# UNIVERSITI KUALA LUMPUR
## MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

## FINAL EXAMINATION
### JANUARY 2016 SEMESTER

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|---|---|
| COURSE CODE | : LDD 30502 |
| COURSE NAME | : SHIP RESISTANCE AND PROPULSION |
| PROGRAMME NAME<br>(FOR MPU: PROGRAMME LEVEL) | : DET SHIP DESIGN |
| DATE | : 24 MAY 2016 |
| TIME | : 02.00 PM – 4.00 PM |
| DURATION | : 2 HOURS |

## INSTRUCTIONS TO CANDIDATES

NOTE: Instructions below to be edited to suit the needs of the intended course/examination.

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. This question paper consists of TWO (2) sections; Section 'A' and Section 'B'. Answer all questions in Section 'A' and TWO (2) questions only from Section 'B'.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 5 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

**SECTION A (Total: 60 marks)**

**INSTRUCTION: Answer ALL questions.**
**Please use the answer booklet provided.**

**Question 1**

(a) Total resistance is consists a number of different components, which is caused by a variety of factors and which interact one with other in a complicated way. Sketch the components of total resistance.

[3 marks]

(b) List and describe three (3) other types of ship resistance.

[9 marks]

(c) In order to perform a model testing, model is scaled down to the model size of 6m length and speed 3.5m/s have wetted surface area 27 $m^2$. A real ship length 105m. Applying Geometrical Similarity, determine the speed of model, $V_S$ (in m/s) and wetted surface area of model, $S_S$.

[8 marks]

**Question 2**

(a) Power delivered from engine to propeller will be experience losses. Sketch the sequence of **power transfer** and specify three (3) of **power transfer** in screw driven ship.

[8 marks]

(b) Total resistance of the ship, 1216.5kN at speed of 6.6 $ms^{-1}$ is calculated based on model testing result. The values of wake fraction and thrust deduction factor are given as 0.174 and 0.272 respectively, taking Total Efficiency is 68 % and assuming $\eta_B$ is 0.72. **Calculate:**

i. Effective Power, $P_E$
ii. Hull efficiency, $\eta_H$
iii. Thrust Power, $P_T$
iv. Power Delivered, $P_D$
v. Quasi Propulsive Efficiency, $\eta_D$

[12 marks]

**Question 3**

(a) Explain the five (5) basic position for the bulb and sketch the **modern bulb** form that typically preferable applied to the ship.

[10 marks]

(b) The common bow developed presently from the bow with vertical stem. State three (3) advantages of a raked stem above water.

[3 marks]

(c) The efficiency of a propeller takes an important place in the designing process of the propulsion system. State six (6) the efficiency depends on the flow field of the propeller.

[7 marks]

**SECTION B (Total: 40 marks)**

**INSTRUCTION: Answer only TWO (2) questions.**
**Please use the answer booklet provided.**

**Question 4**

(a) Describe and sketch the propeller geometries as listed below :

i. Diameter
ii. Blade profile
iii. Rake
iv. Skew
v. Face

[10 marks]

(b) The relationship between the ship speed, pitch, wake and slip at stern of the moving ship equipped with propeller. Table 1 show a requirements data and you are required to **calculate X and Y :**

i. Ship Speed Vs
ii. Theoretical velocity $V_t$
iii. Apparent slip $S_A$
iv. Speed of Advance $V_A$
v. Real slip $S_R$

Table 1

| **Data (unit)** | **X** |
|---|---|
| Ship speed (knot) | 25 |
| Propeller rate of rotation per minute RPM (rev/min) | 205 |
| Taylor wake fraction | 0.3 |
| Pitch (m) | 4.5 |

[10 marks]

## Question 5

(a) Describe and sketch the marine propulsions as listed below:

i. Waterjet Propulsion

ii. Podded Azimuthing Propellers

iii. Voith Schneider Propeler

[12 marks]

(b) Alternative main engine types are marine diesel engine, gas turbine engine and steam turbine engine. Explain briefly four (4) the characteristics comparison between marine diesel and gas turbine.

[8 marks]

## Question 6

(a) Most electrical propulsion system have diesel engine either medium or high speed as their prime movers.

i. State sixth (6) the advantages electrical marine propulsion.

[6 marks]

ii. Sketch and design the typical diagram of marine electrical propulsion system which commonly applied.

[4 marks]

(b) Explain briefly and sketch the combination in marine propulsion as listed below:-.

i. CODOG

ii. COLAG

[10 marks]

**END OF QUESTION**

## LIST OF FORMULAE

1. $R_e = \dfrac{VL}{\mu / \rho}$

2. $R_f = f.S.V^{1.825}$

3. $R_R = C_R \times K$

4. $R_T = R_f + R_R$

5. Scale Factor $= \lambda$

$\lambda = \dfrac{L_S\,(m)}{L_M\,(m)}$ **: Length** $\quad \lambda^2 = \dfrac{S_S\,(m^2)}{S_M\,(m^2)}$ **: Area**

$\lambda^3 = \dfrac{\nabla_S\,(m^3)}{\nabla_M\,(m^3)}$ **: Volume** $\quad \sqrt{\lambda} = \dfrac{V_S(m/s)}{V_M(m/s)}$ **: Speed**

6. $C_{TM} = \dfrac{R_{TM}}{\frac{1}{2}\rho_{FW} \times V_M^2 \times S_M}$

7. $C_{FM} = \dfrac{0.075}{(\log Rn_M - 2)^2}$

8. $C_{TM} = C_{FM} + C_{RM}$
$\therefore C_{RM} = C_{TM} - C_{FM}$

9. $C_{RS} = C_{RM}$

10. $R_n = \dfrac{V_M \times L_M}{\upsilon_{FW}}$

11. $C_{TS} = C_{FS} + C_{RS}$

12. $C_{FS} = \dfrac{0.075}{(\log Rn_M - 2)^2} \times \%\ roughness\ allowance$

13. $R_{TS} = C_{TS} \times \frac{1}{2}\rho_{SW} \times V_S^2 \times S_S$

14. $P_E = R_{TS} \times V_S$

15. $\eta_H = \frac{P_E}{P_T}$

16. $\eta_H = \frac{1-t}{1-w}$

17. $\eta_D = \eta_H \times \eta_B$

18. $\eta_D = \frac{P_E}{P_D}$

19. $P_D = \frac{P_E}{\eta_D}$

20. $\eta_S = \frac{P_D}{P_B}$

21. $\eta_T = \frac{P_E}{P_B}$