KUMARAGURU
college of technology
character is life
1984

M.TECH DEGREE EXAMINATIONS: NOV/DEC 2023
(Regulation 2018)

First Semester

DEFENCE TECHNOLOGY

P18DTT1002: Warfare Simulations and Strategies

COURSE OUTCOMES

CO1: Understand the systems used in warfare scenario.
CO2: Understand combat simulation & modelling.
CO3: Understand the war gaming simulation & modelling and human factor representation.

Time: Three Hours   **Maximum Marks: 100**

Answer any FOUR Questions:-
PART A (4 x 10 = 40 Marks)

1. What is Monte-Carlo Sampling? How it is relevant for Simulation?   CO1   [K2]

2. What will be your approach of doing a Net-Assessment of evolving competition between   CO1   [K2]
   China and India?

3. What methods, techniques and methodologies, have been developed for input oriented and   CO2   [K2]
   output oriented assessment of military capability? Describe one in each category in brief.

4. Measures of Effectiveness (MOE): Identifying the Measure of Effectiveness (MOEs) or   CO2   [K2]
   desired outputs (force ratios impact, degradation in Information, total delay achieved etc.) is
   required to address each dimension of warfare. What will be your approach for identifying
   and establishing key measures of effectiveness of Intelligentized warfare as defined by
   China or Mosaic warfare as envisaged by US (you can select both as well in your approach)
   in future military operations that you can envisage?

5. Why validation of military model, simulations and war-games is more difficult than their   CO3   [K2]
   verification? Explain

Answer any TWO Questions:-
PART B (2 x 20 = 40 Marks)

6. Draw a Petri Net Model the following combat scenarios (explain the places and   20   CO1   [K3]
   transitions chosen along with the time/delay distributions you will chose for each
   transition in your model of the combat. Kindly write your assumptions (tactical and
   technical for the purpose of simulation). Also mark the places on your petri net model

which will be used to collect tokens and measure the outcome of the simulation.

Tank battle between an Armoured regiment of 45 Main battle tanks versus a squadron of 14 main battle tanks on the blue side backed-up by one Attack helicopter carrying 8 Anti-Tank Missiles or 16 Rockets in each sortie that they can launch. Number of sorties that helicopters can launch should also be included in the model.

7. Describe the key elements and propose a design of a **computerized** Seminar Wargame/Crisis Wargame for the Future (include level, scope, and resolution of the wargame in the assumptions along with assumptions about the specific type of war you are designing a game for)? You can take inspiration from the seminar wargaming and scenario writing workshops done in the class, however, the key aim is to design a computerized/automated seminar/crisis/freeform/politico-military wargame.   20   CO2   [K4]

8. Equations for Adaptive Dynamic Model of combat by J.M. Epstein are given below   20   CO3   [K4]

The general equations for battle are

$$A_g(t) = A_g(t-1)[1-\alpha(t-1)] - DCAS(t-1) + RA_g(t), \qquad (1)$$

and

$$D_g(t) = D_g(t-1) - \frac{\alpha(t-1)}{\rho(t-1)} A_g(t-1) - ACAS(t-1) + RD_g(t), \qquad (2)$$

The ground-induced exchange ratio is given by

$$\rho(t) = \rho_0 \frac{\left[D_g(t)\right]^{\lambda_d}}{\left[A_g(t)\right]^{\lambda_a}}, \qquad (3)$$

where ρ_0 is a constant.

The generalized Lanchester Model of Combat are given below

$$\frac{dR}{dt} = -bB^{c_1}R^{c_2},$$
$$\frac{dB}{dt} = -rR^{c_3}B^{c_4}.$$

The corresponding casualty-exchange ratio is

$$\frac{dR}{dB} = \frac{b}{r}\frac{B^{c_1-c_4}}{R^{c_3-c_2}},$$

where c-values are simply reals in the closed interval $[0, 1]$.

Compare and contrast the coefficients b, r, c_1, c_2, c_3, and c_4 in Lanchester model with Alpha. Rho and Lambda in Epstein model. Also state your views and understanding of key value of Epstein's model of Combat over the Lanchester model.

Compulsory Question

PART C (1 x 20 = 20 Marks)

9. Prime Minister of India constituted a high-level committee of experts from multiple fields to conceptualize new military operational concepts and novel weapons and weapon systems for India for the sixth wave of innovation driven by things becoming nano, hypersonic, networked, and autonomous, with algorithmic intelligence and near future quantum technologies, that will provide us ability to synthesize biology, energy, and reality (virtual/hybrid including fake news and deep fakes). You have been made the chairperson of the committee. What models, methods, and methodologies you will use to study the needs and develop the new weapon systems and or systems for warfare for India in the sixth wave of innovation? Provide a comprehensive and detailed process for carrying out this mission.   20   CO3   [K4]

****