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Eoin Collins P150380
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Q1 a) Force TOTAL on ½ cylinder due to internal Pressure = P × Projected area = Pdl

Resolved Vertically

Stress x Area x 2

Total Resistive force = $2\sigma_H \times l \times t$

$\therefore 2\sigma_H lt = Pdl$

$\therefore \sigma_H = \frac{Pd}{2T}$

b) Hoop Stress is Seen To Be Twice Longitudinal Stress. So if a Cylinder is designed to meet the HOOP Stress it will Fulfill the needs of the Longitudinal Stress.

c) ρ = density of Sea water =
1028.5000 M^3/kg Ans
1.0285 cm^3/g UNITS

d) $P = 0$ $h = \frac{P}{g\rho}$
$\rho = 1028.5\ m^3/ks$
$h = ?$

ρ_0

$\rho = \rho_{gl}$

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Q1d) $h = \frac{P}{\rho g}$

Continued

$$P_{MAX} = \frac{2\sigma_{HT}}{d} \quad \frac{2 \times 190 \times 10^{6} \times 1.9 \times 10^{-3}}{1.9} =$$

$$P_{MAX} = 722 \text{ KPA}$$

$$h = \frac{722 \text{ KPA}}{9.81 \times 1029.5} = 71.55 \text{ m}$$

$$71.56 \text{ m}$$

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Q2a A = Define The Problem.
- A Clear definition of the Problem / Issue
i. Find out the Customers needs.
- What Problem does the Product Solve?
ii Develop a Problem Statement
This Should be Broad and Specifically adress the Need Identified
iii CRiteria FOR Success
This Should have input from Multiple Roles including Managers, Scientists, Marketing & Manufacturing

B = ~~Gate~~ Gather Relevant information -
~~Ath~~ AT This Stage Items Such as the following Should Be Considered

i. Is The Problem Real and its Statement Accurate
ii Is There Really a need for a new Solution or has the Problem already Been Solved.
iii. What are the Existing Solutions to the Problem. [if Any]
IV.) What is Wrong with the way the Problem is Currently Being Solved.
V.) What is Right with the way the PROBlem is Being Solved.
VI.) What Companies Manufacture the Existing Solution to the Problem.
VII.) What Economic factors are governing the Solution

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Q2a Continued

VIII) How much will Customers Pay for a Solution to the Problem.
9x.) What other Factors are Important to the Problem Solution (E.g) aesthics Safety Considerations & Environmental issues

C) Generate multiple Solutions
at this Stage Consider Thette following.

i Creative Phase involving BrainStorming
ii.) Synthesis of of new Ideas to Solve the current design Problem.
iii.) Design Teams Should Be free to take Risk
IV.) Members from different disiplines should Be involved

D.) Analise and Select Solution
Carry out the following analysis
i Functional analysis
ii Industrial design / Ergonomics
iii Mechanical / Strength analysis
IV Electrical / Electromagnetic
V Manufacturability / Testability
Vi Product Safety & Reliability
VII ~~Ergonomic~~ Economic And Market Analysis
VIII Regulations And Standards

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Q2a Continued. Cont

c.) Test and Implementation Solution
at this Stage such Items should be considered.
i) Prototyping And Testing under Real Conditions. this Can Be used To Corrolate the ANALYTical work Carried out at this Stage, in addition To Contempory Manufacturing methods such as 3d Printing

ii Documentation This may Be Particularly Relevant if legislative Testing is needed as if An Audit is Carried out on the Final Product to Show what Testing was Carried out

iii.) Apply for Patents To Protect the design

Q2b. - In my Opinion. Category D Analise And Solid Solution Can Benefit from the implementation And Antigration of Fea. These Benefits apply across a Range of the Category S within this Area for EXAmPLE

- Fea Can Be used To increas the Accuracy of the Functional analysis for an Object of improving Quality of design,

Mechanical / Stregth of analysis Could Benefit From the Antigration of Fea as . Fea is Right at the Core of this TOPIC And Plays a key Role in the Initial considerations during this Part of design

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Q3

$$M_{xx} = \frac{w}{2}\left(\frac{L}{2} - x\right) = \frac{wL}{4} - \frac{wx}{2} = EI\frac{d^2y}{dx^2} \quad (1)$$

$$\therefore EI\frac{dy}{dx} = \frac{wLx}{4} - \frac{wx^2}{4} + A$$

$$EIy = \frac{wLx^2}{8} - \frac{wx^3}{12} + Ax + B$$

when $x = 0$ $\frac{dy}{dx} = 0$ $\therefore A = 0$

when $x = \frac{L}{2}$ $y = 0$ $\therefore 0 = \frac{wL}{8}\left(\frac{L}{2}\right)^2 - \frac{w}{12}\left(\frac{L}{2}\right)^3 + B$

$$B = \frac{wL^3}{96} - \frac{wL^3}{32}$$

$$B = \frac{-wL^3}{48}$$

$$\therefore y = \frac{1}{EI}\left[\frac{wLx^2}{8} - \frac{wx^3}{12} - \frac{wL^3}{48}\right]$$

b y_{max} when $(x = 0)$

$$y_{max} = \frac{wL^3}{48EI}$$

$$\frac{dy}{dx} = \frac{1}{EI}\left[\frac{WL}{4}x - \frac{wx^2}{4}\right]$$

$\frac{dy}{dx}_{max}$ when $x = \frac{L}{2}$

$$\frac{dy}{dx}_{max} = \frac{1}{EI}\left[\frac{wL}{4}\left(\frac{L}{2}\right) - \frac{w}{4}\left(\frac{L}{2}\right)^2\right]$$

$$= \frac{1}{EI}\left(\frac{wL^2}{8} - \frac{wL^2}{16}\right)$$

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Q3b $\frac{dy}{dx}_{MAX} = \pm \frac{WL^2}{16EI}$

Continued

$\therefore y_{MAX} = \frac{-WL^3}{48EI}$

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