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FACULTY OF ENGINEERING B.E. 3/4 (Mech.) First Semester (Suppl.) Examination, June/July 2011 HYDRAULIC MACHINERY AND SYSTEMS

Time: Three Hoursl

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1	Note :- Answer ALL	questions from Part	A. Answer any FIVI	E questions from Part	В.					
		PART—A	(Marks : 25)							
1.										
	(a) 15·1	(b) 25·1	(c) 20·5	(d) 32·8	2					
2.	A water jet 0.025 m ² the plate swing is 30	area strikes a hinged o, weight of plate is	plate at its centre with (kN):	ith a velocity of 8 m/s	sec. If					
	(a) 2·3	(b) 3·2	(c) 4·8	(d) 6·4	2					
3.	A single acting recip 120 rpm. The $(C_d =$	procating pump havin 0.9) actual discharge	g piston area 0.08 m is (m³/sec):	and 0.5 m stroke re	uns at					
	(a) 0·1	(b) 0·08	(c) 0.072	(d) 0·064	3					
4.	If 84.8 % of work c pump, then the work is:	an be saved by fitting saved by fitting an a	g an air vessel on a ir vessel on a double	single acting reciprocating	cating pump					
	(a) 42·4 %	(b) 78·4 %	(c) 39·2 %	(d) 32·9 %	1					
5.										
	(a) 72 %		(c) 85 %		3					
6.	A 1/5th scale model prototype pump work	of a Centrifugal pun s under 25 m head,	np runs at 1000 rpm its speed is (rpm):	under 16 m head.	If the					
	(a) 18	(b) 24	(c) 32	(d) 27	3					
7.	In a Pelton wheel the	vanes deflects the je	et through an angle o	of 120°. The η_{max} is:						
	(a) 60 %		(c) 80 %		3					
8.	In a Francis turbine t The flow velocity is	he guide blade angle constant. Its η_{hyd} is :	is 45° and the movir	ng vanes are radial at	inlet.					
	(a) 66.67 %	(b) 75 %	(c) 85·35 %	(d) 50 %	3					
HVS	—837			((Contd.)					

