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L3-/T-I/IPE

Date: 09/09/2025

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-I B.Sc. Engineering Examinations 2023-2024

Sub: IPE 305 (Manufacturing Process-II)

Full Marks: 210

Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION - A

There are **FOUR** questions in this section. Answer to Question No. 1 is **COMPULSORY**.

Answer any **TWO** questions from Questions 2 to 4.

1. (a) Explain orthogonal and oblique cutting with a neat diagram. Discuss their importance in metal cutting and state how orthogonal cutting can be practically achieved. (10)
(CO1)
- (b) Draw a single-point turning tool showing different angles in ORS and ASA system. Derive the equations for converting the rake angles from ASA system to ORS (12)
(CO2)
- (c) A ductile rod of 120 mm diameter is turn at a speed of 320 rpm, feed of 0.24 mm/rev. and 3.0 mm depth of cut by a tool of geometry: 10° , -10° , 8° , 6° , 15° , 30° , $1/8$ (inch). It was observed that $P_z = 750$ N and $P_y = 200$ N and the chip thickness = 0.70 mm. Determine (i) Orthogonal rake angle (ii) Inclination angle, (iii) Shear force and (iv) Cutting power. (13)
(CO2)
2. (a) With the help of Merchant's circle diagram, show that, $P_z = 2\tau_s S_0 \cot\beta_0$, where the notations indicate their usual meaning. (10)
- (b) Explain the differences between abrasion wear, adhesion wear, and diffusion wear in the context of tool wear. What essential properties should a cutting fluid have for effective performance? (12)
- (c) Derive an expression for material removal rate in machining brittle and ductile materials by abrasive jet machining. (13)
3. (a) Briefly explain the working principle of an AWJM showing important elements. List the advantages, limitations, and applications of AWJM. (10)
- (b) Explain the working principle of electrochemical grinding and discuss the process capabilities and application. (12)

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Contd... Q. No. 3

- (c) Derive the MRR expression for ductile materials in USM. Why is erosion lower in ductile materials compared to brittle ones? (13)
4. (a) Briefly explain the working principle of EDM process showing important elements. List the advantages and limitations of EDM. (10)
- (b) Describe the EBM process with a simple sketch and write about its process parameters, advantages and applications (12)
- (c) Explain the casting, potting, and encapsulation processes used in manufacturing with suitable diagrams. Discuss their purposes, materials used, advantages, and typical applications. (13)

SECTION – B

There are **FOUR** questions in this section. **Question No. 5 is COMPULSORY;**

choose any TWO from the remaining questions.

Make appropriate assumptions for any missing data.

5. (a) List and briefly describe some basic turning operations performed on a lathe. Include sketches where necessary. (10) (CO3)
- (b) Explain the techniques used to lower surface temperatures while grinding. (10) (CO3)
- (c) Define machinability rating. (5) (CO4)
- (d) What are machining responses? Illustrate your answer with eight relevant examples. (10) (CO4)
6. (a) How can controlling cutting parameters increase the material removal rate (MRR) in drilling? (5)
- (b) A C40 steel cylindrical shaft is to be machined from an initial diameter of 60 mm down to a final diameter of 40 mm using a lathe. The length of the cylindrical portion to be machined is 150 mm. The machining is to be done in multiple passes, consisting of roughing passes followed by one finishing pass. (15)
- The following cutting conditions apply:
Depth of cut for roughing: 2mm

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Contd... Q. No. 6(b)

Feed rate for roughing: 0.25 mm/rev
Cutting speed for roughing: 30 m/min
Depth of cut for finishing: 0.75 mm
Feed rate for finishing: 0.1 mm/rev
Cutting speed for finishing: 60 m/min

Determine the total machining time required to perform the turning operation.

[Ignore tool approach length and over-travel distances, and spindle speed is calculated based on average diameter during the operation.]

- (c) Provide the formulas for calculating the machining time for drilling through and blind holes. Also, explain the parameters that affect machining time, using appropriate diagrams. (15)
7. (a) What are the differences between surface broaching and internal broaching? (5)
- (b) Explain why the specific energy in grinding is much greater than in conventional machining. (15)
- (c) The abrasive particles, the bonding material, and their fabrication methods determine the five basic parameters of a grinding wheel. Briefly discuss these parameters. (15)
8. (a) List the advantages of a radial drilling machine compared to an upright drill. (5)
- (b) Describe the typical wear curve of a grinding wheel and identify the main causes of wear. (15)
- (c) Describe how a quick return mechanism improves the efficiency of a Shaper machine. How does the hydraulic quick return mechanism differ from the mechanical one? (15)
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