

**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

**FACULTY OF SCIENCE AND ENGINEERING**

**AEH 309**

**Department of Engineering and Physics**

**Bachelor of Science Honours Degree in Agricultural Engineering**

**Repair and Maintenance of Agricultural Machinery**

**3 hours (100 Marks)**

**Instructions:**

1. This paper contains 6 questions
2. Answer any **FOUR** questions, each of which carries 25 marks

**Question 1**

- a) Explain the following benefits of preventive maintenance on farm machinery:  

i. Reduced breakdowns,	[2 marks]
ii. Saving on operating costs,	[2 marks]
iii. Keeps tractors safe.	[2 marks]
- b) Describe the procedure to be followed during maintenance of a cooling system of a tractor. [6 marks]
- c) Explain the possible causes of the following types of smoke in diesel engines:  

i. White smoke.	[4 marks]
ii. Black smoke.	[5 marks]
iii. Blue smoke.	[4 marks]

**Question 2**

- a) Explain four main functions performed by engine oils. [8 marks]
- b) List 3 applications of oil analysis in agricultural machinery. [3 marks]
- c) Explain how oil analysis can be used as a predictive maintenance management strategy. [6 marks]

- d) Explain the significance of each of the following tests used in oil analysis:
- i. The Karl Fischer water Test [2 marks]
  - ii. ICP spectroscopy, [2 marks]
  - iii. Viscosity test, [2 marks]
  - iv. Direct read Ferrography. [2 marks]

### Question 3

- a) Explain the steps one would take to trouble shoot a faulty starter motor. [9 marks]
- b) Explain briefly the function of a turbo. [6 marks]
- c) Discuss five major symptoms that may signal that your turbo has a fault. [10 marks]

### Question 4

- a) State and explain 5 metric factors that can be used to evaluate an operation and maintenance program. [10 marks]
- b) Explain five possible causes of machine failure. [15 marks]

### Question 5

- a) List 4 important aspects of adjusting the front wheel steering system of a tractor. [8 marks]
- b) Explain the significance of the following in steering adjustment:
  - i. Camber, [5 marks]
  - ii. Toe-in, [4 marks]
  - iii. Caster effect [4 marks]
  - iv. King pin inclination. [4 marks]

### Question 6

- a) With the aid of a diagram describe the general equipment failure pattern. [5 marks]
- b) Give a brief explanation of each of the following terms used in predictive maintenance management and give one application of each in agricultural engineering.
  - i. Thermography [5 Marks]
  - ii. Ultrasonic analysis [5 Marks]
  - iii. Vibration analysis [5 Marks]
  - iv. Performance trending [5 Marks]