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Question Paper Code : 41056

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Seventh Semester

Aeronautical Engineering

OPR 751 — BASICS IN MANUFACTURING AND METAL CUTTING PROCESS

(Common to Aerospace Engineering/Material Science and Engineering/
Robotics and Automation)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate Batch Production and Mass production.
2. A square prism of 20 mm × 20 mm × 100 mm is to be machined in to a cylinder of diameter 18 mm using a lathe. What work holding device is suitable for this purpose and why?
3. What is the use of “Clapper Box Mechanism” in a shaper machine.
4. Compare Mechanical and hydraulic shapers.
5. A 12 mm dia drill is rotating at 1440 rpm. What is the maximum cutting speed attained by the drill?
6. What are the main functions of flutes in a drill bit?
7. Sketch orthogonal cutting Indicating tool, chip and shear plane.
8. What is the purpose of providing rake angle to a cutting tool?
9. What are the basic properties required for a cutting tool material?
10. Sketch the typical flank wear of the cutting tool.

PART B — (5 × 13 = 65 marks)

11. (a) Sketch the tool holding arrangement in engine lathe and discuss in detail its function. (13)

Or

- (b) Discuss any two methods by which taper turning operation can be performed in a Lathe. (13)

12. (a) With a block diagram explain the various parts of a Shaper. (13)

Or

- (b) Explain the quick return mechanism with suitable diagram. (13)

13. (a) What are the various types of drilling machines? Sketch a radial arm drilling machine and explain its working. (13)

Or

- (b) Discuss in detail any three work holding devices used in a drilling machine. (13)

14. (a) (i) Sketch the three views of a single point cutting tool and mark the tool angles in the diagram. (8)

- (ii) The tool signature of a HSS tool is given as 5-8-7-9-15-16-0.8. What do each of these numbers mean? (5)

Or

- (b) (i) List the assumptions made in orthogonal Cutting. (5)

- (ii) Sketch the Merchant circle indicating the various force components in orthogonal cutting. (8)

15. (a) (i) A metal cutting experiment was conducted using low carbon steel work material and high speed steel tool. When the cutting speed was increased from 25 m/min to 100 m/min, the tool life got reduced from 120 minutes to 60 minutes. If a tool life of 80 minutes is required, what should be the cutting speed? Assume that other cutting conditions and tool geometry remain same. (8)

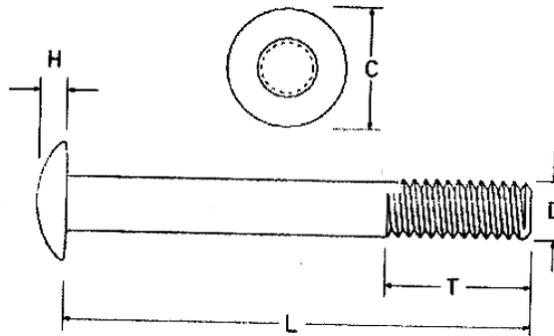
- (ii) Write a brief note with sketches on different types of chips produced in metal cutting process. (5)

Or

- (b) List the various types of tool wear. Discuss any two types in detail along with the associated wear mechanism. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Pan head bolts as shown in the figure below are usually mass produced by metal forming process in large numbers. But if some nonstandard size is required in small numbers they can be manufactured in lathe.



Assume that one number of such bolt of dimensions given below is to be manufactured in lathe using a 25 mm rod of 80 mm length.

$D = 19 \text{ mm}$

Pitch of the thread 1 mm

Chamfer $1 \times 45^\circ$

$T = 30 \text{ mm}$

$L = 75 \text{ mm}$

$H = 5 \text{ mm}$

$C = 24 \text{ mm}$

Identify the various lathe operations to be performed in manufacturing the component and write in detail about any three of these operations. (15)

Or

- (b) The propeller shaft of a small marine boat is to be manufactured using a lathe machine. The shaft material is high carbon steel with a hardness of about 32 HRC.

Identify any three tool materials suitable for carrying out this machining operation, compare their relative merits and demerits and select one tool material for actual machining. (15)
