Question 1
(a) In brief, discuss the difference between hard-time and condition monitoring of aircraft components. [8 marks]

(b) What are the types of modifications as classified by the European JAA? Describe the differences between them. [4 marks]

(c) Explain the MSG-3 assigned task categories; operational check, discard, no-task, and combination. [4 marks]

(d) In brief, discuss the differences between maintenance base and major stations as they relate to aircraft maintenance. [4 marks]

Question 2
(a) Explain the legislation background and principles of each of the following documents:
   i. The Air Operator’s Certificate, AOC.
   ii. Certificate of Maintenance Review, CMR.
   iii. Authorised Release Certificate (Form EASA 1).
   iv. Category B2 licence. [8 marks]

(b) JAR-145.55 specifies the maintenance record requirements for organisations that maintain commercially used aircraft and components. Explain these requirements. [4 marks]

(c) What are the main personnel requirements necessary for a maintenance training organisation seeking JAR147-35 approval? [4 marks]

(d) Explain how organisations with certifying staff working in non-EASA based approved maintenance organisations will comply with JAR 66.
**Question 3**

(a) Several procedures for classifying parts into homogeneous groups are recognised by the majority of the airlines. Discuss how these parts classifications are used.

(b) Explain the difference between rotatable and repairable components in terms of overhaul, repair and life expectancy.

(c) The key ingredients of Material Requirements Planning (MRP) are; Bill Of Material (BOM), Master Schedule (MS), and maintenance Planning Horizon (PH). Briefly discuss the input of each into the MRP process.

(d) A component workshop for Fokker aircraft brake units estimates an annual overhaul requirement of 751 units. The main 100% replacement item is the Pad Assembly which costs £15 each, in addition to which the ordering cost is £25 to process and receive an order, and inventory can be carried at a cost of 0.02 (2%) per-part per-year. Given the following data:

<table>
<thead>
<tr>
<th>Period</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<td>80</td>
<td>70</td>
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<td>20</td>
<td>60</td>
<td>10</td>
<td>66</td>
<td>180</td>
<td>20</td>
</tr>
</tbody>
</table>

i. How many assemblies should be ordered at a time by using EOQ?

ii. Calculate the total inventory cost for the lot-sizing EOQ
Question 4

(a) Briefly discuss the principles and function of the following aircraft maintenance manuals:

i. ATA MSG-3 Operator/Manufacturer Scheduled Maintenance Development.
iii. Guidelines for the Minimization of Foreign Object Damage (FOD) at Air Carrier Airports.

[8 marks]

(b) The primary purpose of the maintenance organization of an airline is to provide a safe, airworthy aircraft for every flight schedule. In addition, there are a number of maintenance efficiency goals. Explain these goals.

[6 marks]

(c) Describe the main categories normally included in the analysis of completed maintenance jobs, so that any undesirable conditions can be identified and corrected.

[6 marks]
Question 5

(a) The purpose of a De-Fuelling and Refuelling station in a maintenance complex is to ensure the efficiency of users for various operations. Describe these operations for both De-fuelling and Refuelling.

[5 marks]

(b) A major decision facing an airline is whether to combine an aircraft painting operation with an intermediate layout or overhaul of the aircraft. Briefly discuss the methods which comprise paint stripping and painting.

[5 marks]

(c) The HFACS-ME framework is adapted to classify human errors and other factors. Under what error categories and levels (third order) could the following cases be investigated using this technique?

i. A technical publication does not specify torque requirements.
ii. A supervisor orders personnel to wash an aircraft without training.
iii. A maintainer who signs off an inspection due to perceived pressure.
iv. A maintainer who uses an old manual because a CD-ROM reader is not available.
v. A maintainer who engages in rule bending that is condoned by management.

[5 marks]

(d) Commission versus Omission errors are among the UK CAA’s top list of maintenance errors. In brief what are the sub-categories of omission errors?

[5 marks]
Question 6
(a) In general, metal aircraft are free from deterioration by corrosion, since the
designers and manufacturers are aware of the problem, and take care to avoid it.
What are the main factors that cause aircraft corrosion?
[5 marks]

(b) As an aircraft ages, more inspections and maintenance is required. In brief discuss
the maintenance issues related to aging aircraft.
[5 marks]

(c) The use of optical instruments in visual inspection is beneficial and is
recommended to magnify defects that cannot be detected by the unaided eye.
Explain the difference between Endoscope and Flexible fibre-optic Borescopes
(Flexiscope) in terms of both their use and their limitations.
[5 marks]

(d) What are the main steps required for the detection of surface flaws by using
Liquid Penetrant Testing (LPT)?
[5 marks]
Question 7
(a) There are various techniques available for magnetizing a component. In brief discuss the following methods:
   i. Magnetization using a magnet.
   ii. Contact current flow method.
   iii. Using a threading bar.

[6 marks]

(b) What are the main limitations of utilizing the Radiographic testing technique for the detection of surface and subsurface flaws?

[5 marks]

(c) A fatigue crack fracture area of the stage 1 fan disk of a B737 aircraft was discovered after using the penetrant testing technique. The width of the fatigue zone across the mating fracture surfaces was 0.10 cm, the depth of the flaw was 2.0 cm and the contact angle of the liquid in the capillary was $45^\circ$. The resistance to penetration is provided by a build-up of pressure to 1.2 MPa as the entrapped air is compressed with surface tension of 7.5 dynes/cm. Determine the depth that the liquid penetrant will penetrate down into the fatigue flaw area.

[5 marks]

(d) What are the main advantages and limitations of utilising Ultrasonic Testing (UT) for detection of surface and subsurface flaws?

[4 marks]
Question 8
(a) What is meant by a fail-safe feature in aircraft construction? [4 marks]

(b) What is the principal difference between a gear-type pump and a fixed/variable delivery pump in terms of their mechanisms? [6 marks]

(c) An airspeed indicator is required on all certificated aircraft except free balloons. Describe some of the uses of the airspeed indicator. [6 marks]

(d) Describe a rain-repellant system, and what may be used to power a windshield wiper system. [4 marks]