"UNIVERSITY OF PETROLEUM & ENERGY STUDIES"

Examination	**: End Term Exam Dec 2017**		
Programme & Branch	**: B.Tech (Mechanical)**	**Semester**	**: VII**
Course Code	**: PSEG 301**	**Duration**	**: 3 hrs**
Course Title	**: Power Plant Engineering**	**Max. Marks**	**: 100**

NOTE:

Question 1- 20 1 marks each
Question 21-30 4 marks each

Attempt all

(Section A)

1. Standard frequency usually for electric supply is
   a. 50 Hz
   b. 60 Hz
   c. 50 to 60 Hz
   d. 50 to 55 Hz
2. In a steam turbine cycle, the lowest pressure occurs in
   a. turbine inlet
   b. boiler
   c. condenser
   d. super heater
3. The overall efficiency of a boiler in a thermal power plant is of the order of
   a. 10%
   b. 25 to 30%
   c. 40 to 50%
   d. 70 to 80%
4. In a thermal power plant cooling towers are used to
   a. condense low pressure steam
   b. cool condensed steam

c. cool water used in condenser for condensing steam

d. cool feed water of boiler

5. Diesel power plant is best suited as

a. base load plant

b. stand-by plant

c. peak load plant

d. general purpose plant

6. A gas turbine power plant usually suits for

a. peak load operation

b. base load operation

c. casual run

d. none of the above

7. A gas turbine works on

a. Carnot cycle

b. Brayton cycle

c. Dual cycle

d. Rankine cycle

8. Which auxiliary of gas turbine consumes most of the power?

a. Burner

b. Combustion chamber

c. Compressor

d. Fuel pump.

9. For low head and high discharge, the hydraulic turbine used is

a. Kaplan turbine

b. Francis turbine

c. Pelton wheel

d. Jonual turbine.

10. In a hydro-electric plant a conduct system for taking water from the intake works to the turbine is known as

i. Dam

ii. Reservoir

iii. Penstock

iv. Surge tank.

11. A Pelton wheel is
    i. inward flow impulse turbine
    ii. Outward flow impulse turbine
    iii. Inward flow reaction turbine
    iv. Axial flow impulse turbine

12. Without Electro static precipitators:
    i. ID fan rating should be increased
    ii. Economizer rating should be increased
    iii. Chimney height should be reduced
    iv. None of the above

13. Cost of operation of which plant is least?
    i. Gas turbine plant
    ii. Thermal power plant
    iii. Nuclear power plant
    iv. Hydroelectric plant.

14. It is important the heat the water before feeding to boiler because:
    i. The dissolved gases which corrodes the boiler are removed
    ii. Thermal stresses arises due to the cold water entering the boiler can be reduced
    iii. Some impurities carried by steam and condensate due to corrosion in boiler and condenser are precipitated outside the boiler
    iv. All the above

15. Which type of alternator is employed in thermal power plant
    i. salient type
    ii. non salient pole type
    iii. both can be used
    iv. none of the above

16. The indication to determine the incomplete combustion is:
    i. high percentage of carbon dioxide content in the flue gases
    ii. high percentage of CO content in the flue gases
    iii. high temperature of the flue gases
    iv. all the above

17. For the same drought required, the power of forced draught fan will be __ than the induced draught fan:
    i. Higher
    ii. Lower
    iii. The same
    iv. may be more or less
18. What are the combustible elements in the fuel:
    i. carbon and hydrogen
    ii. carbon, hydrogen and ash
    iii. carbon, hydrogen and Sulphur
    iv. none of the above
19. For the forced draft the blower is located:
    i. at the top of the chimney
    ii. near the base of the chimney
    iii. near the base of the boiler
    iv. none of the above
20. In steam power plant which of the following component needs more maintenance:
    i. Condenser
    ii. Boiler
    iii. Turbine
    iv. Coal carrying system
21. Ash and dust handling problem is more difficult than coal handling problems. Discuss the fact.
22. Explain the difference between a steam boiler and a steam generator?
23. Discuss how the boiler load variation affect the efficiency of the air preheater?
24. Explain why should no moisture flow along with steam from the drum to the super heater?
25. Discuss the drawback of operating a boiler at part load condition.
26. Describe why is no vapour bubble desired to flow along with saturated water from the drum to the down comes?
27. Explain the functions of the steam drum in a water tube boiler? What are drum internals? Why are they required?
28. Explain why the monitoring of net stack temperature is required.
29. Discuss the reasons of soot deposition on the boiler flue passes.
30. The use of a regenerative feed water heating increases the capital cost but reduces the operating cost of a steam power plant. Explain

Section B **(2*20= 40)**

31.

a. According to ASME Boiler code material specifications are given

- Low pressure heating boilers can be constructed of cast iron or steel
- Miniature boilers may be constructed of copper, stainless steel, etc.
- Power boilers are constructed of special steels.

Discuss how boilers operating pressure effects the choice of materials of construction?

b. The velocity of steam entering a simple impulse turbine is 1000m/s, and the nozzle angle is 20o. The mean blade velocity is 400m/s and the blades are symmetrical. If the steam is to enter the blades without shock, what will be the blade angles?

   i. Neglecting the friction effects on the blades, calculate the tangential force on the blades and the diagram power for a mass flow of 0.75 kg/s. estimate also the axial thrust and diagram efficiency.

   ii. If the relative velocity at exit is reduced by friction to 80% of that at inlet, estimate the axial thrust, diagram power and diagram efficiency.

32.

a. Steam enters a turbine at a static pressure, a static temperature and a flow velocity of 10 bar, 600 C and 250 m/s, respectively. At the turbine exit, the static pressure, static temperature and velocity are 0.8 bar, 250 C and 300 m/s, respectively. If heat transfer during the expansion process may be neglected, calculate:

   i. The total pressure and total temperature at the inlet.

   ii. The total pressure and total temperature at the exit,

   iii. The total-to-total efficiency,

   iv. The total-to-static efficiency,

   v. The static-to-total efficiency

   vi. The static-to-static efficiency.

b. Explain the need for compounding the steam turbines. Discuss the different methods of compounding.

33.

a. Define the static and stagnation states. Derive the expression for the stagnation state enthalpy.

b. A Curtis impulse stage has two rotors moving with an average tangential speed of 250 m/s. the fluid relative velocity is reduced 10% in its passage over every blade, whether fixed or moving. The nozzle inclined at an angle of 17° to the wheel tangent, has an efficiency of 0.92. The inlet angle of the first rotor blade is 22°. The intermediate stator inlet and exit angles are respectively 31.5° and 20°. Assuming that the fluid leaves the second rotor axially, find:

   i. Absolute velocity V_{11} and the speed ratio.

   ii. Ratio of work output from the second rotor to that of the first rotor.

   iii. η_{stage}

   iv. Power output and thrust for a flow of 5 kg/s of gas over the blades.