



TECHNICAL UNIVERISTRY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING
DIPLOMA IN ELECTRICAL POWER ENGINEERING (DEPE 3)

EME 2230: MECHANICAL TECHNOLOGY

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2014

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Answer any **THREE** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

- a) State the meaning of the following:
- (i) Statistical thermodynamic
 - (ii) Classical thermodynamics
- b) With reference to thermodynamics describe the following:
- (i) System
 - (ii) Boundary
 - (iii) Surrounding
 - (iv) Process
- (12 marks)**
- c) (i) A tank has a volume of 0.5m^3 and contains 10kg of an ideal gas having a molecular weight of 24 . The temperature is 25°C . Calculate the pressure.
- (ii) In an experiment, a bunsen burner is placed under the cylinder and the volume of gas increases to 0.1m^3 while the pressure remains constant. Calculate the work done by the system during the process if the cylinder is fitted with a piston on which a number of small weights are placed where the initial pressure is 200KN/m^2 and the initial volume of the gas is 0.04m^3 .

Question Two

- a) (I) State the main reason of using power transmission devices.
- (II) State when the following power transmissions devices are used:
- (i) Belts
 - (ii) Chains
 - (iii) Gears
- (III) Sketch and describe the **THREE** types of belts commonly used. **(7 marks)**
- b) An open belt drive is required to transmit 15KN from a motor running at 740 rpm . The diameter of the motor pulley is 30cm . The driven pulley runs at 300 rpm and is mounted on a shaft which is 3 metres away from the driving shaft. Density of the leather belt is 0.1gm/cm^3 . Allowable stress for the belt material is 250N/cm^2 . If coefficient of friction between the belt is 0.3 . Calculate the width of the belt required. The thickness of the belt is 9.75mm **(13 marks)**

Question Three

- a) (I) With the aid of sketches, describe the following types of riveted joints:
- (i) Lap joint
 - (ii) Butt joint
- (6 marks)**
- b) List **FOUR** ways in which a rivet may fail **(4 marks)**
- c) A double riveted lap joint is made between 15mm thick plates. The rivet diameter and pitch are 25mm and 75mm respectively. If the ultimate shear stress are 400MN/m^2 in tension, 320MN/m^2 in shear and 640MN/m^2 in crushing. Calculate the maximum force per pitch which will rupture the joints. **(10 marks)**

Question Four

- a) (i) State SIX advantages and THREE disadvantages of gear drives.
(ii) State the function of idler pulley in a belt drive. **(10 marks)**
- b) A pulley 40cm in diameter is running at 300rpm is connected by a belt to another pulley at a distance of 4m and the second pulley has to run at 220rpm. The belt 5cm thick and 15cm wide. Allowing a slip of 4% between belt and each pulley. Calculate the size of the second pulley and total effective slip. **(10 marks)**

Question Five

- a) Describe the following thermodynamic processes:
(i) Isochoric process
(ii) Adiabatic process
(iii) Hyperbolic process
(iv) Isobaric process **(8 marks)**
- b) A volume of 0.5m^3 of a gas is expanded in a cylinder from a pressure of 660KN/m^2 and temperature 165°C to a pressure of 120KN/m^2 according to the law: $PV^{1.3} = C$
Calculate:
(i) The final volume and temperature of the air
(ii) The work done by the air during the expansion process
(iii) The change in internal energy during the expansion
(iv) The heat flow across the cylinder walls during the expansion stating the direction
Take $CV = 710\text{KJ/Kgk}$ and $R = 287\text{J/kgk}$ **(12 marks)**