

**QUESTION 1**

ANSWER 2 OUT OF 3 QUESTIONS:

(SE - general theory questions – examples – all worth 10 marks)

1. Gentry Lee, Chief Engineer at the Jet Propulsion Lab, refers to 10 characteristics of Engineers who have a high capacity to become Systems Engineers. List 5 of these characteristics and explain why they are necessary.
2. Explain the concept of Systems hierarchies. Use an example to support your answer.
3. List 4 systems classifications and describe each of them.
4. List and explain 4 types of verification as outlined by NASA.
5. Using the “bathtub curve” explain to what point burn-in testing takes hardware before delivery
6. Using 3 examples how can Systems Engineering Life-cycle differ for different organizations or projects.
7. What is “baselining” in projects and why is it important. Explain and discuss.
8. Explain what “milestones” in projects refer to and why they are important. This will include the review process.
9. What is model-based systems engineering and what are some of its characteristics?
10. Explain what Value Engineering is and why it is important within the Systems Engineering Lifecycle.

**TOTAL: 20 Marks**

QUESTION 2 CONTINUES OVERLEAF/....  
PTO/Page 2...

**QUESTION 2**

ANSWER 2 OUT OF 3 QUESTIONS:

(PM - general theory questions – examples – all worth 10 marks)

1. Explain how the “business-as-usual” environment differs from the project environment in an organization.
2. What are the key characteristics of a project?
3. Explain, using a diagram, how the level of effort between the Systems Engineering and Project Management differs throughout the Project/Systems Lifecycle.
4. As technological uncertainty increases, the type of project implemented changes. Explain this statement.
5. Explain 2 different types of project organization structures. List key advantages and disadvantages for each one.
6. Explain the project management triangle and how it is used.
7. What are the 9 knowledge areas as outlined by PMBOK. What does PMBOK stand for?
8. What are the key differences between the PMBOK and Prince 2 methodologies?
9. Explain the concept of a WBS and why it is important.
10. Define risk in projects and how it should be managed.

**TOTAL: 20 Marks**

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QUESTION 3 CONTINUES OVERLEAF/....  
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**QUESTION 3 (CPM/PERT)**

To complete a wing assembly for an experimental aircraft, Jim Nxumalo has laid out the major activities, A to G, involved. The following table shows these activities, their predecessors and estimated completion times in weeks.

Activity	Optimistic Time	Most Likely Time	Pessimistic Time	Immediate Predecessor
A	1	2	3	-
B	2	3	4	-
C	4	5	6	A
D	8	9	10	B
E	2	5	8	C,D
F	4	5	6	D
G	1	2	3	E

1. Draw the network diagram. (2)
2. Determine the critical path using early start and early finish OR late start and late finish AND slack (use the forward and backward pass method). What is the **estimated** project length (in weeks)? (9)
3. What is the variance and standard deviation for the overall project? (5)
4. What is the probability that the project will be completed on or before the 16 weeks? (2)
5. What is the project due date (number of weeks) that will give the project a 99% chance of being completed on-time? (2)
6. Suppose that Jim has now been given only 13 weeks (instead of 16 weeks) to complete the project. Given the information in the table below, determine which activity(ies) should be crashed and what additional cost this will add to be the project. Show all calculations and explain your answers. (5)

Activity	Normal Time (weeks)	Crash Time (weeks)	Normal Cost (Rands)	Crash Cost (Rands)
A	2	1	22 000	22 750
B	3	1	30 000	34 000
C	2	1	26 000	27 000
D	4	3	48 000	49 000
E	4	2	56 000	58 000
F	3	2	30 000	30 500
G	5	2	80 000	84 500

**TOTAL: 25 Marks**

QUESTION 4 CONTINUES OVERLEAF/....  
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**QUESTION 4**

Systems Thinking – to be determined by Mr. O Keys

**TOTAL: 20 Marks**

**QUESTION 5**

Strategic Management – to be determined by Prof J.R.Brierley

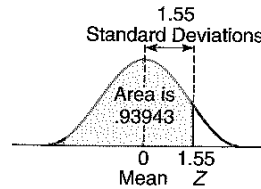
**TOTAL: 15 Marks**

**TOTAL FOR THE EXAM: 100 MARKS**

**CLOSED BOOK EXAM**

## TABLES

## APPENDIX I    NORMAL CURVE AREAS



To find the area under the normal curve, you can apply either Table I.1 or Table I.2. In Table I.1, you must know how many standard deviations that point is to the right of the mean. Then, the area under the normal curve can be read directly from the normal table. For example, the total area under the normal curve for a point that is 1.55 standard deviations to the right of the mean is .93943.

TABLE I.1										
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97784	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99890	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997