The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Mechanical Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: DMX5572 Materials and Manufacturing Technology**
Academic Year	: 2019/20
Date	: 10th August 2020
Time	: 13.30 hours– 16.30 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of Five (05) questions in **Part A** and Three (03) questions in **Part B**
3. Answer any **Three (03)** questions from **Part A** and **Two (02)** questions from **Part B**
4. All questions carry equal marks
5. This is a Closed Book Test (CBT).
6. Attach the question paper to your answer script.

Part A

QUESTION 01

(a) Quoting an example of an engineering product; explain the series of steps that are followed in design and development of the product.

(b) What do you understand by Material processing. You may use appropriate examples to explain your answer.

(c) What are the four basic families of shape-production processes? State one advantage and a limitation of each family.

(d) Explain consolidation process in manufacturing.

QUESTION 02

(a) Briefly explain face milling and slab milling with the help of neat sketches.

(b) Explain clearly the reasons that Milling has a higher metal removal rate than planing operation. Your answer should explain the Milling and Planing operations.

(c) Why does down milling blunt the cutter more rapidly than up milling when machining sand castings? You may illustrate the important features of the cutter to clarify the answer.

QUESTION 03

Answer the following questions based on Figure 01 which shows conventional drill geometry

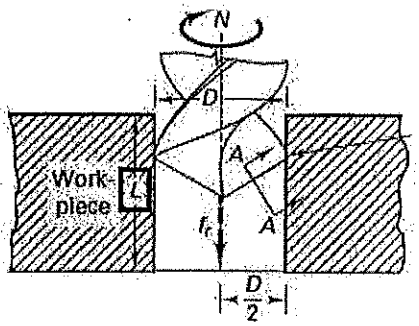

Figure 01

(a) If the rpm of the drilling machine $N = 1000V/\pi D$, then determine the cutting time T_m in terms of length of cut (L), allowance (A) and feed rate in meter/revolution (f_r) , where **V** is cutting speed in meter/minute and **D** is diameter of the drill.

(b) Show that the Metal Removal Rate (**MRR**) for this process is $MRR = 250DVf_r$, (Neglect the allowance **A**)

(c) Calculate the metal removal rate when **D = 10mm, V = 30m/min,** f_r **= 5mm/rev.**

QUESTION 04

(a) Define "Total solidification time" in casting.

(b) State Chvorinov's rule and determine total solidification time (t_s), in terms of mold constant (**B**), volume of the casting (**V**), constant (**n**) and (**A**) is the surface area which heat is extracted.

(c) A cylindrical-shaped part (Figure 02) is to be cast out of Aluminum. The radius of the cylinder r = 40 mm and its height h= 150 mm. If the mold constant B= 2.0 sec/mm^2, using n =2 in Chvorinov's Rule, determine how long will it take the casting to solidify?

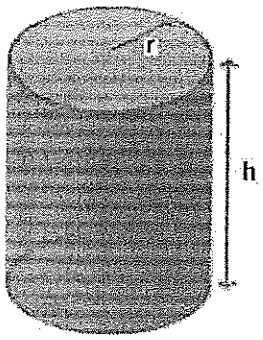

Figure 02

QUESTION 05

(a) State five common methods used for support workpieces in Lathe machines and briefly illustrate any three methods mentioned above.

(b) Define the term "Taper turning" and illustrate four methods to perform this operation on a lathe machine.

(c) Determine the taper angle of the following workpiece shown in Figure 03.

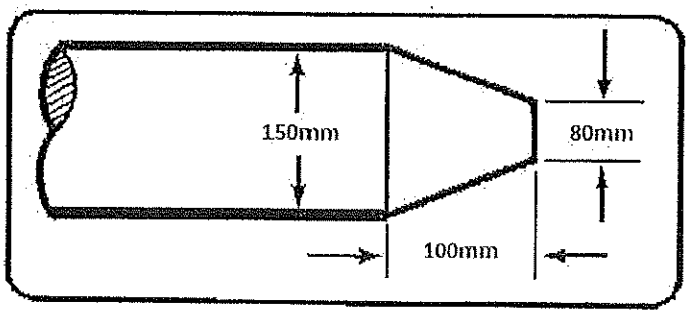

Figure 03

Part B

QUESTION 06

(a) With the help of a graph, explain the relationships between grit sizes, surface finish and material removal rate (MRR) in grinding operation.

(b) State the commonly used materials as bonding agents in grinding wheels.

(c) Explain the differences between honing stones from grinding wheels considering the practical application of both the processes.

(d) State an industrial application of honing.

(e) What is a grinding ratio or G ratio of grinding wheel?

QUESTION 07

(a) What are the properties do nonferrous metals possess that may not be available in the ferrous metals? State the practical use of nonferrous materials based on the stated properties.

(b) Describe and differentiate Addition polymerization and Condensation polymerization.

(c) What unique property of graphite makes it attractive for elevated-temperature applications?

(d) What is austenitic stainless steel? State four of their unique properties.

QUESTION 08

(a) Explain the inherent properties, applications and material specifications of,
   i. Composite materials.
   ii. Tool Steels.

(b) What do you understand by Microdrilling? Give an industrial application where microdrilling is used.

(c) State three reasons to use cutting fluids in drilling operations. Explain one practical examples of usage of cutting fluid in drilling.