SUBJECT CODE NO:- P-114
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E.(Mech) Examination May/June 2017
Turbo Machines
(Revised)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
1. Solve three question from each section
2. Figure to the right indicate full marks

Section A

Q.1 a) Definition a turbo machine. Differentiate between a turbo machine and a positive displacement machine   6

b) Define specific speed of a turbine derive an expression for specific speed of a turbine from fundamentals   7

Q.2 a) A jet of water of diameter 80 mm moving with a velocity of 27 m/s strikes a fixed plate in such a way that   7
the angle between the jet ant plate is 60° Find the force exerted by the jet on the plate
i) In the direction normal to the plate
ii) In the direction of the plate

b) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the   6
jet.

Q.3 a) A jet of water of direction 53 mm having a velocity of 22 m/s strikes a curved vane which is moving with a   7
velocity of 11 m/s in the direction of the jet. The jet leaves the vane at an angle of 60° to the direction of
moving of vane at outlet. Determine
i) The force exerted by the jet on the vane in the direction of motion
ii) Work done per second by the jet

b) A nozzle of 48 mm diameter delivers a stream of water at 24 m/s perpendicular to a plate that moves away 6
from the jet at 6 m/s.
find i) The force on the plats
ii) The work done
iii) the efficiency of jet

Q.4 a) What are the uses of a draft tube? Describe with neat sketches different types of draft tubes   6

b) A pelton wheel is to be designed for the following specifications: shaft power = 11500 kw;   7
Head = 390 meters; speed = 760 rpm; overall efficiency = 86%; jet diameter is not to exceed one sixth of the
wheel diameter. Determine:
i) The wheel diameter
ii) the number of jets required
iii) Diameter of the jet

Q.5 a) A Reaction turbine works at 450 rpm under a head of 125 meters. Its diameter at inlet is 125 cm and the   7
flow area is 0.45 m^2. The angles made by absolute and relative velocities at inlet are 22° and 62° respectively
with tangential velocity. Determine
i) The volume flow rate
ii) The power development

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iii) Hydraulic efficiency Assume whirl at outlet to be zero

b) Draw neat sketches and explain the Kaplan turbine   7

<div align="center">Section B</div>

Q.6   a) What is the different between single-stage and multistage pumps? Describe multistage pump with impeller 6
in parallel and in series.

b) A centrifugal pump is running at 1440 rpm the outlet vane angle of the impeller is 45° and velocity of flow   7
at outlet is 2.8 m/s .The discharge through the pump is 210 litres / s when the pump is working against a total
head of 21m. If the manomatric efficiency of the pump is 80%. Determine
i) The diameter of the impeller
ii) The width of the impeller at outlet

Q.7   In a single row wheel impulse turbine the mean diameter of the blades 1.1 m and the speed is 300 rpm, the   13
nozzle angle is 20° and the ratio of blade speed to steam speed is 0.46 and the relative velocity and outlet
from the blades to that at inlet is 0.87. The outlet angle is made 3° less than the inlet angle. The steam flow is
12 kg/s. Draw the velocity diagram for the blade and determine the following
a) Tangential thrust on the blades
b) Axial thrust on the blade
c) Power developed in the blades
d) Blade efficiency

Q.8   a)Sketch Brayton cycle on p-v plot and derive a relation for its thermal efficiency in terms of pressure ration   6

b) Discuss the influence of reheating, regeneration and inter-cooling on the performance of the gas turbine   7
cycle

Q.9   a) Derive an expression for critical pressure in nozzle flow.   6

b) A nozzle expands steam from 15 bar and 310°c to 5.5 bar. If the flow rate is 1.2 kg/s find the throat and   7
exit area. What should be coefficient of velocity, if exit velocity is 555 m/s?

Q.10   Write short notes on any three of following   14
1) NPSH
2) Ericsson cycle
3) Nozzles and diffusers
4) Characteristics of centrifugal Pump

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