University of Central Lancashire UCLan	**UCLan Coursework Assessment Brief**	Academic Year **2023 - 2024**
SCHOOL OF ENGINEERING	Module Title: **MECHANICAL SYSTEMS RELIABILITY** Module Code: **MP3701**	Level **6**
	MP3701 – COURSEWORK BRIEF	This assessment is worth **40%** of the overall module mark

THE BRIEF/INSTRUCTIONS

- The course work aims to address all the module learning outcomes by focussing on the sustainable systems' design and operations. To be specific, the tribology mechanisms, qualitative and quantitative reliability measures, condition monitoring and structure health monitoring of the systems.
- The module learning outcomes are provided in the coursework brief (Page Number - 4).
- University requests all student to use a uniform coursework cover sheet for submission. Please use the assessment cover sheet provide in the Blackboard (File name: MP3701_Assessment e-coversheet) to submit the coursework as a single document.
- Please look into the coursework brief for the questions (Page Number – 6 to 9).

PREPARATION FOR THE ASSESSMENT

- The entire coursework is based on the taught lectures and tutorial sessions for the module. Read through the lecture materials, exercise and tutorial problems and supplementary materials provided in the Module Material area in the Blackboard space for the module.
- Reading List : http://readinglists.central-lancashire.ac.uk/index

RELEASE DATES AND HAND IN DEADLINE

Assessment Release date: **15/01/2024** Assessment Deadline Date and time: **14/04/2024 @ 23:59**

Please note that this is the final time you can submit – not the time to submit!

Your feedback/feed forward and mark for this assessment will be provided on **05/05/2024.**

SUBMISSION DETAILS

1. The coursework should be your own work and should be properly type-written in your own words. Your assignment **must** be submitted electronically via blackboard by the submission time or before.

2. Please see the instructions to candidates for more information (Page Number - 4).

HELP AND SUPPORT

- Any questions arising from this assessment brief will be discussed in the class, online forum during the lectures/tutorial session. Please contact **Prof. Ted Smith, Dr Geng Feng** (Module Leader/Module Tutor) if you have any further queries. **E-mail: gfeng@uclan.ac.uk**
- For support with using library resources, please contact **Mr Neil Marshall, E-mail: NMarshall7@uclan.ac.uk** or SubjectLibrarians@uclan.ac.uk. You will find links to lots of useful resources in the My Library tab on Blackboard.
- If you have not yet made the university aware of any disability, specific learning difficulty, long-term health or mental health condition, please complete a Disclosure Form. The Inclusive Support team will then contact to discuss reasonable adjustments and support relating to any disability. For more information, visit the Inclusive Support site.
- To access mental health and wellbeing support, please complete our online referral form. Alternatively, you can email wellbeing@uclan.ac.uk, call 01772 893020 or visit our UCLan Wellbeing Service pages for more information.
- If you have any other query or require further support you can contact The <i>, The Student Information and Support Centre. Speak with us for advice on accessing all the University services as well as the Library services. Whatever your query, our expert staff will be able to help and support you. For more information, how to contact us and our opening hours visit Student Information and Support Centre.
- If you have any valid mitigating circumstances that mean you cannot meet an assessment submission deadline and you wish to request an extension, you will need to apply online prior to the deadline.

Disclaimer: The information provided in this assessment brief is correct at time of publication. In the unlikely event that any changes are deemed necessary, they will be communicated clearly via e-mail and a new version of this assessment brief will be circulated.	Version: 1

UNIVERSITY OF CENTRAL LANCASHIRE

SCHOOL OF ENGINEERING

ASSIGNMENT

MODULE CODE: **MP3701**

MODULE TITLE: **MECHANICAL SYSTEMS RELIABILITY**

MODULE LEADER: **Dr. GENG FENG**

YEAR LONG, 2023 - 2024

Time Allowed: STUDENTS SHOULD NOT SPEND MORE THAN THIRTY-TWO HOURS ON THIS ASSIGNMENT

INSTRUCTIONS TO CANDIDATES:

VALUE

As per the module specification, this assignment constitutes **40% of the module mark.**

SUBMISSION DATE AND TIME:

14th April 2024 – 23:59 or any time before.

