

**BACHELOR OF ENGG (MECHANICAL ENGINEERING) EXAM 2019**  
(THIRD YEAR SECOND SEMESTER )

**HYDRO, WIND AND WAVE POWER**

Time: Three hours

**Marks: 100**

*(Answer any FIVE questions)*

*Different parts of the same question should be answered together.  
All symbols carry their usual meanings unless otherwise mentioned.  
Assume any relevant data if necessary.*

1. a) What is hydrologic cycle? Explain its different components with a neat schematic diagram. 8  
 b) What do you mean by catchment area? Discuss its characteristic features. 8  
 c) How rainfall is measured? 6
2. a) Explain the different type precipitation 8  
 b) What is runoff? Explain the different factors affecting the runoff. 8  
 c) Discuss about the mass curve and flow duration curve. 6
3. a) Show the major components of a small hydroelectric power plant with a neat schematic diagram. 8  
 b) Discuss the social and environmental impacts of hydropower. 6  
 c) A Pelton wheel of 3m diameter diameter operates under a head of 350m with a speed of 400rpm having mechanical efficiency 90%. The buckets deflect the jet with an angle of  $165^\circ$  with jet diameter 30cm. Calculate power developed and hydraulic efficiency of the turbine. Assume  $C_v=0.98$  and  $k=0.96$
4. a) Explain briefly governing techniques of hydraulic turbines. 10  
 b) A Francis turbine runs at 600 rpm under a head of 100 m. Its diameter at inlet is 100 cm and flow area is  $0.4\text{m}^2$ . The angle made by absolute and relative velocities at inlet are  $20^\circ$  and  $50^\circ$  respectively with the tangential velocity. Determine power developed and hydraulic efficiency of the turbine if velocity of whirl at outlet is zero.

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5. a) Explain the sources wind for power generation. 6  
b) Find the condition to have the maximum power developed by a wind turbine. 10  
What is the corresponding efficiency?  
c) Explain cut-in and cut-out velocity in a PV diagram. 4
6. a) What is wave power? Derive the expression for total wave power per unit 10  
surface area.  
b) Briefly explain two wave energy conversion techniques with neat sketch. 10
7. a) What are the advantages and limitations of tidal power? 8  
b) Explain the operation of single basin tidal power considering single effect and 12  
double effect schemes separately with neat schematic diagram.
8. Write short notes on: (any **FOUR**) 4 X 5 20  
a) Site selection criteria for SHP  
b) Pumped Storage Power Plant  
c) Water Hammer  
d) Surge Tank  
e) Draft Tube