

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2171917

Date:01/12/2016

Subject Name:Steam and Gas Turbines

Time:10.30 AM to 1.00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks. .

- Q.1** (a) Explain effect of operating variables on thermal efficiency of Gas turbine **07**
(b) Based on General relationship Between Area, Velocity & Pressure explain **07**
A. Accelerated flow dp/p is Negative (flow through nozzle)
B. Retorted flow dp/p is positive (flow through diffuser)

- Q.2** (a) Derive an Equation of thermal efficiency & work-ratio of Ideal Brayton cycle **07**
(b) Derive condition for maximum discharge through the nozzle. **07**
OR
(b) Draw p-v & T-s diagram for gas turbine cycle with: (1) Intercooler, (2) Reheating & (3) Regeneration **07**

- Q.3** (a) Draw & Explain: Pressure-Velocity compounding system of impulse turbine. **07**
(b) Steam leaves nozzles of De-Laval turbine with a velocity of 1150 m/s .the nozzle angle is 20° .The blades are symmetrical with blade angle of 30° . If blade velocity coefficient is 0.8 and Mechanical efficiency is 0.92. Calculate: (1) Speed of rotation if the rotor diameter is 75cm (2) Specific steam consumption in Kg/Kw-hr (3) Blade efficiency & Axial thrust. **07**

- OR**
Q.3 (a) Draw & Explain: Pulse-jet engine with applications **07**
(b) A simple Impulse turbine has a mean blade ring diameter of 75cm and run at 3000 RPM. The blade speed ratio is 0.46. and the discharge is axial the nozzle angle is 20° and blade friction is 0.94. **07**
Determine:
(1) Blade angles
(2) Theoretical specific power output.

- Q.4** (a) Explain construction & working of Turbo-prop Engine. **07**
(b) Draw & Explain Can type combustor with swirl flow flame stabilizer **07**

- OR**
Q.4 (a) Write short note on Turbojet engine with Afterburner. **07**
(b) A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 627°C .The isentropic efficiency of compressor and turbine are 0.82 & 0.85 respectively. Calculate the power output in KW of an electrical generator geared to the turbine when the air enters the compressor at 15°C , 1 bar pressure with flow rate of 18 Kg/sec. **07**

- Q.5 (a)** Draw & Explain: Gas & Steam turbine combined cycle power plant **07**
- (b)** A dry saturated steam enter steam nozzle at pressure of 15 bar and is discharge to a pressure of 2 bar .If the dryness fraction of discharge steam is 0.86. What will be the final velocity of steam? Neglected initial velocity. **07**
If 10% heat is loss due to friction then what is the final reduction in velocity ratio.

OR

- Q.5 (a)** What is governing of steam turbine? Explain “Throttle governing” **07**
- (b)** A C-D nozzle is to be discharge in which steam is initially at 14 bar & 80° C of superheated is to be expand to back pressure of 1.05 bar .Determine the necessary throat & Exit diameter of a nozzle for steam discharge of 500 Kg/hr. Assuming that expansion of steam is thermal equilibrium throughout and friction reheat amount of total isentropic enthalpy drop to be effective in divergent part of nozzle. **07**
