

[4]

- Q.6 Attempt any two:
- i. Write the advantages and disadvantages of centrifugal compressor. **5**
 - ii. Draw and explain the velocity triangle at the inlet and exit for the axial flow compressor. **5**
 - iii. Write short note on the following: **5**
 - (a) Root blower
 - (b) Vane type compressor
 - (c) centrifugal compressor

Total No. of Questions: 6

Total No. of Printed Pages:4

Enrollment No.....



Faculty of Engineering
End Sem (Odd) Examination Dec-2019
ME3CO11 Energy Conversion-II

Programme: B.Tech.

Branch/Specialisation: ME

Duration: 3 Hrs.

Maximum Marks: 60

Note: 1. 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.
2. Use of steal table permitted.

- Q.1
- i. A hydraulic coupling belongs to the category of **1**
 - (a) Power absorbing machines
 - (b) Power developing machines
 - (c) Energy generating machines
 - (d) Energy transfer machines
 - ii. Which component of fluid velocity is responsible for transmission of power through rotodynamic machine? **1**
 - (a) Radial (b) Axial (c) Tangential (d) All of these
 - iii. Degree of reaction for a parson's reaction turbine **1**
 - (a) 0 (b) 1 (c) 1/2 (d) 3/4
 - iv. Optimal speed ratio for 50% reaction turbine is **1**
 - (a) $\cos^2\alpha$ (b) $\cos\alpha/2$ (c) $\cos\alpha$ (d) $\cos^2\alpha/2$
 - v. Pipes of largest diameter which carry water from reservoir to the turbines is known as _____ **1**
 - (a) Tail race (b) Tail stock (c) Pen stock (d) Head stock
 - vi. _____ is an inward radial flow reaction turbine? **1**
 - (a) Pelton turbine (b) Kaplan turbine
 - (c) Francis turbine (d) Propeller turbine
 - vii. 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
 - viii. Power required to drive a centrifugal pump is proportional to _____ **1**
 - (a) Speed (N) (b) N^2 (c) N^3 (d) N^4

P.T.O.

[2]

- ix. Rotary compressors are used where ____ quantities of gas are needed at relatively ____ pressure. **1**
 (a) Large, high (b) Large, low
 (c) Small, high (d) Small, low
- x. In an axial flow compressor, the pressure rise occurs in **1**
 (a) Fixed blades only
 (b) Moving blades only
 (c) Both fixed and moving blades
 (d) None of these
- Q.2 i. Define Turbomachines with example. **2**
 ii. State the major components of a turbomachine with their function **3**
 iii. State and derive Euler's Turbine equation and draw supporting diagram. **5**
- OR iv. What is positive displacement machine? Compare it with a turbo machine. **5**
- Q.3 i. Define the following term for a turbine: **2**
 (a) Blade speed ratio (b) Stage efficiency
 ii. Derive the expression for the maximum blade efficiency in terms of speed ratio and the necessary condition for Impulse turbine. Also write any three comparison between impulse and reaction turbine **8**
- OR iii. A stage of steam turbine with parsons bleeding delivers dry, saturated steam at 2.7 bar from the fixed blade at 90 m/s having specific volume 0.6686 m³/kg. The mean blade height is 40mm, the moving blades exit angle is 20°. The axial velocity of steam is three quarter of the blade velocity at the mean radius. The steam is supplied to the stage at the rate of 9000 kg/hr. The effect of the blade tip thickness on the annular area can be neglected. Calculate: - **8**
 (a) The rotational speed of the wheel
 (b) The diagram powers
 (c) The diagram efficiency
 (d) The enthalpy drop of the steam in this stage.

[3]

- Q.4 i. What is the purpose of draft tube? List any two type of draft tube with neat sketch. **3**
 ii. 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%.
- OR iii. An inward flow reaction turbine develops 1200 kW power having the vane velocity at inlet as 30 m/s and the corresponding whirl velocity of 24 m/s. The ratio of outer to internal diameter is 2. The velocity of flow remains at 6 m/s throughout and discharge at exit is radial. The head available on wheel is 75 m, Find: **7**
 (a) Vane angle (b) Power developed by wheel
 (c) Discharge in m³/s (d) Hydraulic efficiency
- Q.5 i. With the help of neat sketch discuss the main parts of centrifugal pump. **4**
 ii. Define the following term for centrifugal pump: **6**
 (a) Slip factor
 (b) Work factor pressure coefficient
- OR iii. Define the following term for centrifugal pump: **6**
 (a) Manometric head (b) Gross head
 (c) Static head (d) Priming of pump
 (e) Cavitation (f) Specific speed

P.T.O.

