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B. E. VIII Semester (Main & Re-Exam) Examination– May, 2016

THERMAL TURBO MACHINERY AND COMPRESSIBLE FLOW

Branch : Mech. Engg.

Time : Three Hours]   [Maximum Marks : 75

[Minimum Marks : 30

Note :   Attempt *all* questions from Section - A (Objective type questions), *four* questions from Section – B (Short answer type questions) and *three* questions from Section – C (Long/Essay type questions).

SECTION – A   [Marks : 1.5 × 10 = 15

Note :   Attempt *all* the questions.

1.   (i)   A Jet engine works on the principle of :

(a)   conservation of energy   (b)   conservation of Linear momentum

(c)   earth's gravity   (d)   gravitational energy

(ii)   Euler's equation for motion of liquids is based on the assumption that the

(a)   flow in streamline

(b)   flow state place continuously

(c)   flow is homogeneous and in compressible

(d)   flow in turbulent

(iii)   If u, v, w are the components of velocity v of a moving particle, then the equation $\dfrac{u}{dx} = \dfrac{v}{dy} = \dfrac{w}{dz}$ represent an equation :

(a)   one dimensional flow   (b)   two dimensions flow

(c)   three dimensional flow   (d)   multi dimensional flow

P. T. O.

(iv) The ratio of actual work available at the turbine to energy imparted to the wheel is called :

(a) Mechanical efficiency

(b) Hydraulic efficiency

(c) Over all efficiency

(d) Relative efficiency

(v) Reaction turbine are used for :

(a) Low head

(b) High head

(c) High head and Low discharge

(d) Low head and high discharge

(vi) According to the laws of proportionality for homologous turbines speed is proportional to :

(a) $\sqrt{H}/D$ (b) $\sqrt{H/D}$ (c) $\sqrt{H}/D^2$ (d) $H^{3/2}/D$

(vii) The maximum blade efficiency of a single stage impulse turbine having nozzle angle α under ideal condition is :

(a) $\cos \alpha/2$ (b) $\cos^2 \alpha/2$ (c) $\cos^2 \alpha$ (d) $\cos 2\alpha$

(viii) Turbine is triped when the :

(a) Pressure at inlet increase

(b) Speed shoots up

(c) Mass flow increases

(d) Casing is very hot

(ix) Maximum work is done in compressing air when the compression is :

(a) isothermal

(b) adiabatic

(c) polytropic

(d) None of these

(x) Kinematic viscosity (ν) is equal to :

(a) μ/ρ

(b) ρ/μ

(c) $\mu \times \rho$

(d) none

(2)

SECTION – B [Marks : 6 × 4 = 24

Note : Attempt only *four* questions out of *six* questions.

1. How do you differentiate between an impulse and a reaction turbine ? With neat sketches explain the working of an impulse and a reaction stage.

2. A pelton wheel has a mean bucket speed of 10 meters. per second with a Jet of water flowing at the rate of 700 liters is under a head of 30 meters. The buckets deflect the Jet through and angle of 160°. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume efficient of velocity as 0.98.

3. Draw the schematic diagram of a simple cycle with reheat and explain the working principle.

4. A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the Jet at 5 m/s, find :

   (i) The force on the plate

   (ii) The work done and the efficiency of Jet.

5. What is a draft tube ? Also explain its function.

6. A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 r.p.m. against a head of 25 m. The impeller diameter 15250 mm it with at outlet is 50 mm and menometric efficiency is 75%. Determine the vane angle at the outs periphery of the impeller.

SECTION – C [Marks : 12 × 3 = 36

Note : Attempt any *three* questions out of *five* questions.

1. Explain the different types of the efficiency of a Hydraulic turbine.

P. T. O.

2. A francies turbine with an overall efficiency of 75% is required to produce 148.25 KW power. It is working under a head of 7.62 m. The peripheral velocity $= 0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gH}$ the wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine :

(i) The guide blade Angle

(ii) The wheel vane angle at inlet

(iii) Diameter of the wheel at inlet

(iv) width of the wheel at inlet.

3. With a neat sketch explain a single stage velocity triangle and derive an expression for the work output of a steem turbine.

4. Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump and what is the effect of acceleration in suction and delivery pipes on indicator diagram.

5. In a single-stage impulse turbine nozzle discharges the fluid on to the blades at an angle of 25° to the plane of rotation and the fluid leaves the blades with an absolute velocity of 300 m/s at an angle of 120° to the direction of motion of the blades if the blades have equal inlet the outlet angles and there is no axial thrust, estimate the blade angle power produced per kg/s of the fluid and diagram efficiency.

