

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

MECHANICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION
DECEMBER 2011 SESSION

J4103 : WORKSHOP TECHNOLOGY 4

DATE : 02 MAY 2012 (WEDNESDAY)
DURATION : 2 HOURS (11.15 AM - 1.15 PM)

This paper consists of **FIVE (5)** pages including the front page.
Structured/Essay (6 questions – answer any **4 question**)

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THE CHIEF INVIGILATOR

QUESTION 1

- (a) State the basic working principles of a comparator. (4 marks)
- (b) List **FIVE (5)** features of a comparator. (5 marks)
- (c) Discuss **THREE (3)** advantages and **THREE (3)** disadvantages of an electrical comparator. (6 marks)
- (d) Explain what a gauge block is and indicate its usage in a measurement? (10 marks)

QUESTION 2

- (a) List **THREE (3)** types of grinding machine. (3 marks)
- (b) Give **TWO (2)** types of work blade material for Centerless Grinding Machine. (2 marks)
- (c) Explain the differences between universal and ordinary type of grinding machine. (4 marks)
- (d) Sketch and label the basic diagram of Centerless Grinding Machine method. (6 marks)
- (e) Find force feed and production rate manufacturing in every 1 hour for 2 weeks in unit millimetre per second below:-
Steel length = 800 mm
Alignment degree = 2°
Rotation of control wheel = 100 rpm
Diameter control wheel = 175 mm (10 marks)

QUESTION 3

- (a) Define what is overcut in Electro Discharge Machining (EDM) process.
(1 mark)
- (b) Give **FIVE (5)** factors that influence the removal rate in an Electro Discharge Machining (EDM) process.
(10 marks)
- (c) List **FOUR (4)** criteria in choosing material for cutting tool in Electrochemical Machining (ECM) process.
(8 marks)
- (d) Explain **THREE (3)** differences between Electro Discharge Machining (EDM) and Electrochemical Machining (ECM).
(6 marks)

QUESTION 4

- (a) List **FOUR (4)** advantages of powder metallurgy.
(4 marks)
- (b) State **FOUR (4)** basic steps to produce powder metallurgy.
(4 marks)
- (c) Sketch and label the schematic diagram for powder metallurgy process.
(8 marks)
- (d) Explain the **THREE (3)** chambers of furnaces in sintering process.
(9 marks)

QUESTION 5

- (a) Define the meaning of machinability.
(2 marks)
- (b) State **THREE (3)** factors affecting the machinability of material.
(6 marks)
- (c) List **FOUR (4)** factors that affect high cutting velocity.
(4 marks)
- (d) Calculate the cutting feed if the maximum metal removal rate for carbon steel is $970 \text{ mm}^3/\text{s}$, the cutting depth is 5.9 mm and cutting speed is 550 mm/s.
(5 marks)
- (e) The maximum metal removal rate for carbon steel is $928.4 \text{ mm}^3/\text{s}$. If the lathe machine's maximum power is 3.82 kW:-
- calculate the power used.
(4 marks)
 - calculate the cutting feed if the cutting depth is 5.98 mm and the cutting speed is 500 mm/s.
(4 marks)

QUESTION 6

- (a) State the effect of increasing metal hardness on machinability?
(2 marks)
- (b) List **FIVE (5)** factors which affect machinability test.
(5 marks)
- (c) Give **TWO (2)** factors of material properties that can influence the performance of a machine.
(2 marks)
- (d) The lathe machine can cause some defects on material. State the factors that may cause the defects of:-
i. diameter becoming narrow.
ii. non-centredness.
(4 marks)
- (e) Give **ONE (1)** suitable alignment for the lathe machine to create a step shaft with a perfect dimension. Sketch and describe the alignment in detail.
(12 marks)