



# TECHNICAL UNIVERSITY OF MOMBASA

## DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

FOURTH YEAR UNIVERSITY EXAMINATION FOR THE DEGREE IN BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING (BSME)

### EMG 2419 ENGINE TECHNOLOGY

#### END OF SEMESTER EXAMINATIONS

**SERIES:** DECEMBER, 2013

**TIME:** 2 HOURS

#### INSTRUCTION TO CANDIDATES

1. You should have the following for this examination:-
    - Answer Booklet
    - Scientific Calculator
  2. This paper consists of **FIVE** questions.
  3. Answer **ANY THREE** Questions.
  4. Maximum marks for each part of Question are as shown.
  5. This paper consists of **THREE** printed pages.
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#### Question ONE

- (a) For the following engine parts explain the material used, manufacturing process, and component functional requirement. Also specify the part functions:
- (i) Cylinder block/engine block
  - (ii) Cylinder heads
  - (iii) Conrods
  - (iv) Pistons assembly

(20 marks)

- (b) Identify and explain any **FIVE** engine systems specifying their role.

(5 marks)

#### Question TWO

A single cylinder reciprocating engine has a speed of 240 rpm, stroke of 300mm, mass of reciprocating part is 50kg, mass of revolving part at 150mm is 37kg.

$\frac{2}{3}$

If  $\frac{2}{3}$  of the reciprocating part and all the revolving parts are to be balanced. Determine:

- (a) The balance mass required at a radius of 400mm. **(6 marks)**
- (b) The residual unbalanced force when the crank has rotated 60° from top dead center. **(6 marks)**
- (c) Explain the difference between inside cylinder locomotives and outside cylinder locomotives. **(4 marks)**
- (d) Show that:
  - (i) The primary force is balanced of  $B.R = m.r$ . **(4 marks)**
  - (ii) Resultant unbalanced force at any instant is:

$$m.w^2.r\sqrt{(1-C)^2 \cos^2 \theta + C^2 \sin^2 \theta}$$

Where:

- B = Balancing mass
- R = Radius of balancing mass from crank pin
- r = Crank radius
- C = Crank pin
- Θ = Angle of inclination of the crank

**Question THREE**

- (a) Briefly describe the operation of:
  - (i) A four stroke engine **(10 marks)**
  - (ii) **TWO** stroke engine **(10 marks)**

Illustrate where necessary and specify functional parts involved.

- (b) Explain the major difference between a **FOUR** stroke and **TWO** stroke engines. (5 mark)

**Question FOUR**

- (a) Explain the differences between the single open (direct injections and the divided chamber) Indirect injections combustion chamber designs. State examples for each type with illustrations. (17 marks)
- (b) Discuss the various engine cooling systems and specify their applications and limitation. (8 marks)

**Question FIVE**

- (a) Outline the major differences between exhaust valves and inlet valves. (2 marks)
- (b) Define:
- (i) Valve seat
  - (ii) Valve guide
  - (iii) Valve spring
  - (iv) Seal
  - (v) Collets
- (5 marks)
- (c) Define cam shafts and explain their role. (2 marks)
- (d) Discuss **FOUR** methods of boosting power by valve mechanism modification. (8 marks)
- (e) (i) Explain the meaning of valve overlap. (2 marks)
- (ii) With the aid of a diagram discuss valve timing in internal combustion engines. (6 marks)