



**UNIVERSITY OF ESWATINI
FINAL EXAMINATION PAPER**

PROGRAMME: BSC ABE. II

COURSE CODE: ABE205

TITLE OF PAPER: FARM POWER

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: DRAWING EQUIPMENT

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO
OTHER QUESTIONS.**

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GRANTED BY THE CHIEF INVIGILATOR**

SECTION I COMPULSORY

QUESTION 1 [40 marks]

a) Describe the operation of a four stroke internal combustion engine using events that take place as key features. [20 marks]

b) A John Deere 5435 diesel tractor has the engine data presented in Table 1.

Calculate

- (i) Piston displacement in cm³ [4 marks]
- (ii) Total piston displacement in litres. [2 marks]
- (iii) Engine capacity in litres. [2 marks]
- (iv) Compression ratio [3 marks]

Table 1 Engine data for JD 5435 tractor

Parameter	Dimension
Number of cylinders	3
Cylinder bore	88.9 mm
Stroke	127 mm
Clearance volume	52 mL

c) State three ways of hitching implements on wheeled tractors.

[3 marks]

d) Discuss the necessity of having transmission elements between agricultural tasks and power sources?

[6 marks]

QUESTION 3 [30 marks]

- a) Distinguish between controls and signals/instruments as devices used on agricultural tractors. [4 marks]

Give one example of a control and an instrument. [2 marks]

- b) An internal combustion engine is common power source for agricultural tractors.
i. Name the four basic parts of an internal combustion engine. [4 marks]

ii. Briefly describe the functions of the basic parts named in i) above. [8 marks]

- c) Figure 2 shows electrical connections that rotate the starter motor to drive the engine flywheel. Measurements show that the engine's internal resistance of 240 Nm is overcome when the starter motor rotates the engine flywheel at 100 rpm before combustion takes place. Determine

- i. The speed of the starter motor, if the starter rotor has 12 teeth and the flywheel has 96 teeth. [8 marks]
- ii. The torque generated by the starter motor to crank the engine. [4 marks]

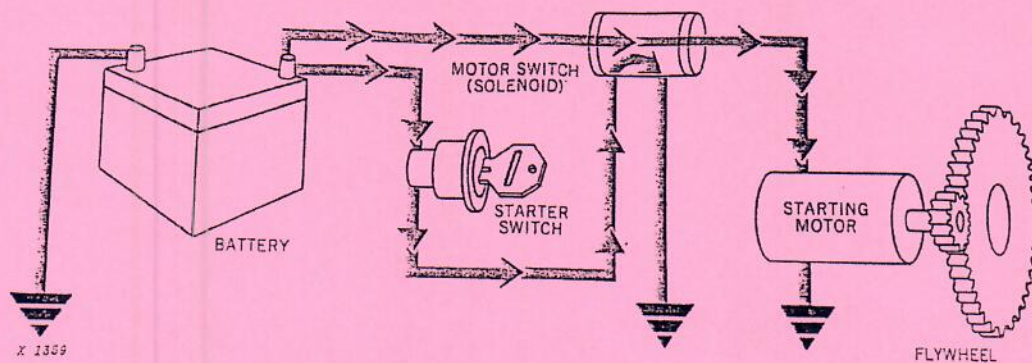


Figure 2 Basic starting circuit for an internal combustion engine

QUESTION 4 [30 marks]

- a) Figure 3 shows a two stage gear reduction system for a forage harvester.

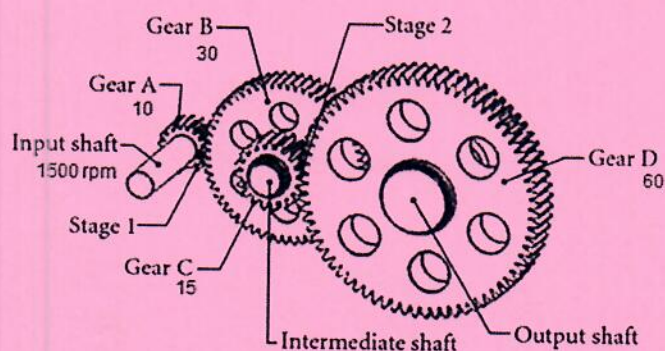


Figure 3 A two stage gearbox

- (i) Determine the speed of the intermediate shaft. [4 marks]
 - (ii) What is the gear ratio of the gearbox? [6 marks]
 - (iii) What is the speed of the output shaft? [4 marks]
- b) Name the common motion transformation system. [8 marks]
- c) Discuss the limitations of using gear drives compared to belt and chain drives in agricultural operations. [8 marks]