**VALLIAMMAI ENGINEERING COLLEGE**
**DEPARTMENT OF MECHANICAL ENGINEERING**
**ME6402 MANUFACTURING TECHNOLOGY-II**
**QUESTION BANK**

## UNIT-I THEORY OF METAL CUTTING

**Part-A (2 Marks)**

| | | |
|---|---|---|
| 1. | Write a short note on heat zone in cutting. | BT2 |
| 2 | Write a short note on any two modern tool materials. | BT2 |
| 3. | Mention the condition that induces the formation of Built up edge. | BT3 |
| 4. | How tool life is estimated? | BT1 |
| 5. | Classify the different types of chip breakers. | BT4 |
| 6. | List the various metal removal processes. | BT1 |
| 7. | What do you understand by negative rake angle? | BT1 |
| 8. | Explain how chip formation occurs in metal cutting. | BT4 |
| 9. | Mention the various parts single point cutting tool. | BT5 |
| 10. | Classify the various angles in cutting tool. | BT4 |
| 11. | Explain the assumptions made by merchant circle. | BT2 |
| 12. | Define chip thickness ratio. | BT1 |
| 13. | Explain the total energy of the cutting process. | BT2 |
| 14. | Sketch the orthogonal cutting. | BT3 |
| 15. | Define machinability of metal. | BT1 |
| 16. | Write Taylor's tool life equation. | BT2 |
| 17. | Classify the tool wear. | BT4 |
| 18. | Mention the advantage of high machinability. | BT4 |
| 19. | What is machinability index? | BT1 |
| 20. | Classify the types of cutting fluids. | BT4 |
| | | BT2 |

**Part-B (13 Marks)**

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|---|---|---|---|---|
| 1. | a | With reference to orthogonal cutting, explain the following terms: shear stress in shear plane, Shear strain, cutting ratio, Shear angle | **7** | **BT1** |
| | b | Prove that in orthogonal cutting, the kinetic coefficient of friction ($\mu$) is given by $\mu = F_c \sin\alpha + F_t \cos\alpha / F_c \cos\alpha - F_t \sin\alpha$ | **6** | **BT6** |
| 2 | a | Tool life tests in turning yield the following data: (1) V = 110 m/min, T = 20 min; (2) V = 85 m/min, T= 40 min. (A) Determine the n and C values in the Taylor tool life equation. Based on the equation, compute (B) the tool life for a speed of 95 m/min and (C) the speed corresponding to a tool life of 30 min. | **7** | **BT4** |
| | b | Name the techniques used to measuring tool wear. Describe their advantage and limitations.. | **6** | **BT2** |
| 3 | a | Discuss briefly the various types of tool wear with neat sketches. | **7** | **BT2** |
| | b | Mention the desirable properties of a cutting tool material and the improvements caused by coated carbides. | **6** | **BT5** |
| 4 | | Tool life testing on a lathe under dry cutting conditions gave n and C of Taylor's tool life equation as 0.12 and 130m/min respectively. When a coolant was used, C increased by 10%. Find percentage increase in tool life with the use of coolant at a cutting speed of 90m/min. | **13** | **BT3** |

