

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3989

Roll No.

--	--	--	--	--	--	--	--	--	--

B.Tech.

(SEMESTER-IV) THEORY EXAMINATION, 2011-12

APPLIED THERMODYNAMICS

Time : 3 Hours]

[Total Marks : 100

Note : Attempt questions from **all** Sections as directed.

Section – 1

1. Answer **all** the questions.

10 × 2 = 20

- What is Isothermal compressibility ?
- Define adiabatic flame temperature.
- How Equivalent evaporation is used for comparison of boilers ?
- What are the sources of air leakage in condenser ?
- Explain the significance of Willian's law in steam engines.
- What is super saturated flow in Nozzles ?
- Explain about cogeneration.
- What are the losses in steam turbine ?
- How regeneration in gas turbine increases thermal efficiency of the plant ?
- What are the differences between Turbo jet engine and Turbo prop engine ?

Section – 2

2. Answer any **three** of the following:

3 × 10 = 30

- With the help of v-T graphs, explain coefficient of expansion and compressibility.
- With the help of a neat sketch explain Babcock & Wilcox Boiler.
- Explain the differences between Rankine and modified Rankine cycle.
- What are the governing methods of Steam turbine ? Explain.
- Derive the expression for thermal efficiency of a simple gas turbine plant.

Section – 3

Answer **all** the questions.

5 × 10 = 50

3. Explain Clausius – Clapeyron equation. Represent on p-T diagram.

OR

Calculate stoichiometric air/fuel ratio by mass and the percentage composition of the products of combustion per kg of Alcohol (C_2H_5OH).

4. Explain different types of Condenser with neat sketches.

OR

In a boiler the following observations were made: Pressure of steam is 10 bar, steam condenser 540 kg/hr, fuel used is 65 kg/hr, moisture in fuel is 2% by mass, mass of dry flue gases is 9 kg/kg of fuel, LCV of fuel is 32,000 kJ/kg, temperature of flue gases is 325 °C, temperature of boiler house is 28 °C, feed water temperature is 50 °C, quality of steam is 95%. Draw heat balance sheet for the above data.

5. With the help of a neat sketch explain the working principle of Steam engine.

OR

A convergent divergent nozzle is required to discharge 2 kg/sec of steam. The nozzle is supplied with steam at 7 bar and 200 °C and discharge takes place against a back pressure of 1 bar. The expansion up to throat is isentropic and the frictional resistance between throat and exit is equivalent to 63 kJ/kg of steam. Taking approach velocity of 75 m/sec and throat pressure of 4 bar estimate suitable areas for the throat and exit.

6. Explain different types of combined cycles. Give the advantages also.

OR

In a Delaval turbine the steam issues from the nozzles with a velocity of 850 m/sec the nozzle angle is 20° mean blade velocity is 350 m/sec the blades are equiangular. The mass flow rate is 1000 kg/min friction factor is 0.8. Determine (i) Blade angles (ii) Axial thrust (iii) Power (iv) Blade efficiency (v) Stage efficiency if nozzle efficiency is 93%.

7. What are the major differences between air breathing engines and rocket engines ? Explain.

OR

Find the required air fuel ratio in a gas turbine whose turbine and compressor efficiencies are 85% and 80% respectively. Max cycle temperature is 875 °C. The working fluid can be taken as air which enters the compressor at 1 bar pressure and 27 °C. The pressure ratio is 4. Calorific Value of fuel is 42,000 kJ/kg. There is a loss of 10% of Calorific Value in the combustion chamber.