Marking Scheme
ME3CO11 Energy Conversion-II

Q.1	i.	A hydraulic coupling belongs to the category of		1
		(d) Energy transfer machines		
	ii.	Which component of fluid velocity is responsible for transmission of power through rotodynamic machine?		1
		(c) Tangential		
	iii.	Degree of reaction for a parson's reaction turbine		1
		(c) 1/2		
	iv.	Optimal speed ratio for 50% reaction turbine is		1
		(c) $\cos\alpha$		
	v.	Pipes of largest diameter which carry water from reservoir to the turbines is known as_____		1
		(c) Pen stock		
	vi.	_____is an inward radial flow reaction turbine?		1
		(c) Francis turbine		
	vii.	In a centrifugal pump the liquid enters the pump_____		1
		(c) At the centre		
	viii.	Power required to drive a centrifugal pump is proportional to____		1
		(b) N^2		
	ix.	Rotary compressors are used where ____ quantities of gas are needed at relatively ____ pressure.		1
		(b) Large, low		
	x.	In an axial flow compressor, the pressure rise occurs in		1
		(c) Both fixed and moving blades		
Q.2	i.	Definition Turbomachines	1 mark	2
		Example	1 mark	
	ii.	Components of a turbomachine with their function		3
		1 mark for each component	(1 mark * 3)	
	iii.	Euler's Turbine equation		5
		Definition	1 mark	
		Derivation	3 marks	
		Diagram	1 mark	
OR	iv.	Definition of positive displacement machine	1 mark	5
		Difference with a turbo machine		
		1 mark for each difference (1 mark * 4)	4 marks	

Q.3	i.	Define the following term for a turbine:		2
		(a) Blade speed ratio	1 mark	
		(b) Stage efficiency	1 mark	
	ii.	Derivation	4 marks	8
		Necessary condition for Impulse turbine	1 mark	
		Any three comparison between impulse and reaction turbine		
		1 mark for each comparison (1 mark * 3)	3 marks	
	OR	iii.	Calculate: -	8
		(a) The rotational speed of the wheel	2 marks	
		(b) The diagram powers	2 marks	
		(c) The diagram efficiency	2 marks	
		(d) The enthalpy drop of the steam in this stage.	2 marks	
Q.4	i.	Purpose of draft tube	1 mark	3
		Any two type of draft tube with sketch		
		1 mark for each (1 mark * 2)	2 marks	
	ii.	Find:		7
		(a) Jet velocity	1 mark	
		(b) Bucket velocity	1 mark	
		(c) Speed ratio	1 mark	
		(d) Water power	1 mark	
		(e) Tangential force on buckets	1 mark	
		(f) Power developed by wheel	1 mark	
		(g) Overall efficiency	1 mark	
	OR	iii.	Find:	7
		(a) Vane angle	1 mark	
		(b) Power developed by wheel	2 marks	
		(c) Discharge in m^3/s	2 marks	
		(d) Hydraulic efficiency	2 marks	
Q.5	i.	Parts of centrifugal pump.		4
		1 mark for each part	(1 mark * 4)	
	ii.	Define the following term for centrifugal pump:		6
		(a) Slip factor	3 marks	
		(b) Work factor pressure coefficient	3 marks	
	OR	iii.	Define the following term for centrifugal pump:	6
		1 mark for each	(1 mark * 6)	

- Q.6 Attempt any two:
- | | | | |
|------|--|--------------|----------|
| i. | Advantages and disadvantages of centrifugal compressor | | 5 |
| | 1 mark for each | (1 mark * 5) | |
| ii. | Inlet velocity triangle | 2.5 marks | 5 |
| | Exit velocity triangle | 2.5 marks | |
| iii. | Write short note on the following: | | 5 |
| | (a) Root blower | 1 mark | |
| | (b) Vane type compressor | 2 marks | |
| | (c) centrifugal compressor | 2 marks | |