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|---|---|---|---|---|
| 5 | | In a two dimensional cutting of mild steel with a sintered carbide tool the following data were observed Rake angle = 12˚; Depth if cut = 0.2mm; width of cut =5 mm; Thrust force = 1000 N; Cutting Force = 1500 N Thickness of the chip = 0.55mm find the mean shear stress and mean compressive stress on the shear plane. | **13** | **BT2** |
| 6 | | Cylinder bars of 100mm diameter and 576mm length are turned in a single pass operation. The spindle speed used is 144 rpm and the total feed is 0.2mm/rev. Taylors tool life relationship is $VT^{0.75}$=75. Where "V" is the cutting speed in m/min and This tool life in min. Calculate<br>1. The time required for turning one piece<br>2. The average tool change time per piece given that it takes 3min to change the tool each time, and<br>**3.** The time required to produce one piece given that the handling time is 4min | **13** | **BT5** |
| 7 | a | In an orthogonal cutting test with a tool of rake angle 10˚ the following observation were made: Chip thickness ratio = 0.3; Horizontal component of the cutting force = 1290 N Vertical component of the cutting force = 1650 N. From the merchant's theory, calculate the various components of the cutting forces and the coefficient of friction at the chip tool interface. | **7** | **BT3** |
| | b | What are the functions of a cutting fluid? Explain in detail the guidelines adopted for the selection of cutting fluid based on material and tool characteristics. | **6** | **BT1** |
| 8 | a | Explain the classification of various cutting tool materials. | **7** | **BT2** |
| | b | Explain the properties of each of the tool materials. | **6** | **BT2** |
| 9 | | What is a chip breaker? Describe the different types of chips produced during metal machining with neat sketches | **13** | **BT1** |
| 10 | a | Show with the help of a sketch, crater wear and flank wear on a cutting tool. | **7** | **BT5** |
| | **b** | Explain the types and applications of different types of cutting tools. | **6** | **BT2** |
| 11 | a | Is material ductility important for machinability? Explain. | **7** | **BT1** |
| | b | What is the measure of metal removing process machinability? What are the factors that affect it? | **6** | **BT1** |
| 12 | a | Describe an expression for the determination of shear angle in orthogonal metal cutting. | **7** | **BT5** |
| | b | What is meant by orthogonal cutting and oblique cutting? | **6** | **BT1** |
| 13 | a | State the parameters that influence the life of tool and discuss. | **7** | **BT6** |
| | b | Explain the geometry of a single point cutting tool with suitable sketches. | **6** | **BT2** |
| 14 | | Explain "Merchant force circle" and formulate the expressions along with assumptions | **13** | **BT2** |

**PART-C (15 Marks)**

| | | | |
|---|---|---|---|
| 1 | Give your understanding of the basic metal-cutting process, what are the important physical and chemical properties of a cutting tool? | **BT6** | **15** |
| 2 | What you think the maximum temperature in orthogonal cutting is located at about the middle of the tool-chip interface? | **BT6** | **15** |
| 3 | Why is it not always advisable to increase cutting speed in order to increase production rate? | **BT6** | **15** |
| 4 | Describe in detail your thoughts regarding the technical and economic factors involved in tool material selection. | **BT6** | **15** |

## UNIT-II TURNING MACHINES

**Part-A (2 Marks)**

| | | |
|---|---|---|
| 1. | What is meant by "swing of the lathe'? | BT1 |
| 2 | What is the difference between fed rod and lead screw? | BT1 |
| 3. | Write the specification of a typical lathe. | BT3 |
| 4. | Write down the names of any four lathe accessories. | BT3 |
| 5. | Define the term "Conicity". | BT1 |
| 6. | State the various methods for taper turning operation. | BT3 |
| 7. | Write down the formula for calculating taper turning angle by tailstock set over distance and compound rest method. | BT3 |
| 8. | Determine the angle at which the compound rest will be swivelled when cutting a taper on a piece of work having the following dimensions. OD = 60 mm; Length of the tapered portion 80 mm and smallest diameter – 20mm. | BT4 |
| 9. | Define the term "Thread cutting". | BT1 |
| 10. | How can the number of teeth on various change gears be calculated? | BT1 |
| 11. | Write down the formula to find the following parameters (i) Machining time (ii) Total length of tool travel (iii) Number of passes or cut. | BT3 |
| 12. | Define automatic machine. | BT2 |
| 13. | What are the three stages of a tool-layout? | BT1 |
| 14. | Compare the advantages of turret lathe over capstan lathe. | BT4 |
| 15. | What are the different drives used in copying lathes? | BT1 |
| 16. | What do you mean by copy turning? | BT1 |
| 17. | What are the difference between automatic lathe and capstan lathe? | BT4 |
| 18. | Give a sketch illustrating the principle of operation of Swiss type automatic lathe. | BT1 |
| 19. | Compare the parallel action and progressive action multi spindle automatic lathes. | BT1 |
| 20. | What are the four major parts of Swiss type automatic lathes? | BT1 |

