MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (DEFENCE TECHNOLOGY)

END SEMESTER ONLINE PROCTORED EXAMINATIONS, FEB 2022

SUB: WARFARE SIMULATIONS AND STRATEGIES [AAE-5176]

REVISED CREDIT SYSTEM

(23/02/2022)

Duration: 3 Hours Max. Marks: 50

Instructions to Candidates:

- Question 9 in Section C is compulsory and is of 14 marks
- Answer any *4 questions* from Section A. However, if you have time, you can answer more than 4 questions as well. For marking, best of 4 answers will be considered.
- Answer any 2 questions from Section B. However, if you have time, you can answer more than 2 questions as well. For marking, best of 2 answers will be considered.
- The questions are to be considered as they are printed. In case of any doubt, make relevant assumptions and mention the assumptions in your answer.
- Answers expected are your views and understanding and not what is taught in the class.
- Originality in giving answers will be given extra importance while marking.
- This is an NOT an examination of memorizing ability or your ability to search on internet. We are looking for original thinking about defence/military problems.

SECTION A

(answer any 4 out of 5 questions, each question is of 5 Marks) – Maximum Marks from this Section = 20 marks

1 What mistakes the faculty made in teaching Warfare Simulations and Strategies course?

2 What mistakes you made while studying Warfare Simulations and Strategies course?

3 While doing assignment 2, where the task was to find out and list similarities and differences between military structures of 5 countries – US, Russia, China, Pakistan and India – using 2021 IISS Military Balance as the key source, what were your findings and learning?

4 Can the effectiveness of any weapon system in future battlefields be measured, especially since each future war is going be different from past wars? Explain with your own learning and thinking on how it can or cannot be done

5 You have been made the sole authority to create technical and functional requirements for a new weapon system which is to be developed. How will you go about the task?

SECTION B

(answer any 2 out of 3 questions, each question is of 8 Marks) – Maximum Marks from this Section = 16 marks

6 Draw a Petri Net Model of **any one** of the following combat scenarios (explain the places and 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

(a) Tank battle between an Armoured Brigade of 135 Main battle tanks on Red Side and a regiment of 45 Main battle tanks on the blue side

(b) Sortie generation and combat model of following air war scenario – 3 Squadrons (each squadron has 18 aircraft) of Su-30 MKI (with an availability figure of 55%) pitted against one squadron of Rafale fighter aircraft (with an availability figure of 90%).

(c) A naval task force of 2 destroyers and one aircraft carrier is attacked by two submarines on high seas. Assume relevant capabilities of Anti-surface warfare within the task force which includes a complement of 6 anti-submarine helicopters

7 Describe the key elements and propose a design of a computerized Wargame for the future war (include level, scope and resolution of the wargame in the assumptions)?

8 In the Adaptive Dynamic Model of combat by J.M. Epstein (as given below) what is the key significance of following parameters – explain each of the following parameters of the model - Rho, Rho-Naught, Lambda-d, Lambda-a, W-max, Alpha-d (t), Alpha-aT, Alpha-a(t), Ag(t) and Dg(t).

Equations of the Model:
The general equations for battle are

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

and

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

$$\alpha(t) = \alpha_g(t)\left(1 - \frac{W(t)}{W_{max}}\right), \quad (3)$$

$$W(t) = \begin{cases} 0 & \text{if } \alpha_d(t-1) \le \alpha_{dT} \\ W(t-1) + \left(\frac{W_{max} - W(t-1)}{1-\alpha_{dT}}\right)(\alpha_d(t-1) - \alpha_{dT}) & \text{if } \alpha_d(t-1) > \alpha_{dT} \end{cases} \quad (4)$$

$$\alpha_d(t) = \frac{D_g(t) - \left[D_g(t+1) - RD_g(t+1) \right]}{D_g(t)}. \quad (5)$$

We set W(1) = 0, on the attacker's side

$$\alpha_g(t) = \alpha_g(t+1) - \left(\frac{\alpha_{aT} - \alpha_g(t-1)}{\alpha_{aT}} \right) \left(\alpha_a(t-1) - \alpha_{aT} \right), \quad (6)$$

$$\alpha_a(t) = \frac{A_g(t+1) - \left[A_g(t+1) - RA_g(t+1) \right]}{A_g(t)}. \quad (7)$$

We set $\alpha_g(1)$ equal to some initial value [$\alpha_g(1) < \alpha_{aT}$].
The ground-induced exchange ratio is given by

$$\rho(t) = \rho_0 \frac{\left[D_g(t) \right]^{\lambda_d}}{\left[A_g(t) \right]^{\lambda_a}}, \quad (8)$$

where ρ_0 is a constant.

SECTION C

(14 Marks) Compulsory Question

Background Material for Section C (Taken from Wikipedia)

India currently has service–specific commands system. However, joint and integrated commands, also known as unified commands; and further divided into theatre or functional commands, have been set up and more are proposed. The only fully functional theatre command is the Andaman and Nicobar Command set up in 2001 while the Strategic Forces Command, set up in 2003, is an integrated functional command or specified combatant command. Recently constructed integrated functional commands under the Integrated Defence Staff include the Defence Cyber Agency, Defence Space Agency and the Special Operations Division. The Air Defence Command is the first integrated command being undertaken.

There is and has been significant support as well as significant opposition to some of the attempts at jointness and integration, such as the theaterisation process, at the highest levels of government and the public.

There is a need to Evaluate Military Capability of Service-Specific Command System versus Joint and Integrated Command systems

9 **Capability Assessment and Measures of Effectiveness**: Identification and Understanding of capabilities from Change of command structure from Service Specific command structure to a unified (joint and/or integrated) command structure is of paramount importance. What will be **your approach** for assessment of **change in military capability/ change of the armed forces capability** because of proposed changes to Unified command structure? In your proposed approach to assessment of military capability you can start with any of the approaches including

direct measurement/historical analysis, expert judgements and including their views through different methodologies, Simulation of wars and or analytical models/mathematical models or any combination thereof. What metrics or measures of effectiveness will you be using/proposing and how will you assess each of those metrics of assessing Military Capability

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