INSTRUCTIONS

1. The assignment should be your own original work and should be properly type-written in your own words. It will be checked for plagiarism using Turnitin. Any plagiarism or copying from others will be dealt through the university's plagiarism procedures. **Similarity (plagiarism) level higher than 10% is highly suspicious.**
2. The whole report should be 1500 words plus any relevant material. Any references to materials should be given in standard Harvard or Vancouver form.
3. Your assignment **must** be submitted electronically via blackboard by the submission time or before. The report should be contained in a Word document or pdf document. No other means of submission will be accepted.
4. Drawings can be done by hand or electronically. They can either be scanned / copied into your Word or pdf document.
5. Any assignment submitted late, but within 5 working days of the deadline, will be given a maximum mark of 50%. Assignments submitted more than 5 working days after the deadline will not be marked, and a mark of 0% will be recorded.
6. Students with special needs will be addressed on individual basis.
   (Candidates that may require any special requirement will be dealt with on a one-on-one basis **which must be discussed with the module tutor/lead** before the due date).

Learning Outcome to be assessed:

This assignment is structured that students show evidence for partial fulfilment of the following module learning outcomes

1.	Analyse and predict the statistical behaviour of machine failures.
2.	Discuss the typical causes of failures in machines, analyse failed systems and identify the causes of failure.
3.	Develop equations of liquid film lubrication, and apply them to typical industrial bearings.
4.	Synthesise designs of dry and lubricated bearings using an understanding of the fundamental operating principles, and aided by computerised design guides.
5.	Describe the most common condition-monitoring systems, and evaluate their reliability for specific situations.

University of Central Lancashire
UCLan

2023/2024 MODULE CODE: MP 3701

DESIGN AND OPERATION OF SUSTAINABLE SYSTEMS

ASSIGNMENT

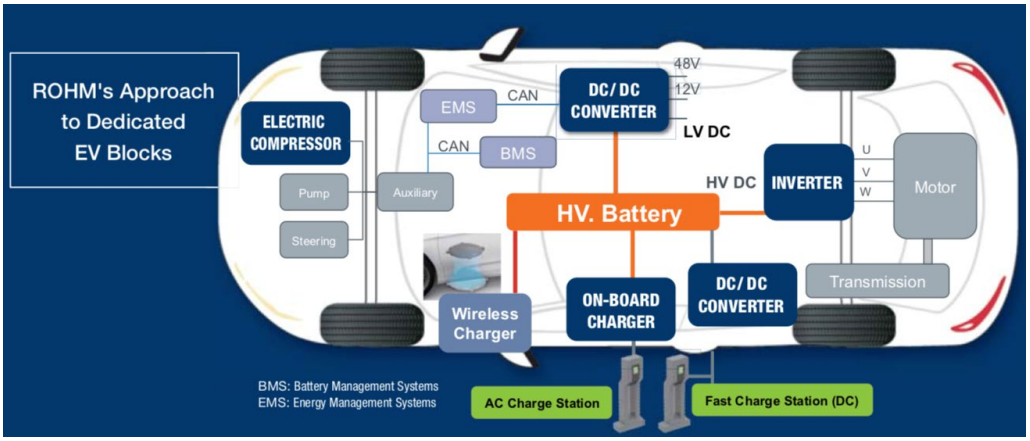
REG / ID NUMBER:

DATE:

By submitting electronically, I confirm that this piece of submitted work is all my own work (unless indicated otherwise within the assignment) and that all references and quotations from both primary and secondary sources have been fully identified and properly acknowledged in the body of the writing, with full references at the end.

ASSIGNMENT

ROHM Semiconductor Automotive Solutions Limited is planning to introduce a new model to address urban transportation challenge by investing in the emerging mobility service with the generation of cleaner vehicles and sustainable urban logistics. You have been asked to design and analyse the reliability of this new electric car system.



https://www.youtube.com/watch?v=0jXnHeH9GNg

https://www.youtube.com/watch?v=K4JhruinbWc

This is an open assignment, the result and data of the car component is not known.

ASSIGNMENT OBJECTIVES:

- To understand the history of automobiles and the methodologies to analyse the automobile systems.
- To construct a reliability block diagram (RBD) analysis for the simplified new electric car system model.
- To perform failure mode effects analysis (FMEA) for the same electric car system model.
- To do a fault tree analysis (FTA) on the same electric car system model.
- To propose measures to prevent the system/ sub-systems failure, and compare the difference among the RBD, FMEA and FTA.

