EML2322L – MAE Design and Manufacturing Laboratory

Concept Selection Checklist / DR2 Grade Sheet

Group Number: _____ **TA** or **Group Performing Evaluation: _____**

First Review or **Final Grading** (circle one)

EVALUATION MATRICES.

□ YES □ NO **1. Are separate matrices used for different parts of the design** (i.e. mobile platform, ball/bucket manipulator, ball sorter, ball hopper, and ball dispensing mechanism)?

□ YES □ NO **2. Does each matrix contain an appropriate number of objectives (typically 5 or 6)?**

□ YES □ NO **3. Are appropriate objectives used for each matrix?** It rarely makes sense to use the exact same objectives for all matrices, so select appropriate objectives for each. As an example, the time required for a motor to operate a mechanism which grabs or releases balls is much more meaningful than the speed of the motor.

□ YES □ NO **4. Does each objective have a clearly written and meaningful definition and evaluation criteria?** If evaluating speed, for example, does the fastest robot receive the highest score or are scores based on how close the conceptual designs are to a predetermined target velocity established during testing?

□ YES □ NO **5. Are weighting factors for each matrix justified and do they sum to one** (or 100%)?

□ YES □ NO **6. Do quantitative objectives use quantitative assessments?** Never score objectives like *speed, size, material cost, manufacturing time, etc.* using qualitative assessments. If an objective can be quantified, **effort must be invested to do so, without exception.**

□ YES □ NO **7. Do quantitative assessments include complete, correct, and clear calculations?** Magnitudes for quantitative assessments must be computed and justified. Assessment data lacking clear justifications will receive no credit, so include explicit quantitative assessments by presenting one example formula with units and present the results of identical calculations in tabular format using Excel.

□ YES □ NO **8. Is quantitative assessment data presented in a clear and consistent tabular format and does it include appropriate explanations?** Example formulas and summary tables containing calculation results must be formatted consistently and placed in the report appendix. Each example formula must be accompanied by a typed description clearly explaining the logic between each step and defining all variables.

□ YES □ NO **9. Do all quantitative magnitude assessments use linear score assignments?** In this course assign the best concept a score of 10 and use linear ratios to rank other designs. If, for example, *material cost* is an objective and one design costs twice as much as the cheapest design, the cheapest design must receive the highest score (10) and the more expensive design must receive half the score assignment (5) since it costs twice as much.

□ YES □ NO **10. Are quantitative score assignments interpreted correctly?** If, for example, *manufacturing time, material cost* and *mobile platform size* are listed as objectives, the LOWEST magnitudes should receive the HIGHEST scores.

□ YES □ NO **11. Do qualitative objectives use qualitative assessments?** If *ease of assembly* is used as an objective, assign magnitudes and scores, such as "fair = 4", "okay = 6", "good = 8", etc. However, NEVER rate two designs as "good" and assign each a different score, such as 8 and 9, as doing so circumvents the intent of the decision matrix.

□ YES □ NO **12. Do all qualitative magnitude assessments have (a) clearly written justifications, (b) comparisons to all other designs, (c) references to sketches of the design aspects being evaluated, and (d) evidence of testing?**

□ YES □ NO **13. Is the design with the highest composite score selected?** Occasionally a group misses the point of the evaluation matrices and selects a design that doesn't achieve the highest score. The matrices should determine the best design, not the group. Once the group chooses the objectives used to evaluate the designs and the associated weighting factors, the design with the highest score MUST be selected for each matrix. The best designs from each matrix are then combined to form the overall best hybrid design.

□ YES □ NO **14. Are new design ideas properly incorporated into the evaluation matrix?** If a new idea develops while working through this phase of the design process, simply add another column to the relevant matrix (i.e. "Design 5") and compare the new idea to the others, as shown in the *Decision Matrix Example*.

□ YES □ NO **15. Are reasonable and consistent significant figures reported in the matrices?** Do not report estimated robot speed to 5 decimal places, as an estimate never has that level of precision. Since robot size cannot be measured to 0.001", or manufacturing time to 0.1s, never report magnitudes and scores with inappropriate precision.

□ YES □ NO **16. Are grammar and formatting at a collegiate level?** Take pride in your work: check grammar and spelling; use the provided templates and format the matrices to fit nicely across the page without using small font sizes; highlight the winning designs; avoid screen captures; and use a quality printer.

ROBOT SPEED, TIME & TORQUE CALCULATIONS.

□ YES □ NO **17.** Do the **computer generated path illustrations** clearly show the **complete** path trajectories with **clearly** labeled distance and speed vectors in tabular format for each concept? Are all illustrations presented in a consistent manner?

□ YES □ NO **18.** Do the robot **wheel motor speed calculations** for each concept use the provided Excel template and course notes on motor calculations $(V_{LOADED} = 0.75*\pi DN)$?

□ YES □ NO **19.** Are **minimum and maximum drive times** reasonable and do they illustrate the tradeoff between motor speed and robot controllability?

□ YES □ NO **20.** Are **maneuvering, manipulation, and release times** reasonable and clearly explained in the report appendix (not just listed on the spreadsheet)?

□ YES □ NO **21.** Are the percentages used to compute the **Average Robot Velocity parameter** clearly explained in the report appendix (not just listed on the spreadsheet)?

□ YES □ NO **22.** Is **Estimated Competition Time** for the final design reasonable and conservative?

□ YES □ NO **23.** Do all calculations have **reasonable & consistent use of significant figures?**

□ YES □ NO **24.** Are the **drive wheel and lifting motor torque calculations** for the final design complete and correct, and formatted using the provided guide / template?

APPENDICES.

□ YES □ NO **25.** Are appendices labeled and located as instructed in the DRT?
□ YES □ NO **26.** Does each appendix have a separate cover page using the required formatting?
□ YES □ NO **27.** Is the proper material in each appendix?
□ YES □ NO **28.** Does Appendix A have an accurate table of contents with page numbers?

FINAL COMMENT.

This assignment is a lot of work but **MUST BE COMPLETED ON SCHEDULE** so the ENTIRE group can move on to the next phase of the project; pay attention to the provided guidelines and templates, and ask questions BEFORE the TA evaluates your work using this checklist.