PROGRAM	:	BEng Tech INDUSTRIAL ENGINEERING
SUBJECT	:	**LOGISTICS ENGINEERING 3A**
CODE	:	**LOGMIB3**
DATE	:	SUPPLEMENTARY EXAMINATION 08 JANUARY 2020
DURATION	:	11:30AM- 14:30PM
TOTAL MARKS	:	100

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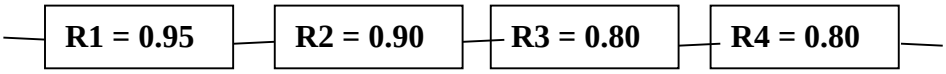
MODERATOR	:	MR A. MAKHUBELE
NUMBER OF PAGES	:	PAGES 7

INSTRUCTIONS	:	ONLY ONE POCKET CALCULATOR PER CANDIDATE MAY BE USED.
REQUIREMENTS	:	NONE

SECTION A

1. Given the following Reliability Block Diagram (RBD) :



The system reliability is:

   A. 0.5814
   B. 0.8514
   C. 0.5472
   D. 0.8752

2. If the reliability of 0.95 must be maintained, but the MTBF is reduced to 7,500 hours, the impact on the operating cycle would be :
   A. Reduction from 500 hours to 435 hours.
   B. Reduction from 500 hours to 385 hours.
   C. No effect.
   D. Reduction from 500 hours to 405 hours.
3. Availability is a function of :
   A. Reliability and Supportability.
   B. Reliability and Maintainability.
   C. Reliability and Failure Rate.
   D. Reliability and Reliability Apportionment.
4. Life Cycle Cost (LCC) includes all system cost and may be broken down into various categories to include:

i. design and development cost,
ii. construction and/or production cost,
iii. system operation and maintenance cost,
iv. system retirement and material recycling or disposal cost

   A. i, ii, iii
   B. i, ii, iii, iv
   C. i ii, iv
   D. i, iv

5. The design process involves three design stages :
   A. Preliminary design, detailed design and final design.
   B. Conceptual design, detailed design and final design.
   C. Conceptual design, preliminary design and detailed design.
   D. Conceptual design, preliminary design and final design.
6. The first step in the primary design phase is the :
   A. Functional analysis.
   B. Feasibility study.
   C. Detailed design.
   D. Design framework.
7. The purpose of a feasibility study is
   A. To meet the needs identified in the disposal phase.
   B. To validate the disposal phase life cycle costs.
   C. To develop new directions for future planning
   D. To develop a set of useful solutions to meet the needs identified in the concept phase.
8. The proposal should contain an adequate description of each of these categories :
   A. Purpose, needs analysis, identification of the problem, conclusions, references and/or bibliography.
   B. Purpose, identification of the problem, conclusions, references and/or bibliography.
   C. Purpose, needs analysis, identification of the problem, references and/or bibliography.
   D. Purpose, needs analysis, identification of the problem, conclusions.
9. System effectiveness is connected with all of the following EXCEPT :
   A. Availability.
   B. Dependability.
   C. Observability.
   D. Capability.
10. Integrated logistics support (ILS):
   A. Focuses on prime equipment performance requirements.
   B. Is a major subdivision of the Society of Logistics Engineers.
   C. Assures that the consumer will have a system that is properly supported during its life.
   D. None of the above.

[20]

SECTION B

QUESTION 1

You have been appointed by your organization to lead all Logistics Engineering projects. Discuss broadly the definition of Logistics Engineering taking into account the following:

Definition of logistics, Supply Chain, Benefits, Costs, Reliability, Availability and Maintainability, also logistics as a mathematical model (MTBF, MTTF, FMEA, etc.)

[20]

QUESTION 2

Blanchard recommends that every stage of the system evaluation during the life cycle need to be tested and evaluated.

Apply 5 Stages of System Testing & Evaluation in the system life cycle to develop a Test plan for the cell phone.

[16]

QUESTION 3

System design and development incorporate related design disciplines.

Explain what is meant by:

Give examples of each

2.1.	Design for reliability	(5)
2.2.	Design for maintainability	(5)
2.3.	Design for human factor and safety	(5)
2.4.	Design for producibility	(3)
2.5.	Design for quality	(3)
2.6.	Design for disposability	(4)
2.7.	Design for economic feasibility	(4)
2.8.	Design for the environment	(5)

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QUESTION 4

A system consists of 5 components in parallel. If each component has a reliability of 0.97, what is the overall reliability of the system?

Draw the diagram and show all calculations

[10]

GRAND TOTAL=100

ANNEXURE A

1 Reliability

R (t) = 1 - F (t)

Where F (t) is the probability that the system will fail by time (t)

$$R(t) = 1 - F(t) = \int_t^{\infty} f(t)\,dt$$

2 Failure rate

$$\lambda = \frac{number\ of\ failure}{total\ operating\ hours}$$

3 Mean time between failures

$$MTBF = 1/\lambda$$

4 Mean corrective maintenance time

$$\overline{M}_{ct} = \frac{\sum_{i=1}^{n}(\lambda_i)\ (M_{ct_i})}{\sum_{i=1}^{n}\lambda_i} \text{ or } \frac{\sum M_{ct_i}}{n}$$

5 Mean preventive maintenance time

$$\overline{M}_{pt} = \frac{\sum_{i=1}^{n}(f_p t_i)\ (M_{pt_i})}{\sum_{i=1}^{n} f_p t_i}$$

6 Inherent Availability

$$A_i = \frac{\mu}{\lambda + \mu} = \frac{MTBF}{MTBF + \overline{M}_{ct}}$$

where λ = failure rate = 1 / MTBF.

μ = repair rate = 1 / MTTR.

7 Achieved Availability

$$A_a = \frac{\text{MTBM}}{\text{MTBM} + \overline{\text{M}}}$$

where MTBM is the mean time between maintenance action both preventive and corrective.

$\overline{M}$ is mean active maintenance.

8 Operational Availability

$$A_o = \frac{\text{MTBM}}{\text{MTBM} + \text{MDT}}$$

where MDT is mean down time.

9 OEE = (availability) (performance rate) (quality rate)

Where:

Availability (A) = $\frac{loading\ time - down\ time}{loading\ time}$

Performance rate (P) = $\frac{(output)(actual\ cycle\ time)}{(loading\ time - downtime)}$ X $\frac{(ideal\ cycle\ time)}{(actual\ cycle\ time)}$

Quality rate (Q) = $\frac{input - (quality\ defects + start\ up\ defects + rework)}{input}$

10

EOQ = $\sqrt{\frac{2CpD}{Ch}}$