ASSIGNMENT BRIEF:

As an engineer in the 'ROHM Semiconductor Automotive Solutions Limited', you have been asked to perform reliability analysis on the electric car system. To be specific, by using reliability block diagram (RBD), failure mode effects analysis (FMEA) and fault tree analysis (FTA) to analysis the model. Additionally, you should propose measures to prevent the system/ sub-systems failure, and compare the differences among the three methodologies.

Provide a **detailed, professional** report that contains the following items mentioned below:

1. Illustrate the history of automobiles and the methodologies to analyse the automobile systems.

   Hint1: You should use the online resources (papers, reports, books) to illustrate this in the introduction part. Do not forget to use references.

2. Look through different online resources to find the failure data for various components of the electric car system model. Construct a reliability block diagram (RBD) analysis for the simplified model. List out all the assumptions you have made in the construction of the RBD (e.g. failure criteria, failure/repair interval, maintenance strategy, etc.)

   Hint2: Websites mentioned below could be useful however you should also search for more specific data and put your findings in a table with references cited. *http://reliabilityanalyticstoolkit.appspot.com/mechanical_reliability_data*

3. Perform the Failure Mode Effects Analysis (FMEA) on the electric car system model.

   Hint3: Review the FMEA method and perform the FMEA analysis on the bearing. FMEA data can be got through questionnaire or based on your own reasonable assumptions. You should use the FMEA worksheet to explain your work.

4. Construct your own fault tree and do a Fault Tree Analysis (FTA) on the electric car system model.

   Hint4: You should consider the events that will cause the electric car failure, and construct the fault tree by using AND/OR logic gates. Make your own assumption for the events failure rate, and calculate the failure rate of Top event (electric car failure).

5. Discuss and propose measures to prevent the system/ sub-systems failure, compare the differences among RBD, FMEA and FTA.

   Hint5: In the discussion part, you should specify what measures you want to use the mitigate the risks. And illustrate the differences among these three methodologies based on your own calculations.

ASSESSMENT CRITERIA

The Department's Principles of Assessment will be used to determine grading levels.

1	Illustrate the history of automobiles and the methodologies to analyse the automobile system.	20%
2	Look through different online resources to find the failure data for various components of the electric car system model. Construct a reliability block diagram (RBD) analysis for the simplified model. List out all the assumptions you have made in the construction of the RBD.	20%
3	Perform the Failure Mode Effects Analysis (FMEA) on the electric car system model. Using FMEA worksheet.	20%
4	Construct your own fault tree and do a Fault Tree Analysis (FTA) on the electric car system model.	20%
5	Discuss and propose measures to prevent the system/ sub-systems failure, compare the differences among RBD, FMEA and FTA.	20%

REFERENCES

1. Reliability in automotive and mechanical engineering: determination of component and system reliability - Bertsche, B., Schauz, Alicia, Pickard, Karsten c2008

2. Wolstenholme, Linda C. Reliability modelling: a statistical approach. Routledge, 2018.

3. Carlson, Carl S. Effective FMEAs: Achieving safe, reliable, and economical products and processes using failure mode and effects analysis. Vol. 1. John Wiley & Sons, 2012.

4. Stamatis, Diomidis H. Failure mode and effect analysis. Quality Press, 2003.

5. Vibration-based condition monitoring: industrial, aerospace, and automotive applications - Robert Bond Randall 2010

6. Guidelines for process equipment reliability data with data tables - American Institute of Chemical Engineers c1989

7. Vesely, William E., et al. Fault tree handbook. Washington, DC: Systems and Reliability Research, Office of Nuclear Regulatory Research, US Nuclear Regulatory Commission, 1981.

8. Wolstenholme, Linda C. Reliability modelling: a statistical approach. Routledge, 2018.

9. Birolini, Alessandro. Reliability engineering. Vol. 5. Berlin: Springer, 2007.

10. Billinton, Roy, and Ronald Norman Allan. Reliability evaluation of engineering systems. Vol. 792. New York: Plenum press, 1992.

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