

**NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR****Odd Semester Mid-Term Examination, 2023-24**

Course Code: MEE 724

Full Marks: 25

Course Name: HYDRAULIC MACHINES

Time: 90 Minutes

**PART A**

Instructions: Answer all the questions.

Question No.	Body of the Question	Marks	Mapped CO
1	<p>Answer any three of the following:</p> <p>(a) Explain the operation of a reciprocating pump by its performance characteristics.</p> <p>(b) Prove that for a single acting reciprocating pump, maximum discharge : mean discharge = <math>\pi</math>.</p> <p>(c) From the area from the ideal indicator diagram how is the power of a reciprocating pump obtained?</p> <p>(d) What do you mean by safe operation of a reciprocating pump? From the combined indicator diagram show the salient points that are to be considered for the determination of safe speed of operation for the pump.</p> <p>(e) Explain the negative slip phenomenon with the help of an indicator diagram. What is the condition to be satisfied for negative slip in a reciprocating pump?</p>	2.5x3 = 7.5	CO1
2.	In a single acting reciprocating pump suction lift is 3.5 m, delivery head is 4.0 m, lengths of suction and delivery pipes are 6 m and 15 m, diameter of both pipes is 10 cm, diameter of piston is 15 cm and stroke length is 60 cm. Find the maximum safe working speed of the pump. Is there any chance of negative slip during operation?	5	CO2

**Part B**

Instructions: Answer all the questions.

Question No.	Body of the Question	Marks	Mapped CO
1	Derive an expression for the specific speed of a hydraulic turbine.	3.5	CO1
2	A turbine is to operate under a head of 25 m at 200 r.p.m. The discharge is $9 \text{ m}^3/\text{s}$ . If the efficiency is 90 percent determine the performance of the turbine under a head of 20 m.	4	CO2
3	A turbine develops 5,000 horse-power under a head of 110 m at 100 rpm. What is its specific speed? What would be its normal speed and output under a head of 81 m ?	5	CO2

**Course Outcomes**

CO1: To acquire an in depth knowledge of hydraulic machines used in the Industry

CO2: To learn the basic design procedure for different hydraulic machines