

Total No. of Questions: 6

Total No. of Printed Pages:3

Enrollment No.....



Faculty of Engineering
End Sem (Odd) Examination Dec-2022
ME3CO11 Energy Conversion-II

Programme: B.Tech.

Branch/Specialisation: ME

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. What is the effect of increasing flow coefficient (Φ) in an axial flow compressor on blade loading coefficient (Ψ)? **1**
(a) Blade loading coefficient (Ψ) increases
(b) Blade loading coefficient (Ψ) decreases
(c) Blade loading coefficient (Ψ) remains constant
(d) Unpredictable
- ii. What is the ratio of the actual work absorbed by an axial flow compressor to the theoretical work called? **1**
(a) Work input factor (b) Work-done factor
(c) Both (a) and (b) (d) None of these
- iii. What is a steam turbine? **1**
(a) Machine that uses pressurised steam to extract mechanical energy
(b) Machine that uses pressurised steam to extract thermal energy
(c) Machine that uses pressurised steam to extract kinetic energy
(d) Machine that uses pressurised steam to extract electrical energy
- iv. Which of the following is a type of turbine classified based on the fuel that supplies the driving force? **1**
(a) Steam Turbine (b) Gas Turbine
(c) Wind Turbine (d) All of these
- v. Hydraulic energy is converted into another form of energy by hydraulic machines. What form of energy is that? **1**
(a) Mechanical Energy (b) Electrical Energy
(c) Nuclear Energy (d) Elastic Energy

P.T.O.

[2]

- vi. Which of the following is not a hydraulic turbine? **1**
 (a) Pelton (b) De laval (c) Francis (d) Kaplan
- vii. Discharge of a centrifugal pump is proportional to- **1**
 (a) Impeller diameter (D) (b) D^2
 (c) D^3 (d) $1/D^3$
- viii. In a centrifugal pump the liquid enters the pump- **1**
 (a) At the top (b) At the bottom
 (c) At the centre (d) From sides
- ix. A rotary compressor is driven by an- **1**
 (a) Electric motor (b) Engine
 (c) Either (a) or (b) (d) None of these
- x. In the vane compressor, air is compressed by means of- **1**
 (a) Backflow from receiver only
 (b) The reciprocating action of the plunger
 (c) Squeezing action and backflow from the receiver
 (d) All of these
- Q.2 i. What is turbo-machinery? **2**
 ii. Enlist classification of turbomachines. **3**
 iii. Derive an expression of Euler's Turbine equation with neat sketch and statement. **5**
- OR iv. Explain the following terms. **5**
 (a) Degree of reaction. (b) Positive displacement machine
- Q.3 i. Explain the importance and need of velocity triangles. **2**
 ii. Write the difference between impulse and reaction turbine. Also explain the terms vane efficiency, speed ratio, and axial thrust of a steam turbine. **8**
- OR iii. Steam flow from the nozzles of a single row impulse turbine with a velocity 450 m/s at a direction which is inclined at an angle of 16° to the peripheral velocity. Steam comes out of the moving blades with an absolute velocity of 100 m/s in the direction at 110° with the direction of blade motion. The blades are equiangular and steam flow rate is 6 kg/s. Determine the power loss due to friction. **8**

[3]

- Q.4 i. What is Francis Turbine? Explain with neat sketch. **3**
 ii. The following data related to a hydroelectric power plant employing Kaplan turbine. Power output is 30 MW, Speed ratio (u/C_1) = 2, flow ratio (C_{f1}/C_1) = 0.65, Hub to tip diameter ratio = 0.3, Overall efficiency = 0.92. Calculate following: **7**
 (a) The volume flow rate (b) The speed
 (c) The hub and tip diameter (d) The specific speed
- OR iii. A single Pelton wheel of runner diameter 2.4 m runs at 360 rpm under a net head of 500 m. The jet diameter is 20 cm and its deflection inside the bucket is 165° . The relative velocity at exit of bucket is reduced by 14% due to friction. Assuming coefficient of velocity of nozzle as 0.98, find: **7**
 (a) Jet velocity
 (b) Bucket velocity
 (c) Speed ratio
 (d) Water power
 (e) Tangential force on buckets
 (f) Power developed by wheel
 (g) Overall efficiency, assuming mechanical efficiency of 88%.
- Q.5 i. What is centrifugal pump? Explain with neat sketch. **4**
 ii. Explain the classification of centrifugal pump with neat sketch. **6**
- OR iii. Explain the following term with neat sketch. **6**
 (a) Priming of pump (b) Specific speed
- Q.6 Attempt any two: **5**
 i. Describe the working principle of centrifugal compressor with neat sketch. **5**
 ii. Discuss the working principle of axial flow compressor with the help of T-S representation. **5**
 iii. Explain and draw the velocity triangle at the inlet and exit for the axial flow compressor **5**

- Q(1)
- i) b) Blade loading coefficient (ψ) decreases
 - ii) a) Work input factor
 - iii) b) M/c that uses pressurised steam to extract thermal energy.
 - iv) d) All of these.
 - v) a) Mechanical Energy
 - vi) b) De Laval
 - vii) c) D^3
 - viii) c) At the centre
 - ix) c) Either (a) or (b)
 - x) c) Squeezing action and backflow from the receiver.

- Q(2)
- i) Definition of Turbo machine 2 marks.
 - ii) 3 classification 3 marks.
 - iii) Derivation 2 marks.
 statement 2 mark
 diagram 1 mark } ⑤
 - iv) (a) DOR 2.5 marks.
 (b) PDM 2.5 marks. } ⑤

- Q(3)
- (i) importance and need 2 marks.
 - ii) difference 5 marks
 Vane Efficiency 1 mark.
 Speed Ratio 1 mark
 Axial thrust 1 mark. } ⑧
 - (iii) Velocity Triangle and Components 6 marks
 determine losses due to friction 2 marks. } ⑧

- Q(4)
- (i) Francis turbine 2 marks.
 sketch/diag. 1 marks. } ③
 - (ii) Supporting velocities & power 3 marks
 vol. flow rate 1 mark.
 The hub and tip dia 1 mark.
 speed 1 mark
 sp. speed 1 mark } ⑦

Q(4) (ii)

- (a) jet velocity
- (b) Bucket velocity
- (c) Speed Ratio
- (d) water power
- (e) tangential force on bucket
- (f) power developed by wheel
- (g) overall efficiency

Q(5) (i)

centrifugal pump
diagram

3 Marks
1 Marks } (4)

(ii)

classification of Cent pump
diagram

5 Marks
1 mark } (6)

(iii)

- (a) priming of pump with
sketch
- (b) sp. speed with sketch

3 Marks
3 Marks } (6)

Q(6)

(i)

centrifugal compressor
Diagram

4 Marks
1 Marks } (5)

(ii)

Axial flow compressor
T-s representation

4 Marks
1 mark } (5)

(iii)

inlet velocity triangle
Exit vel. triangle of
Axial flow compressor

2.5 Marks
2.5 Marks } (5)