**Part-B (13 Marks)**

| | | | | |
|---|---|---|---|---|
| 1. | | What are the different types of machining operations that can be performed on a lathe? And explain any six in detail. | **13** | **BT1** |
| 2 | | Explain the construction and working principle of a lathe with a neat sketch. | **13** | **BT2** |
| 3 | a | Describe the difference between a steady rest and a follow rest. Give an application of each. | **7** | **BT2** |
| | b | Explain the various types of Chucks explain any two in detail | **6** | **BT2** |
| 4 | a | Explain taper turning operation in a lathe by taper turning attachment method. | **7** | **BT2** |
| | b | Why can boring on a lathe be a difficult operation? | **6** | **BT1** |
| 5 | | Explain the following methods of taper turning in lathe by i. Swivelling the compound rest, ii. Form tool method. | **13** | **BT2** |
| 6 | a | Explain the thread cutting operation in a lathe with a neat sketch. Also make a note on knurling, grooving and forming operations in a lathe. | **7** | **BT2** |
| | b | Enumerate the purpose of various attachments used on a centre lathe | **6** | **BT6** |

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|---|---|---|---|---|
| 7 | a | Calculate the gears for cutting metric threads of following pitch. i) 4mm pitch, ii) 5.25 mm pitch. The lead screw of lathe contains 6 TPI. The lathe is supplied with 20 to 120 teeth in step of 5and an additional gear wheel of having 127 teeth | **7** | **BT5** |
| | b | Calculate the time required for one complete cut on a piece of work having 250 mm long and 40 mm diameter. The cutting speed is 32 m/min and feed is 0.4 mm/rev. | **6** | **BT5** |
| 8 | | Explain with neat sketch Geneva mechanism of turret lathe. | **13** | **BT2** |
| 9 | a | Why is there more than one turret in turret lathe. | **5** | **BT1** |
| | **b** | Discuss the features of Ram type and Saddle type turret with neat sketches. | **8** | **BT5** |
| 10 | a | Explain the tooling layout for the producing of a Hexagonal bolt in a Capstan lathe. | **7** | **BT5** |
| | b | Discuss the tooling layout for production of a hexagonal nut in Turret lathe | **6** | **BT2** |
| 11 | | Classify transfer machines. Sketch and explain the working of Swiss type automatic screw machine. What are the advantages of automatic machines? | **13** | **BT4** |
| 12 | a | Briefly explain the principle of working of sliding head type single spindle automatic machine. | **7** | **BT3** |
| | b | Differentiate between parallel action and progressive action multi spindle automatics. | **6** | **BT3** |
| 13 | | Explain the working principle of turret lathe and capstan lathe with neat sketch. | **13** | **BT2** |
| 14 | | Describe the working principle of multi spindle automatics. Give its advantages and applications | **13** | **BT5** |

**PART-C (15 Marks)**

| | | | |
|---|---|---|---|
| 1 | A badly oxidized and uneven round bar is being turned on a lathe. Would you recommend a small or in large depth of cut? Explain. | **BT6** | **15** |
| 2 | Describe the problems, if any, that may be encountered in clamping a work piece made of a soft metal in a three-jaw chuck. | **BT6** | **15** |
| 3 | We have seen that cutting speed, feed, and depth of cut are the main parameters in a turning operation. In relative terms, at what values should theses parameters be set for a (a) roughing operation and (b) finishing operation? | **BT6** | **15** |
| 4 | Explain the economic justification for purchasing a turret lathe instead of a conventional lathe. | **BT6** | **15** |

## UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES

**Part-A (2 Marks)**

| | | |
|---|---|---|
| 1. | What do you meant by differential indexing? | BT1 |
| 2 | Why milling is a versatile machining process? | BT1 |
| 3. | Distinguish Up milling and Down milling. | BT3 |
| 4. | Sketch the nomenclature of a drill bit. | BT3 |
| 5. | List out the major parts of a shaper. | BT1 |
| 6. | Mention some of the work holding devices used in a shaper. | BT4 |
| 7. | Define the cutting speed, feed and machining time for drilling. | BT1 |
| 8. | Calculate the tap drill size to cut an internal thread for bolt of outside diameter of 10 mm, Pitch 1.5 mm and Depth of thread 0.61 pitch | BT4 |
| 9. | What are the classification of milling operations | BT1 |
| 10. | How do you classify milling cutters? | BT1 |
| 11. | Discuss a shell mill. | BT2 |
| 12. | What do you understand by peripheral milling? | BT1 |
| 13. | Define a vertical milling machine? | BT1 |
| 14. | What is an index plate? | BT1 |
| 15. | What are the different types of indexing heads? | BT1 |
| 16. | List out the various elements of a plain milling cutter with a neat sketch. | BT1 |
| 17. | Give the two principal methods of gear manufacturing. | BT2 |
| 18. | List out the gear finishing processes. | BT1 |
| 19. | Explain gear hobbing. | BT4 |
| 20. | What is meant by gear shaving? | BT1 |

**Part-B (13 Marks)**

| | | | | |
|---|---|---|---|---|
| 1 | | Explain with neat sketches the procedure for carrying out the following operations on a shaper. Horizontal cutting, Vertical cutting, concave surface and keyway cutting. | **13** | **BT2** |
| 2 | a | With a simple sketch explain working of crank and slotted link quick return motion mechanism used in shaper. | **7** | **BT1** |
| | b | How the stroke length and position of a ram is adjusted? | **6** | **BT1** |
| 3 | a | Discuss various hole making processes. | **7** | **BT5** |
| | b | Write short notes on the following tools, i. Reaming tool and ii. Tapping tool | **6** | **BT1** |
| 4 | | Sketch and explain the hydraulic drive of a horizontal shaper. | **13** | **BT4** |
| 5 | a | Explain various milling cutters with neat sketches | **7** | **BT2** |
| | b | Describe the working mechanism of a universal dividing head with a neat diagram | **6** | **BT5** |
| 6 | a | Explain the different types of milling operations with neat sketches | **7** | **BT2** |
| | b | Discuss the common work holding devices used in shaper and drilling machines. | **6** | **BT5** |

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|---|---|---|---|---|
| 7 | a | Explain up milling and down milling with a neat sketch and state which one is suitable for machining a flat surface. | **7** | **BT2** |
| | b | With a neat sketch explain the principle parts and angles of plain milling cutter. Explain them. | **6** | **BT5** |
| 8 | a | Compare Plain and Universal milling machine. | **7** | **BT5** |
| | b | Differentiate between gear forming and gear generation. | **6** | **BT3** |
| 9 | a | Enumerate with a neat sketch gear shaping. | **7** | **BT4** |
| | b | List the advantages and disadvantages of gear shaping process. | **6** | **BT1** |
| 10 | | List out the gear finishing processes. Explain any two with neat sketches. | **13** | **BT1** |
| 11 | | Explain the principle of gear hobbing operation. What are the advantages and disadvantages of gear hobbing process? | **13** | **BT6** |
| 12 | | Find out the indexing movement of milling 119 teeth spur gear on a gear blank | **13** | **BT6** |
| 13 | | A gear blank on the milling machine is to be indexed for cutting 73 teeth. The machine 40:1 ratio index head. Calculate the gear ratio necessary between the spindle and the indexing plate. | **13** | **BT5** |
| 14 | | Find the gear combination and index movement necessary for 139 divisions. | **13** | **BT5** |

**PART-C (15 Marks)**

| | | | |
|---|---|---|---|
| 1 | In milling operations with horizontal and vertical spindle machines, which one is likely to hold dimensional accuracy better? Why? | **BT6** | **15** |
| 2 | How would you recommend machining dovetails onto air compressor blades? | **BT6** | **15** |
| 3 | Why do machined gears have to be subjected to finishing operations? Which of the finishing processes are not suitable for hardened gear teeth? Why? | **BT6** | **15** |
| 4 | If expanded honeycomb panels were to be machined in a form milling operation, what would you do to keep the sheet metal from buckling? Think up as may solutions as you can and write down any two. | **BT6** | **15** |

