AE 4552 – Introduction to Humans and Autonomy

Hours: 3-0-3

CATALOG DESCRIPTION (25 words or fewer):
Learn the fundamental principles underlying the functions performed by humans and by autonomous systems in dynamic, complex domains. Credit will not be awarded for both AE 4552 and AE 6552.

PREREQUISITES:
AE 3515 System Dynamics and Control or AE 3531 Control System Analysis and Design

COURSE OBJECTIVES: Provide students with an understanding of: the functions performed by humans and automation in current and potential-future systems; how humans and automation can perform those functions, with special focus on functions not covered elsewhere in the AE curriculum; and how humans and automation interact when performing these functions, to the extent that the student can understand fundamental trade-offs in the decision of whether to automate.

LEARNING OUTCOMES:
Students will gain working knowledge, sufficient to:

(1) Identify and describe the functions performed by humans and autonomous systems in current and potential-future systems;
(2) Develop and apply appropriate algorithms for automatous systems to perform these functions; and
(3) Develop the appropriate function allocation between humans and autonomous systems, and design the appropriate interfaces.

TOPICAL OUTLINE:	**Hrs**
1. Introduction	1
2. Definition of key measures of sensing	1
3. Human sensing, contrasting with machine sensing	1
4. How human attention drives human sensing	1
5. Quantitative modeling of human attention based on salience and expectation	1
6. Review of relevant probability (probability/cumulative density functions)	1
7. Derivation of system operating curve	1
8. 'Optimal' thresholds for alerting systems	1
9. Human judgment – common biases	1
10. Linear models of ecological behavior (e.g., Brunswick's Lens Model)	2
11. Machine algorithms for filtering based on time average and on redundant sensors	2
12. Model based observers, including optimal Kalman filter	3
13. Decision making – strict definition as selection between options	1
14. Decision analysis – decision trees	2
15. Naturalistic decision making in complex, time-stressed operating environments	2
16. Contextual control	1
17. Planning as pre-decision making	1
18. Planning as procedures, and concerns with procedure following	2
19. Continuous methods for path planning (e.g., proportional navigation)	1.5
20. Discrete methods for path planning (e.g., A* algorithm)	1.5
21. Manual control – human adaptation, Cross-over model	2
22. Handling qualities	1
23. Sensitivity to adverse aircraft-pilot coupling	2
24. Modeling operator's understanding of automation as a finite state machine	3
25. Re-cap of choices of functions to automate	1
26. Implications for human-automation interaction	2
27. Relating course topics to current-day operational issues	3
28. Exams	2
Total	**44**