TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

THE DEGREE IN BACHELOR OF SCINCE IN MECHANICAL ENGINEERING

EMG 2308 : ENGINEERING THERMODYNAMICS III

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date May 2016

Instructions to Candidates
You should have the following for this examination
    -*Answer Booklet, examination pass and student ID*
This paper consists of **FIVE** questions. Attempt any THREE questions.
Do not write on the question paper.

Question ONE

a) Explain the following terms as applied to internal combustion engines.
    i.   Bore
    ii. Stroke
    iii. Clearance volume.
    iv. Swept volume   (4 marks)

b) Explain with suitable sketches the working of a four-stroke otto engine.   (4 marks)

c) Explain the fundamental differences between combustion Ignition and spark ignition engines.
                                                                    (8 marks)

d) State four purposes of lubrication of an engine   (4 marks)

Question TWO

a) Descrbe a hypothetical indicator diagram and derive the equation to determine the mean effective pressure with clearance. (6 marks)

b) Explain adiabatic flame temperature (3 marks)

c) Explain the stoichiomeric air-fuel fuel ratio(A/F) (3 marks)

d) A steam boiler uses pulverised coal in the furnace. The ultimate analysis of coal by mass is C =78%, H_2=3% ,O_2=3%,S=1%,ash 10% and 5% moisture. Excess air supplied is 30%.Calculate the mass of air to be supplied and mass of gaseous product formed per kg of coal burnt. (8 marks)

Question THREE

a) Describe otto cycle using appropriate diagrams and derive it's efficiency. (10 marks)

b) In an air standard Otto cycle,the compression ratio is 7 and the compression begins at 1 bar and 313k.The heat added is 2510 Kj/kg. Calculate
   i.   Maximum temperature and pressure of the cycle.
   ii. Work done per kg of air
   iii. Cycle efficiency
   iv. Mean effective pressure
   Take for air C_v=0.713kJ/kg K and R=287j/kg K (10 marks)

Question FOUR

a) Define the following engine performance parameters of internal combustion engines.
   i.   Specific output
   ii. Specific fuel consumption
   iii. Volumetric efficiency
   iv. Specific weight (4 marks)

b) With appropriate sketches describe the following designs of combustion chambers
   i.   Turbulent chamber
   ii. Pre combustion chamber
   iii. Energy cell (6 marks)

c) The following particulars were obtained in a trial on a 4-stroke gas engine
   Duration of trial   = 1 hour
   Revolutions   =14000
   Number of missed cycles = 500

Net brake load	=1470 N
Mean effective pressure	=7.5 bar
Gas consumption	=20000 litres
Calorific value of gas	=21kJ/litre
Cylinder diameter	= 250 mm
Stroke	=400 mm
Effective brake circumference	=4 m
Compression ratio	=6.5 : 1

Calculate

    i.   Indicated power
    ii.   Brake power
    iii.   Mechanical efficiency
    iv.   Indicated thermal efficiency   (10 marks)

Question FIVE

a) Explain the difference between theoretical and actual value timing diagrams of a petrol engine
                                                       (4 marks)

b) Explain the following methods of cooling I.C engines
    i.   Air cooling
    ii.   Liquid cooling   (6 marks)

c) Describe a rope brake dynamometer and derive the brake power equation.   (7 marks)

d) The following data were recorded in MPUC laboratory experiment with the rope brake.

Diameter of the fly wheel	=1.2 m
Diameter of the rope	= 12.5 mm
Engine speed	=200 r.p.m
Dead load on the brake	=600 N
Spring balance reading	=150 N

Calculate the brake power of the engine.   (3 marks)