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# Paper ID [A0805]

(Please fill this Paper ID in OMR Sheet)

## B.Tech. (Sem. - 3rd)

## APPLIED THERMODYNAMICS - I (ME - 209)

**Time : 03 Hours** **Maximum Marks : 60**

**Instruction to Candidates:**

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

### Section - A

*Q1)* *(10 x 2 = 20)*

a) Write a note on latent heat and $h_{fg}$ of steam at a specified temperature. Whether they are different or same?

b) Discuss briefly the term entropy.

c) Explain the term quality of steam.

d) Enlist the merits and demerits of water tube boilers over fire tube boilers.

e) What are the causes of incomplete combustion?

f) Define capacity & volumetric efficiency of the compressor.

g) Explain why the nozzles are made convergent - divergent?

h) What is compounding? Enlist the various ways of compounding steam turbines.

i) What is an impulse reaction turbine?

j) Define the term "Vacuum efficiency" as applied to a condenser.

## Section - B

*(4 x 5 = 20)*

*Q2)* Explain the advantages gained by using forced circulation over free circulation in high pressure boilers.

*Q3)* Draw T-s diagram of Rankine cycle using dry-saturated steam and develop the equation for Rankine cycle efficiency.

*Q4)* Derive the relationship between area, velocity and pressure in nozzle flow.

*Q5)* Show that the maximum discharge of steam per unit area through a nozzle takes place when the ratio of the steam pressure at the throat to the inlet pressure is $\left(\frac{2}{n+1}\right)^{\frac{n}{n-1}}$ where $n$ is the index of adiabatic expansion.

*Q6)* With the help of velocity and pressure variation explain the difference between impulse and reaction turbines. Discuss their relative merits.

## Section - C

*(2 x 10 = 20)*

*Q7)* (a) Show that for maximum diagram efficiency of a reaction turbine the blade speed ration is equal to cos $\alpha$ where $\alpha$ is the angle of absolute velocity at inlet. State the assumptions made. Hence derive an expression for maximum efficiency.

(b) Describe the various losses in steam turbines.

*Q8)* (a) Distinguish between air cooled and water cooled condensers.

(b) Explain the dry expansion evaporator with the help of a neat diagram.

(c) What are the sources of air leakage into a condenser? Briefly state the effects of air leakage on the performance of a condenser.

*Q9)* (a) Describe the operation of single stage reciprocating compressor. Derive the equation for work per kg of compressed air with and without clearance.

(b) A single cylinder, single acting air-compressor delivers 10 kg of air per minute from 1 bar & 27°C to 6 bars. The compression follows the law pv1.25 = constant. Determine

(i) the work required to compress and deliver 1 kg of air

(ii) actual power required to run the compressor if mechanical efficiency is 80%.

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