Total Number of Pages: 02

Course: B.Tech/IDD
Sub_Code: MEPC3003

5th Semester Regular Examination: 2025-26
SUBJECT: Metal Cutting & Machining
BRANCH(S): MECH, ME
Time: 3 Hours
Max Marks: 100
Q.Code: U283
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   (2 x 10)

a)   State suitable machining parameters for forming continuous chips during turning operation.

b)   Write all the tool signature of ASA system.

c)   Which machining processes are suitable for making square holes in the brittle workpieces?

d)   Write down the expression for optimum cutting velocity (V_{opt}.) and optimum tool life (T_{opt}.) for a machining process with respect to maximum production rate criteria.

e)   What is the importance of hot hardness temperature in cutting tools?

f)   What are the different types of Laser materials used for producing LASER source?

g)   What are the major applications of EDM process in the modern industries?

h)   State the difference between up-cut milling and down-cut milling operation.

i)   What is trepanning operation and what are its advantages?

j)   What are the major classifications of CNC machine tool based on feedback system?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)

a)   A 31.8 mm HSS drill bit is used to drill a hole in a mild steel block of 90 mm thick at a cutting speed of 21 m/min and feed of 0.35 mm/rev. If the over travel of drill is 4 mm and approach is 10 mm. Calculate the time required to drill the hole.

b)   Explain the working principle of LASER beam machining process.

c)   Calculate the time required for completing a 3 mm deep finishing cut on a 150 mm wide, 400 mm long face of a 120 mm thick steel block using a face milling cutter of 250 mm diameter with 8 teeth. The cutting speed is 1.2 m/sec and feed per tooth is 0.1 mm.

d)   Define Plasma. What are the advantages for a Plasma Arc Machining (PAM) over other machining processes?

e)   With a neat sketch explain the heat generation mechanism and show different heat zones, produced during the machining operation.

f) What are the major cause of formation of crater wear and flank wear on the tool surface? Also, explain how to prevent these tool wear.

g) Write the properties, applications and limitations of three different cutting tool materials, used in modern industries for machining operation.

h) Explain face milling and gang milling operation with neat sketch. Also mention their specific applications and limitation.

i) An Electro Chemical Machining (ECM) operation is to be used to cut a hole into an Iron plate (specific removal rate, $C = 3.69 \times 10^{-2}$ mm^3/A-sec) of 14 mm thickness. The hole has a square cross-section of 20 mm × 20 mm. The ECM operation will be accomplished at a current = 1250 Amps. Efficiency is expected to be 95 %. Determine the feed rate and time required to cut through the plate.

j) A batch of 8 cutting tools could produce 400 components while working at 50 rpm with a tool feed of 0.25 mm/rev and depth of cut of 1 mm. A similar batch of 8 tools of the same specification could produce 96 components while working at 80 rpm with a feed of 0.25 mm/rev and 1 mm depth of cut. How many components can be produced with one cutting tool at 60 rpm?

k) Orthogonal machining of a steel work-piece is done with a HSS tool with zero rake angle. The ratio of cutting force and the thrust force on the tool is 0.352. The length of cut chip is 3.51 mm while uncut chip length is 9 mm. What are the shear plane angle (φ) and friction angle (β) in degree? Use Merchant's theory.

l) What are the different components of modern CNC system? Explain with a neat sketch.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Explain the working principle of Abrasive Jet Machining (AJM) and Ultrasonic Machining (USM) processes with neat sketches. Compare all the advantages and disadvantages with respect to modern machining requirements. **(16)**

Q4 How do you classify a lathe machine? Explain various operations that can be performed on a lathe machine. Highlight the significance of turret and capstan lathe. **(16)**

Q5 In an orthogonal cutting operation on a workpiece of width 2.4 mm, the uncut chip thickness was 0.24 mm and the tool rake angle was zero degrees. It was observed that the chip thickness was 1.3 mm, cutting force measured as 950 N and the thrust force as 480 N. Find the mean shear strength of the workpiece material and machining constant, if the coefficient of friction between the chip and tool was 0.5. **(16)**

Q6 Explain orthogonal and oblique machining process with neat sketches. Draw the merchant circle diagram and write-down the correlation between all the forces, involved in the machining operation. **(16)**