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(4)

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B.E. VIII Semester (Main & Re-Exam) Examination, May 2017

THERMAL TURBO-MACHINERY & COMPRESSIBLE FLOWS

(M E)

Time : Three Hours]

Maximum Marks : 75

[Minimum. Marks : 30

Note : Attempt **all** the questions of **Section-A, four** from **Section-B** and **three** questions from **Section C.**

Section-A

(Objective Type Questions)　　　　　　　1.5×10=15

Note : This section will contain **ten** objective type questions. They may be fill in the blanks. True/False or Multiple Choice Type.

1.　For high head low discharge the suitable turbine is

　(a)　Pelton

　(c)　Kaplan

　(b)　Francis

　(d)　None of these

2.　Main characteristic curves of a turbine means :

　(a)　curves at constant speed

　(b)　curves at constant efficiency

　(c)　curves at constant head

　(d)　None of the above

3.　Unite power (Pu) is given by the expression.

　(a)　$Pu = \dfrac{p}{\sqrt{H}}$

　(b)　$Pu = \dfrac{p}{H^{\frac{3}{2}}}$

　(c)　$Pu = \dfrac{p}{H^{\frac{3}{4}}}$

　(d)　$Pu = \dfrac{p}{H^{\frac{5}{4}}}$

P.T.O.

4. Speed ratio is given by :

(a) $\dfrac{4}{\sqrt{2gh}}$

(b) $\dfrac{V\partial}{\sqrt{2gh}}$

(c) $\dfrac{\sqrt{2gh}}{vj}$

(d) $\dfrac{Vw}{\sqrt{2gh}}$

5. Mechanical efficiency of a turbine is the ratio of.

(a) Power the inlet to the power at the shaft of turbine

(b) Power at the shaft to the power given to the runner

(c) Power at the shaft to power at the in let of turbine

(d) None of the above

6. Reheating of steam under ideal conditions takes place at constant :

(a) Entropy

(b) Enthalpy

(c) Pressure

(d) Temperature

7. An economiser in a boiler.

(a) Increases steam pressure

(b) Increases steam flow

(c) Decreases fuil consumption

(d) Decreases steam pressure

8. Indicator diagram of a reciprocating pump is a graph between :

(a) flow Vs. Swept Volume

(b) Pressure in cylinder Vs Swept Volume

(c) Pressure Vs Speed

(d) Swept Volume Vs. Speed

9. A Reaction turbine draft tube is used:

(a) To convert the Kinetic energy to flow energy by a gradual expansion of the flow cross- section.

(b) To transport water down stream without eddies

(c) For Safety of turbine

(d) To increase flow rate

10. Maximum work is done in compression air when the compression is :

   (a) Isothermal

   (b) Adiabatic

   (c) Polytropic

   (d) None of these

Section-B

Note : Attempt any **four** question. $6 \times 4 = 24$

1. Differentiate between the turbines and pumps.

2. What is cavilation and what are its causes?

3. Find the number of pumps required to take water from a deep well under a total head of 89 M all the pumps are indential and are running at 800 r.p.m. The specific speed of each pump is given us 25 while the rated capacity of each pump 130.16 M³/s.

4. Two Jets strike the buckets of a Pellon wheel which is having shuft power as 15450 Kw . The diameter of each jet is given as 200 mm. If the net head on the turbine is 400m. Find the over all efficiency of the turbine. Take $e_v = 1.0$

5. What are the methods of dimensional analysis.Describe the Rayleigh' s Method for dimensional analysis.

Section-C

(Long Answer Questions) $12 \times 3 = 36$

Note : Attempt any **three** questions out of five questions.

1. Draw inlet and outlet velocity triangle for a pelton turbine and indicate the direction of various velocities.

2. An inward flow Reaction turbine has an exit diameter of one meter and its breadth at inlet 15250mm if the velocity of flow at inlet is 2 meters/sec. find the mass of water passing through the turbine per second. Assume 10% of the

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area of flow is blocked by blatte thickness. If the speed of the runner is 210 R.P.M. and guide blads make an angle of 10^0 to the wheel tangent draw the inlet velocity triangle and find.

(i) The runner vane angle at inlet

(ii) Velocity of wheel at inlet

(iii) The absolute velocity of water leaving the guld vanes

(iv) The relative velocity of water entering the runner blade

3. Draw and discuss the operating characteristics of a centrifugal pump.

4. A Jet of water having a velocity of 35m/s inpinges on a series of vanes nooving with a velocity of 20 m/s. The Jet makes on angle of 30^0 to the direction of vanes when entering and leaves it an angle of 120^0 Draw the triangle of velocity of inlet and outnet and find.

(a) The angle of venes tips so that water enters and leavs without shock

(b) The work done per unit weight of water entering the vanes

(c) The efficiency

5. Define the specific speed of a turbine? Derive an expression for the specific speed what is the significance of the specific speed.