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A of	turbine develops the turbine is:	7225 kW power	r under a head	of 81 m at	243 rpm.	The specif	ic speed		
(a)	170	(b) 85	(c)	255	(d)	765	3		
. The displacement volume of a Hydraulic accumulator is 0.115 m³. If the plunger diameter is 0.35 m its stroke length is (m):									
(a)	0.1195	(b) 11.95	5 (c)	1.195	(d)	2.12	2		
		PART-	B (Marks: 5>	(10=50)			A Law		
A jet of water with a velocity of 60 m/sec strikes a curved vane moving at 30 m/sec. The jet enters an angle of 20° and the angle between relative velocities is 120° . Draw velocity triangles and determine (a) blade angles at inlet and exit (b) work done/N of water, and (c) η_{hyd} .									
A single acting reciprocating pump has a plunger diameter of 0.375 m and 0.6 m stroke. The delivery pipe is 90 m long and 0.15 m diameter. Find the power saved by fitting an air vessel near the cylinder. The pump runs at 50 rpm and friction factor (f) = 0.008.									
An impeller of a Centrifugal pump with inner and outer diameters of 0.6 m and 1.2 m runs at 200 rpm and discharges 1.8 m ³ /sec of water under a head of 6 m. The vane exit angle is 26° and exit flow velocity is 2.5 m/sec. Determine η_{max} and minimum starting speed of									
In inle	In a Francis turbine the vane velocity at inlet, constant flow velocity and whirl velocity at inlet are 24 m/sec, 3 m/sec and 30 m/sec respectively. Assuming radial discharge and $\eta_{hyd} = 78$ %, determine head of the turbine, guide vane angle, rotor vane angle at inlet and exit.								
A Kaplan turbine produces 20600 kW of power under a head of 22 m with $\eta_o = 85\%$. If speed ratio = 1.6 and flow ratio = 0.5 find the diameter of the runner, speed of the runner and specific speed of the turbine. Take the hub diameter = 0.35 times the runner diameter.									
							6		
(b)	(b) 0.2 m³/sec of water is supplied from a height of 3 m to a Hydraulic Ram which raises 0.002 m³/sec of water to a height of 20 m from the Ram. Determine D' Aubuisson's and Rankine's efficiencies of the Hydraulic Ram.								
(a)	a) Functions of Air vessels of Reciprocating pumps								
(b) Performance curves of Centrifugal pumps									
(c) Conditions of similarity of Turbines.							4		
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	of (a) Th is (a) A j jet tria (c) A s del ves An at is 2 the In a inle (a) (b) Wri (a) (b) (c)	(a) 170 The displacement veris 0.35 m its stroke (a) 0.1195 A jet of water with jet enters an angle of triangles and determ (c) η _{hyd} . A single acting recip delivery pipe is 90 vessel near the cylin An impeller of a Cerat 200 rpm and disc is 26° and exit flow the pump. Neglectin In a Francis turbine inlet are 24 m/sec, η _{hyd} = 78 %, determine inlet are 24 m/sec, η _{hyd} = 78 %, determine in the properties of the work of the pump. The properties of the work of the pump of the work of the pump of the work of the pump of the properties of the work of the pump of the work of the pump of	(a) 170 (b) 85 The displacement volume of a Hydis 0·35 m its stroke length is (m): (a) 0·1195 (b) 11·95 PART— A jet of water with a velocity of 60 jet enters an angle of 20° and the atriangles and determine (a) blade a (c) η _{hyd} . A single acting reciprocating pump helivery pipe is 90 m long and 0·1 vessel near the cylinder. The pump An impeller of a Centrifugal pump at 200 rpm and discharges 1·8 m³/s is 26° and exit flow velocity is 2·5 the pump. Neglecting impeller lossed In a Francis turbine the vane velocitinlet are 24 m/sec, 3 m/sec and 3 η _{hyd} = 78 %, determine head of the exit. A Kaplan turbine produces 20600 k speed ratio = 1·6 and flow ratio = 0 and specific speed of the turbine. Ta (a) Describe the working of a Hyde 0·002 m³/sec of water is supplied 0·002 m³/sec of water to a heige and Rankine's efficiencies of the Write short notes on:— (a) Functions of Air vessels of Recombination of Similarity of Turbine Conditions of Similarity	(a) 170 (b) 85 (c) The displacement volume of a Hydraulic accumulation of the turbine is: (a) 0.1195 (b) 11.95 (c) PART—B (Marks: 5× A jet of water with a velocity of 60 m/sec strikes a jet enters an angle of 20° and the angle between retriangles and determine (a) blade angles at inlet a (c) η _{hyd} . A single acting reciprocating pump has a plunger diadelivery pipe is 90 m long and 0.15 m diameter. vessel near the cylinder. The pump runs at 50 rpm An impeller of a Centrifugal pump with inner and cat 200 rpm and discharges 1.8 m³/sec of water und is 26° and exit flow velocity is 2.5 m/sec. Determin the pump. 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(a) 170 (b) 85 (c) 255 The displacement volume of a Hydraulic accumulator is 0·11: is 0·35 m its stroke length is (m): (a) 0·1195 (b) 11·95 (c) 1·195 PART—B (Marks: 5×10=50) A jet of water with a velocity of 60 m/sec strikes a curved velocity in a single acting reciprocating pump has a plunger diameter of 0 delivery pipe is 90 m long and 0·15 m diameter. Find the performance of a Centrifugal pump with inner and outer diameter at 200 rpm and discharges 1·8 m³/sec of water under a head is 26° and exit flow velocity is 2·5 m/sec. Determine η _{mano} and the pump. Neglecting impeller losses, determine the specific In a Francis turbine the vane velocity at inlet, constant flow velocity are 12 m/sec, 3 m/sec and 30 m/sec respectively. Ass η _{hyd} = 78 %, determine head of the turbine, guide vane angle, exit. A Kaplan turbine produces 20600 kW of power under a head speed ratio = 1·6 and flow ratio = 0·5 find the diameter of the and specific speed of the turbine. Take the hub diameter = 0·3 (a) Describe the working of a Hydraulic Ram with a sketch. (b) 0·2 m³/sec of water is supplied from a height of 3 m to a 0·002 m³/sec of water is supplied from a height of 3 m to a 0·002 m³/sec of water to a height of 20 m from the Ram and Rankine's efficiencies of the Hydraulic Ram. Write short notes on :— (a) Functions of Air vessels of Reciprocating pumps (b) Performance curves of Centrifugal pumps (c) Conditions of similarity of Turbines.	(a) 170 (b) 85 (c) 255 (d) The displacement volume of a Hydraulic accumulator is 0·115 m³. If the is 0·35 m its stroke length is (m): (a) 0·1195 (b) 11·95 (c) 1·195 (d) PART—B (Marks: 5×10=50) A jet of water with a velocity of 60 m/sec strikes a curved vane moving jet enters an angle of 20° and the angle between relative velocities is 12 triangles and determine (a) blade angles at inlet and exit (b) work don (c) η _{hyd} . 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