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Complex Engineering Problem in Final Examination

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The Attributes of Complex Engineering Problems (IEA, 2013)

Complex problem = 1st attribute (the depth of knowledge) + several other attributes

WP1	Depth of Knowledge Required	In-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamental based, first principles analytical approach
WP2	Range of Conflicting Requirements	Wide-ranging or conflicting technical, engineering and other issues
WP3	Depth of Analysis Required	No obvious solution and require abstract thinking, originality in analysis to formulate suitable models
WP4	Familiarity of Issues	Infrequently encountered issues
WP5	Extent of Applicable Codes	Outside problems encompassed by standards and codes of practice for professional engineering
WP6	Extent of Stakeholder and Level of Conflicting Requirement	Diverse groups of stakeholders with widely varying needs
WP7	Interdependence	High level problems including many component parts or sub-problems



Challenges in the implementation of Complex Problem in Examination



Time constraint



Hassle in marking/assessment



Design of question

Examples on Complex Engineering Problem Solving in Final Examination



Question no. 2 – Construction Management

During inspection prior to preparation of final account, you notice that the size of the beam fabricated by the contractor on site is not as per the construction drawing. The fabricated beam, as shown in Figure 1, having dimension of 300 x 600mm is not reflected to the as-built drawing showing the dimension of 300 x 750mm. As a design engineer, what is your decision while facing the scenario; to accept the size or reject the fabricated beam? Please elaborate your decision considerations taking into accounts the design, construction method, construction time and cost-benefit ratio to the project.

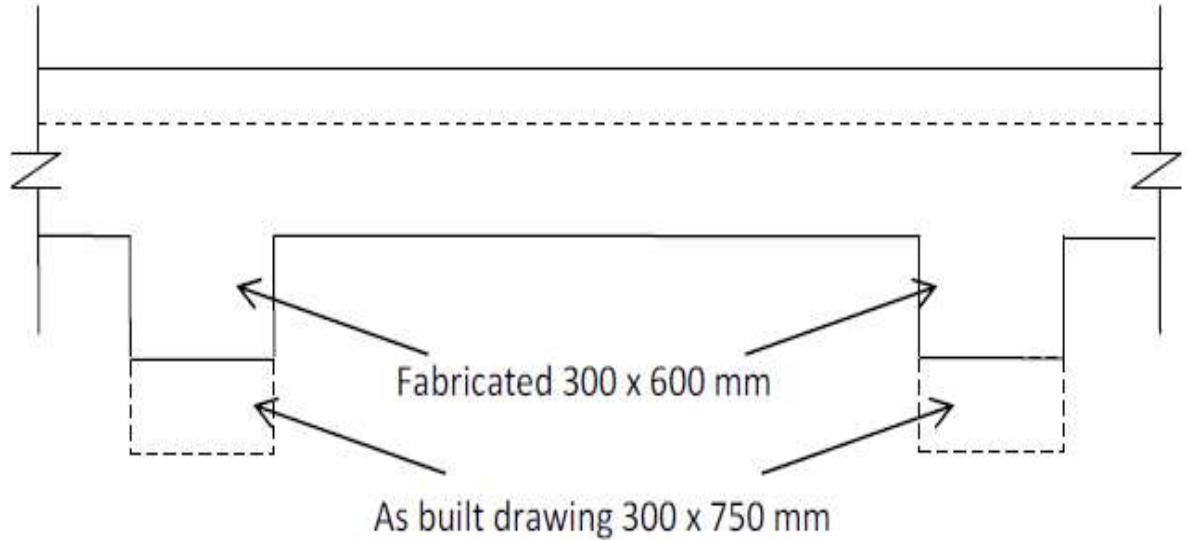


Figure 1: Elevation of Beam

(30 marks)

WK		
WK1	Natural Sciences	
WK2	Mathematics	
WK3	Engineering fundamentals	
WK4	Specialist knowledge	
WK5	Engineering design	
WK6	Engineering practice	
WK7	Comprehension	
WK8	Research literature	

WP		
WP1	Depth of Knowledge	
WP2	Conflicting requirement	
WP3	Depth of analysis	
WP4	Familiarity of issues	
WP5	Extent of applicable codes	
WP6	Extent of stakeholder	
WP7	Interdependence	

Power Generation

Sub-bituminous coal is gaining its popularity in many coal-fired power plant in the world today. One of the known sub-bituminous coal in used in most power plant in Malaysia is Adaro Coal. The property of this coal is given in Table 1.

Element	C	H ₂	O ₂	H ₂ O	S	N ₂
%	74.0	4.0	18.0	1.5%	1.0	1.5%

Discuss the advantages and the disadvantages of this type of coal as a fuel of choice.

[4 Marks]

Assuming stoichiometric combustion, determine the dew point temperature of the product in °C, if the total pressure is 1 bar

[6 Marks]

In actual operation 20% excess air is supplied to the boiler. Evaluate on the effect the excess air has to the dew point temperature of the combustion product assuming the pressure of combustion product is 1 bar. Relate the applications of this phenomenon to common problem in boiler furnace

[10 Marks]

Knowledge Profile

WK1	Natural Sciences	
WK2	Mathematics	
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Complexity

WP1	Depth of Knowledge	
WP2	Conflicting requirement	
WP3	Depth of analysis	
WP4	Familiarity of issues	
WP5	Extent of applicable codes	
WP6	Extent of stakeholder	
WP7	Interdependence	

End of Presentation
Thank You

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