Module Descriptor

Module: Monitoring and Fault Diagnosis of Engineering Systems

In order to pass this unit, the evidence that you present for assessment needs to demonstrate that you can meet all the learning outcomes for the unit. The assessment criteria for a pass (P) grade describe the level of achievement required to pass this unit.

<table>
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<tr>
<th>Learning Outcomes</th>
<th>Assessment Criteria</th>
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| Know the health and safety requirements relevant to monitoring and fault diagnosis of engineering systems | 1. list the aspects of health and safety legislation that apply to monitoring and fault diagnosis of an engineering system (P1)  
2. describe the workplace hazards and safe working practices relevant to specific monitoring and fault diagnosis situations (P2) |
| Know about system monitoring and reliability | 1. describe a condition monitoring method and technique related to a given engineering system (P3)  
2. use given data to calculate failure rates for a range of components and equipment (P4)  
3. describe the factors affecting reliability for a given engineering system (P5)  
4. identify and describe four factors which influence either failure or reliability in a given engineering system (M1)  
5. identify and describe the environmental conditions which affect the reliability of the components in given items of congruent equipment. (M2)  
6. analyse the environmental effects on reliability of temperature, humidity, vibration and pressure for a given engineering system (D1) |
| Be able to use monitoring and test equipment | 1. describe the monitoring and test equipment used for measuring given system condition parameters (P6)  
2. use procedures to carry out system monitoring on two separate engineering systems (P7)  
3. evaluate the quality of measurements made and the limitations of given items of condition monitoring equipment (M3) |
| Be able to carry out fault diagnosis on engineering systems. | 4. describe the terms and two different techniques related to fault diagnosis (P8)  
5. use diagnostic techniques, test and measuring equipment and aids to locate faults on two separate engineering systems where two malfunction symptoms are evident on each system (P9)  
6. demonstrate a logical approach to finding faults by identifying and distinguishing between symptoms, faults and causes (M4)  
7. analyse monitoring/quality control data and information to predict/detect potential failures in given engineering systems. (D2) |
1 Know the health and safety requirements relevant to monitoring and fault diagnosis of engineering systems


Hazards and practices: workplace hazards eg compressed air, hydraulic fluid, gases, hot surfaces, electrical equipment, unconfined machinery, toxic substances and fumes, falling objects, liquid spillage, unhygienic work area, badly maintained tools and test equipment; safe working practices eg isolation procedures, methods of immobilising equipment, precautions to be observed when operating or working on live equipment, permit to work, use of danger tags, warning notices, safety barriers, cones and tapes

Engineering systems: process monitoring and control; fault diagnosis; systems eg mechanical, fluid power, electrical, process control, environmental systems (such as fume extraction or air conditioning), medical (such as cardiovascular, anaesthetic and ventilation, medical imaging)

2 Know about system monitoring and reliability

Monitoring terminology: condition monitoring methods eg offline portable monitoring, sampled monitoring, continuous monitoring, protection monitoring, human sensory monitoring; monitoring techniques eg vibration analysis, temperature analysis, flow analysis, particle analysis, crack detection, leak detection, pressure analysis, voltage/current analysis, thickness analysis, oil analysis, corrosion detection, environmental pollutant analysis

Failure and reliability: calculations concerning failure eg degrees and causes of failure, failure rate, failure modes, functional failure, primary and secondary functions, mean time between failures (MTBF), reliability; factors affecting reliability eg design, operation, environment and manufacture, reduction in system/device failure eg routine servicing, adjustments; data eg defects examination, statistical process control (SPC), quality

3 Be able to use monitoring and test equipment

Monitoring and test equipment: use of fixed and portable monitoring equipment for on and offline monitoring including continuous and semi-continuous data recording eg vibration monitoring of bearings, self-diagnostics (such as PLCs/smart sensors, computerised data acquisition, data logging, electrical data, gas analysis); use of handheld instruments eg meters, thermal imaging; test equipment for taking measurements of parameters eg temperature, pressure, viscosity, speed, flow, voltage, current, resistance, sound, vibration

Procedures: practical methods eg crack detection, leak detection, corrosion detection, flow analysis, vibration analysis, pressure analysis

4 Be able to carry out fault diagnosis on engineering systems

Diagnostic terminology and techniques: terminology (definitions and explanations of symptoms, faults, fault location, fault diagnosis and cause); techniques eg six point, half-split, input–output, emergent problem sequence, functional testing; injection and sampling, unit substitution

Diagnostic aids: test and measuring equipment; other aids eg plant personnel, manufacturers’ manuals, system block diagrams, circuit and schematic diagrams, data sheets, flow charts, maintenance records/logs, self-diagnostics, software-based test and measurement, trouble shooting guides
Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

<table>
<thead>
<tr>
<th>To achieve a pass grade the evidence must show that the learner is able to:</th>
<th>To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:</th>
<th>To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:</th>
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<td>P1 list the aspects of health and safety legislation that apply to monitoring and fault diagnosis of an engineering system</td>
<td>M1 identify and describe four factors which influence either failure or reliability in a given engineering system</td>
<td>D1 analyse the environmental effects on reliability of temperature, humidity, vibration and pressure for a given engineering system</td>
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<td>P2 describe the workplace hazards and safe working practices relevant to specific monitoring and fault diagnosis situations</td>
<td>M2 identify and describe the environmental conditions which affect the reliability of the components in given items of congruent equipment</td>
<td>D2 analyse monitoring/quality control data and information to predict/detect potential failures in given engineering systems</td>
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<td>P3 describe a condition monitoring method and technique related to a given engineering system</td>
<td>M3 evaluate the quality of measurements made and the limitations of given items of condition monitoring equipment</td>
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<td>P4 use given data to calculate failure rates for a range of components and equipment</td>
<td>M4 demonstrate a logical approach to finding faults by identifying and distinguishing between symptoms, faults and causes</td>
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<td>P5 describe the factors affecting reliability for a given engineering system</td>
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<td>P6 describe the monitoring and test equipment used for measuring given system condition parameters</td>
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<td>P7 use procedures to carry out system monitoring on two separate engineering systems</td>
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<td>P8 describe the terms and two different techniques related to fault diagnosis</td>
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Criteria covered | Assignment title | Scenario | Assessment method |
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<tbody>
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<td>P1, P2</td>
<td>Health and Safety in System Monitoring and Fault-finding</td>
<td>An investigation of practical health and safety issues and legislation, relating to system monitoring and fault diagnosis</td>
<td>A learner report and risk assessment, identifying and discussing relevant H&amp;S issues, including the methods used to address these</td>
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Indicative reading

Textbooks
