ADVANCED PROPULSION SYSTEM – MID-TERM EXAM II
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1. A Motoryacht propeller has been given below. Determine the whole propeller weight and moment of inertia excluding boss by taking 3% for blade fillets? Take 30% increment for added mass or water effect. (1**5 Points**)

D =1.25 m (propeller diameter)
Z = 5 (number of blades)
ρ = 8600 kg/m^3. (Density of propeller material - bronze)
r, A = propeller radii and sectional areas referring Table 1

Table 1: Propeller radii and sectional areas

i	r (cm)	A (cm^2)
1	12.50	64.21
2	18.75	66.35
3	25.00	63.97
4	31.25	57.52
5	37.50	48.34
6	43.75	37.57
7	50.00	25.82
8	56.25	13.63
9	59.38	6.34
10	60.94	2.86
11	62.50	0.99

2. Explain the stages of propeller and machinery selection including reduction gear starting from a known diameter. (5 points)
Hint: The diameter will be the one that installed the largest radius on the ship hull.

Good Luck! Dr. Ali Can Takinacı

SOLUTIONS

1. First, it should be obtained simple table for one blade as below. Then it should be multiplied by the number of blades, then fillets should be added to the total sum.

i	r(i) (cm)	Ax(i) (cm2)	m(i) (kg)	Iox (kg.m2)
1	12.50	64.210	--	--
2	18.75	66.350	3.51	0.086
3	25.00	63.970	3.50	0.168
4	31.25	57.520	3.27	0.258
5	37.50	48.340	2.84	0.336
6	43.75	37.570	2.31	0.381
7	50.00	25.820	1.70	0.374
8	56.25	13.630	1.06	0.299
9	59.38	6.340	0.27	0.090
10	60.94	2.860	0.06	0.022
11	62.50	0.990	0.03	0.010

rho_m=	8600	kg/m3	
m=	18.55	kg	
Iox=	2.02	kg.m2	
Z=	5		
Iox=	10.12157	kg.m2	(propeller inertia in air excluding hub)
Iox=	13.15803	kg.m2	(propeller inertia in water excluding hub)

2. Here is the steps;

i. The largest diameter of propeller is chosen and an optimization procedure is applied. This yields to optimum rotation rate and delivered power.

ii. Engine power is detected according to margins (MCR, Sea Margin and shaft loss) provided. If there is shaft generator; the power of shaft generator is added to the latest power.

iii. Therefore the main engine is selected according to the resultant power in step ii.

iv. A comparison is made between RPM 's in step i and machinery revolution in step iii. Therefore a suitable reduction gear is selected. Propeller RPM is determined.

v. Additional optimization is applied together with the diameter from step i and revolution rate from step iv.

vi. If it needs the diameter would be increased or decreased according to demand of other loading conditions such as ballast condition. The propeller tip should not be risen from sea level abaft of ship.