Enrollment No: _____   Exam Seat No: _____

C. U. SHAH UNIVERSITY
Summer Examination-2020

Subject Name: Turbomachines
Subject Code: 4TE07TMA1   **Branch: B.Tech (Mechanical)**
Semester: 7   **Date: 27/02/2020**   **Time: 10:30 To 01:30**   **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 maximum temperature in a gas turbine is   **01**
      A. 200
      B. 500
      C. 700
      D. 1000
   (b) Reheating in a gas turbine   **01**
      A. Increases the thermal efficiency
      B. Increases the compressor work
      C. Increases the turbine work
      D. Decreases the thermal efficiency
   (c) The ratio of the net work obtained from the gas turbine plant to the turbine work is   **01**
      known as
      A. compression ratio
      B. work ratio
      C. pressure ratio
      D. None of these
   (d) A closed cycle gas turbine works on   **01**
      A. Carnot cycle
      B. Rankine cycle
      C. Ericsson cycle
      D. Joule cycle
   (e) In a nozzle, whole frictional loss is assumed to occur between   **01**
      A. inlet and throat
      B. inlet and outlet
      C. throat and exit
      D. all of these
   (f) The impulse reaction turbine has its driving force   **01**
      A. as an impulsive force

B. as a reaction force

C. partly as an impulsive force and partly as a reaction force

D. none of the above

(g) The steam leaves the nozzle at a   **01**

    A. high pressure and a low velocity

    B. high pressure and a high velocity

    C. low pressure and a low velocity

    D. low pressure and a high velocity

(h) The action of steam in a steam turbine is   **01**

    A. static

    B. dynamic

    C. static and dynamic

    D. neither static nor dynamic

(i) The steam enters the nozzle at a   **01**

    A. high pressure and a low velocity

    B. high pressure and a high velocity

    C. low pressure and a low velocity

    D. low pressure and a high velocity

(j) Steam turbines may be classified according to   **01**

    A. direction of steam flow

    B. number of stages

    C. mode of steam action

    D. all of these

(k) In an impulse turbine, steam expands   **01**

    A. wholly in blades

    B. wholly in nozzle

    C. partly in the nozzle and partly in blades

    D. none of these

(l) In a reaction turbine, when steam flows through the moving blades,   **01**

    A. pressure increases while velocity decreases

    B. pressure decreases while velocity increases

    C. pressure and velocity both decreases

    D. pressure and velocity both increase

(m) In order to reduce the rotor speed of an impulse turbine, the method employed is   **01**

    A. velocity compounding

    B. pressure compounding

    C. pressure-velocity compounding

    D. all of these

(n) A single stage impulse turbine with a diameter of 1.2 m runs at 3000 r.p.m. If the blade speed ratio is 0.42, then the inlet velocity of steam will be   **01**

    A. 79 m/s

    B. 188 m/s

    C. 450 m/s

D. 900 m/s

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

Q-2		**Attempt all questions**	**(14)**
	a)	Derive Steady flow energy equation for nozzle.	**07**
	b)	Explain about different methods of efficiency improvement of gas turbine.	**07**

Q-3		**Attempt all questions**	**(14)**
	a)	With neat sketch explain detail about nozzle control governing of turbine.	**07**
	b)	State merits and demerits of closed cycle gas turbine over open cycle.	**07**

Q-4		**Attempt all questions**	**(14)**
	a)	With neat sketch explain in detail pressure compounding of impulse turbine.	**07**
	b)	The effective jet velocity from a rocket engine is 2800 m/sec. the forward velocity is 1550 m/s and the propellant consumption is 80 kg/sec. calculate the thrust, thrust power and propulsive efficiency.	**07**

Q-5		**Attempt all questions**	**(14)**
	a)	With neat sketch explain in detail about turbine blade attachment.	**07**
	b)	With neat sketch explain about working of ram jet engine also draw the T-s diagram.	**07**

Q-6		**Attempt all questions**	**(14)**
	a)	An open gas turbine plant works between the fixed absolute temperature limits 300K and 1400 K the absolute pressure limit being 1 bar and 23 bar. The isentropic efficiency of compressor is 0.85 and that of turbine is 0.86. Estimate the actual thermal efficiency of the plant and the power available for driving external load if the fuel consumption is 10 kg/s and the calorific value is 42000 kJ/kg.	**07**
	b)	Derive equation for thermal efficiency of joule cycle.	**07**

Q-7		**Attempt all questions**	**(14)**
	a)	With neat sketch explain in detail about combustion chamber.	**06**
	b)	The following data refers to a gas turbine using intercooling, regeneration and reheating arrangement. Pressure ratio 64, compressor inlet temperature 3000 K, turbine inlet temperature 1500 K, compressor efficiency 0.88, regeneration effectiveness 0.8, inlet pressure to compressor 1 bar. Determine 1. Cycle thermal efficiency 2. Cycle work ratio 3. Cycle air rate.	**08**

Q-8		**Attempt all questions**	**(14)**
	a)	Derive equation for thrust power, propulsive power and propulsive efficiency.	**07**
	b)	Derive equation for optimum pressure ratio for maximum specific output in actual simple gas turbine cycle.	**07**