Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Summer Examination-2022

Subject Name: Turbomachines

Subject Code : 4TE07TMA1 **Branch: B.Tech (Mechanical)**

Semester: 7 **Date: 22/04/2022** **Time: 02:30 To 05:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) The flow through a nozzle is regarded as_____.
A. constant pressure flow
B. constant volume flow
C. isothermal flow
D. isentropic flow

b) The steam leaves the nozzle at a_____.
A. low pressure and a low velocity
B. high pressure and a low velocity
C. high pressure and a high velocity
D. low pressure and a high velocity

c) The critical pressure gives the velocity of steam at the throat____-
A. less than the velocity of sound
B. equal to the velocity of sound
C. more than the velocity of sound
D. none of these

d) The ratio of the workdone on the blades to the energy supplied to the blades, is called_____.
A. mechanical efficiency
B. gross or stage efficiency
C. nozzle efficiency
D. blading efficiency

e) The person's reaction turbine has____
A. Only moving blades
B. Only fixed blades
C. Identical moving and fixed blades
D. Fixed and moving blades of different shape

f) The reheating of steam in a turbine____
- A. Increases the workdone through the turbine
- B. Increases the efficiency of the turbine
- C. Reduces wear on the blades
- D. All of the above

g) In a reaction turbine, when the degree of reaction is zero, then there is___
- A. No heat drop in the moving blades
- B. No heat drop in the fixed blades
- C. Maximum heat drop in the moving blades
- D. Maximum heat drop in the fixed blades

h) A closed cycle gas turbine works on ____
- A. Joule cycle
- B. Rankine cycle
- C. Ericsson cycle
- D. none of above

i) The ideal efficiency of simple gas turbine cycle depends on ____
- A. Pressure ratio
- B. Maximum cycle temperature
- C. Minimum cycle temperature
- D. Property of gas

j) A closed cycle gas turbine gives _____ efficiency as compared to an open cycle gas turbine.
- A. Same
- B. Lower
- C. Higher
- D. variable

k) Inter-cooling in gas turbine results in ____
- A. Increase in net output but decrease in thermal efficiency
- B. Increase in thermal efficiency but decrease in net output
- C. Increase in both thermal efficiency and net output
- D. Decrease in both thermal efficiency and net output

l) In a jet propulsion unit, the products of combustion after passing through the gas turbine are discharged into ____
- A. Atmosphere
- B. Vacuum
- C. Discharge nozzle
- D. Back to the compressor

m) In jet engines, for the efficient production of large power, fuel is burnt in an atmosphere of ____
- A. Vacuum
- B. Atmospheric air
- C. Compressed air
- D. Oxygen alone

n) The ratio of the useful heat drop to the isentropic heat drop is called____.
- A. condenser efficiency
- B. vacuum efficiency
- C. nozzle efficiency
- D. boiler efficiency

Attempt any four questions from Q-2 to Q-8

Q-2	**A)**	A Parson reaction turbine running at 400 rpm with 50 % reaction develops 78 kW per kg of steam. The exit angle is 20º and the steam velocity is 1.42 times the blade velocity. Determine : (1) Blade velocity (2) Blade inlet angle (3) Maximum diagram efficiency	**(07)**
	B)	Explain in details binary vapour cycle.	**(07)**
Q-3	**A)**	State the different methods of improving the thermal efficiency of a gas turbine and explain any one of them in detail.	**(07)**
	B)	A gas turbine unit has a pressure ratio of 6:1 and maximum temperature of 627ºC. The isentropic efficiencies of the compressor and turbine are 0.82 and 0.85 respectively. Calculate the power output in kW of an electric generator geared to the turbine when the air enters the compressor at 15ºC at the rate of 18 kg/sec. Take Cp = 1.005 kJ/kg K and γ = 1.4 for the compression process and take Cp = 1.11 kJ/kg K and γ = 1.33 for the expansion process.	**(07)**
Q-4	**A)**	List the factor affecting combustion chamber design and performance and explain any one.	**(07)**
	B)	Explain the requirements and different types of combustion chambers in brief.	**(07)**
Q-5	**A)**	Derive an expression for maximum discharge through convergent divergent nozzle.	**(07)**
	B)	What is critical pressure? Derive the expression for critical pressure ratio in flow through nozzles. Calculate its value for superheated steam.	**(07)**
Q-6	**A)**	Explain turbojet engine with neat sketch.	**(07)**
	B)	Draw a schematic diagram of a "Pulse Jet Engine" and describe its operation. What are the advantages and disadvantages of Pulse Jet Engine?	**(07)**
Q-7	**A)**	Explain all methods of attachment of blades to turbine rotor with neat sketch.	**(07)**
	B)	Explain all Losses in steam turbine in details.	**(07)**
Q-8	**A)**	Explain the ideal and actual Brayton cycles withT-S diagrams. Derive expressions for air standard efficiencies for both cases.	**(07)**
	B)	Explain any one governing method with neat sketch with its effect on performance and or efficiency of plant.	**(07)**