E-740

B. E. VIII Semester (Main & Re-Exam) Examination, May – 2018

THERMAL TURBO MACHINERY AND COMPRESSIVE FLUID

Branch : ME

Time : Three Hours]

[Maximum Marks : 75
[Minimum Marks : 30

Note : Attempt *all* questions from Sec-A, any *four* questions from Sect-B and *three* questions from Sec-C.

SECTION – A

1. When steam reaches turbine blades the type of force responsible for moving turbine blade are :

   (a) Axial force

   (b) Tangential force

   (c) Shear force

   (d) Longitudinal force

2. Kaplan turbine is a propeller turbine in which the vanes fixed on the hub are :

   (a) Non Adjustable

   (b) Adjustable

   (c) Fixed

   (d) None of the above

3. Run away of speed of a Petton wheel means :

   (a) Full load speed

   (b) No load speed

   (c) No load speed with no governor mechanics

   (d) None of the above

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4. What is the ratio of isentropic work to Euler work in an centrifugal compressor called ?

   (a) Work coefficient   (b) Velocity coefficient

   (c) Pressure coefficient   (d) Flow coefficient

5. Fraude No. (fe) is given by :
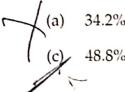
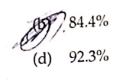   (a) $Fe = V\sqrt{\dfrac{L}{g}}$ (b) $Fe = V\sqrt{\dfrac{g}{L}}$

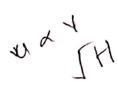   (c) $Fe = \dfrac{V}{\sqrt{Lg}}$ (d) $Fe = \dfrac{\sqrt{Lg}}{V}$

6. The work saved by fitting & air vessel to a single acting reciprocating pump is :

   (a) 34.2%   (b) 84.4%

   (c) 48.8%   (d) 92.3%

7. The unit speed (Nu) is given by the expression :

   (a) $N_u = \dfrac{N}{H^{3/2}}$ (b) $N_u = \dfrac{N}{H^{3/4}}$

   (c) $N_u = \dfrac{N}{H^{1/2}}$ (d) $N_u = \dfrac{N}{H^{5/4}}$

8. Indicator diagram of a reciprocating pump is a graph between :

   (a) Flow Vs Swept volume

   (b) Pressure in cylinder Vs Swept volume

   (c) Pressure Vs speed

   (d) Swept volume Vs speed

9. Turbine is trippel when the :

   (a) Pressure at inlet increases   (b) Speed shoots up

   (c) Mass flow increases   (d) Casing is very hot

(2)

10. Main characteristics curves of a turbine means :

(a) Curves at constant speed

(b) Curves at constant efficiency

(c) Curves at constant head

(d) None of the above

SECTION – B

1. Draw the schematic diagram of a simple cycle with reheat & explain the working Principle.

2. The Nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate moves away from the jet at 5 m/s. Find (i) The force on the pláte (ii) The work done and the efficiency of the jet.

3. What is draft tube ? Why is it used in reactive turbine ? Describe with neat sketch two different type of draft tube ?

4. The external and internal diameter of an inward flow reaction turbine are 1.2 m and 0.6 m respectively. The head on the turbine in 8 m. The velocity of flow is constant and is given by $0.3\sqrt{2gH}$ if the width of the turbine at the outlet is 300 mm. Find the discharge and the width of the turbine at inlet.

5. A centrifugal pump is to discharge 0.118 m³/se at a speed of 1450 rpm against ahead of 25 m. The impeller diameter is 250 mm its width at outlet is 50 mm and monometric efficiency is 75%. Determine the vene angle at the outer pheriphery of the impeller.

6. Explain the different type of efficiency of hydraulic turbine.

SECTION – C

1. With a neat sketch explain a single stage velocity triangle and derive an expression for the work output of a steam turbine.

(3)

2. An inward flow reaction turbine has an exit diameter 1 m and its breadth at inlet is 250 mm. If the velocity of flow at inlet is 2 m/sec. Find the mass of water passing through the turbine per second. Assume 10% of area of flow is blocked by blade thickness. If the speed of the runner is 210 rpm, the guide blade makes an angle of 10° to the wheel target, draw the inlet velocity triangle and find :

   (i)   The runner vane angle at inlet

   (ii) Velocity of wheel at inlet

   (iii) The absolute velocity of the water leaving the guide vanes

   (iv) The turbine relative velocity of water entering the runner blade.

3. Show the maximum blade efficiency η blade$_{(max)}$ = $\dfrac{2\cos^2 \alpha_1}{1+\cos^2 \alpha_1}$ for 50% reaction Person's turbine.

4. Draw and discuss the operating characteristics of a centrifugal pump.

5. The power P required to run a centrifugal pump depends on the impeller diameter D. The rotational speed N, the rate of discharge Q, density ρ and viscosity μ using Bucking hum's π theorem obtains an expression for power.

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