy is_____.
- A. Mechanical energy from tides
 - B. Chemical energy stored in organic matter
 - C. Solar radiation directly
 - D. Nuclear decay of plant materials
38. The greenhouse effect in power generation refers to_____.
- A. The heating of plant buildings by solar collectors
 - B. The trapping of heat in the atmosphere due to gases like CO_2 and CH_4
 - C. The rise in boiler temperature due to improper insulation
 - D. A method of reducing thermal pollution in lakes

Multiple Choice Questions

39. The primary purpose of applying engineering economy principles in power plant projects is to—
- A. Increase the thermal efficiency of the plant
 - B. Evaluate the economic feasibility and optimize resource allocation
 - C. Improve environmental compliance
 - D. Reduce the size of the plant
40. Which of the following is a key financial indicator used to assess the performance of a power plant?
- A. Adiabatic flame temperature
 - B. Net Present Value (NPV)
 - C. Steam turbine blade efficiency
 - D. Boiler draught

Short Answer Questions

1. Compare and contrast the environmental impacts of renewable and non-renewable power generation systems. How can modern power plants minimize greenhouse gas emissions and pollution while maintaining high efficiency? _____

_____.

2. Explain how the efficiency and sustainability of power generation can be improved through advanced cycle modifications and hybrid systems (e.g., combined cycle plants, reheat-regenerative steam cycles, or solar-assisted thermal systems). _____

_____.

Short Answer Questions

3. Explain the principles of engineering economy and their application in evaluating the economic feasibility of power plants. How do these principles help in decision-making for power generation projects?" _____

4. Discuss the key financial indicators used to assess the performance of power plants. How can these indicators be used to optimize the economics of power generation?" _____

Thank you !