

**PROGRAM** : BACHELOR OF ENGINEERING TECHNOLOGY  
INDUSTRIAL ENGINEERING

**SUBJECT** : **SYSTEM DYNAMICS 3B (SYSMIB3)**

**CODE** : **SYSMIB3**

**DATE** : JANUARY SSA EXAMINATION 2020  
08 JANUARY 2020

**DURATION** : 11:30-14:30 (SESSION 2)

**WEIGHT** : 40: 60

**TOTAL MARKS** : 100

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**ASSESSOR** : DR. G. MUYENGWA

**MODERATOR** : DR. N. NDOU

**NUMBER OF PAGES** : 3 PAGES

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**INSTRUCTIONS** : STUDENTS ARE EXPECTED TO SAVE THEIR SIMIO MODEL  
IN A COMPRESSED ZIPPED FOLDER LABELLED WITH THEIR  
STUDENT NUMBER AND SURNAME. THE COMPRESSED  
ZIPPED FOLDER MUST BE SAVED IN C: / LAN SCHOOL FILES  
(C DRIVE).

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**SECTION A: SYSTEM DYNAMICS THEORY****65 Marks****QUESTION 1**

Develop and discuss a causal loop diagram that shows how information feedback is interpreted by existing mental models in a single-loop learning. **(15 marks)**

**QUESTION 2**

Develop a causal-loop diagram that shows that effective modelling involves constant iteration between experiments and learning in the virtual world and experiments and learning in the real world. **(15 marks)**

**QUESTION 3**

In a way to reduce accidents, most automakers and governments have introduced various measures, one of which has been the development of antilock brakes and other automotive safety devices. However these safety measures has caused some people to drive more aggressively, thus offsetting some of their benefits.

Develop a detailed causal loop diagram showing compensating feedbacks undermining the effectiveness of auto safety devices. Clearly indicate both the balancing and reinforcing feedback loops. **(20 marks)**

**QUESTION 4**

Develop a flow and stock diagram showing an economic capital with reinforcing growth loop constrained by a renewable resource. **(15 marks)**

**SECTION B: MODELING and SIMULATION using SIMIO Software****QUESTION 5**

A Hotel Investment company based in Kempton Park would like to analyse the utilization of one of its food outlet from the data shown in Table Q5. Customer arrive at the gate, get collected with a vehicle to the restaurant, order food, pay on next counter and collect food, eat, get collected (after eating food) by a vehicle and dropped off at the parking. The vehicle is retuned with an empty load to collect the next batch. On arrival all customer arrival pattern is different. All customer types are merged into one line.

Table Q5

Vehicle Type	Arrival Pattern	Food ordering	Payment and collect food	Eat food
Cash payment	Randm.Expo(3)	Random Triangular (1,4,8)	Random Triangular (6,8,9)	Random Triangular (30,40,50)
Card Payment	Random Expo(2)	Random Triangular (1,4,8)	Random Triangular (6,8,9)	Random Triangular (30,40,50)

- a) Develop a simulation model. Run your model for 30 hours and collect statistics. (30 marks)
- b) Animate your model. (5 marks)

**[Total Marks 35]**

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**TOTAL = 100**

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