## UNIT IV ABRASIVE PROCESS AND BROACHING

**Part-A (2 Marks)**

| | | |
|---|---|---|
| 1. | How does loading differ from glazing in grinding process? | BT1 |
| 2 | List out the factors involved in the selection of a grinding wheel. | BT1 |
| 3. | Why are most abrasives now made synthetically? | BT6 |
| 4. | Narrate the working principle of abrasive jet machining. | BT4 |
| 5. | What is an abrasive? What are super abrasives? | BT2 |
| 6. | Define hardness of the grinding wheel. | BT1 |
| 7. | Define lapping. | BT1 |
| 8. | How will you express“ grade” and “structure” of a grinding wheel? | BT2 |
| 9. | Discuss the parameters that would affect the MRR in abrasive jet machining. | BT2 |
| 10. | Give four important factors that influence the selection of grinding wheel. | BT2 |
| 11. | Discuss the need of truing and dressing operations in a grinding wheel. | BT2 |
| 12. | Point out the abrasives used in manufacture of grinding wheels. | BT4 |
| 13. | Classify the types of external grinders. | BT3 |
| 14. | Discuss the operations done in centre less grinders. | BT2 |
| 15. | Explain the work holding and supporting devices used in grinders. | BT4 |
| 16. | Explain why the centre less grinders are called as specialized machines for Cylindrical parts? | BT5 |
| 17. | Classify the different types of fine finishing process. | BT3 |
| 18. | Discuss surface integrity. | BT2 |
| 19. | What is the principle of a broaching process? | BT1 |
| 20. | What are the principal types of broaching machines? | BT1 |

**Part-B (13 Marks)**

| | | | | |
|---|---|---|---|---|
| 1 | a | Explain the working mechanism of cylindrical and surface grinding. | **7** | **BT2** |
| | b | Discuss the various bonding materials used for making grinding wheels. | **6** | **BT5** |
| 2 | a | What are the consequences of allowing the temperature to rise during grinding? | **7** | **BT1** |
| | b | The performance of a grinding wheel depends upon the type of abrasive, grain size, grade, structure and bonding material. Discuss the effect of each. | **6** | **BT4** |
| 3 | a | What do you understand by grinding as an abrasive process? Explain with a neat sketch. | **7** | **BT1** |
| | b | What precaution should you take when grinding high precision? | **6** | **BT3** |
| 4 | a | What is Surface grinding? What are the different types of surface grinding machines? | **7** | **BT1** |
| | b | Explain why there are so many different types and sizes of grinding wheels? | **6** | **BT2** |
| 5 | | Explain the working principle and various methods of centreless grinding with a neat sketch. | **13** | **BT2** |

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|---|---|---|---|---|
| 6 | a | Sketch and explain the three methods of external cylindrical centre less grinding. | **7** | **BT4** |
| | b | Why speeds so much higher in grinding than in cutting? | **6** | **BT1** |
| 7 | a | Explain dressing and truing of grinding wheel. | **7** | **BT1** |
| | b | What factors could contribute to chatter in grinding? | **6** | **BT2** |
| 8 | a | Explain the factors to be considered to select a grinding wheel and recommended parameters. | **7** | **BT2** |
| | b | What are the effects of wear flat on the grinding process? | **6** | **BT1** |
| 9 | a | How do you classify cylindrical grinders? What is the difference between "Plain and universal "cylindrical grinder? | **7** | **BT1** |
| | b | Describe the use of cutting fluids in grinding. | **6** | **BT3** |
| 10 | a | Briefly discuss about the different types of abrasives used in a grinding wheel. | **7** | **BT4** |
| | b | Discuss with neat sketch vertical broaching machines. | **6** | **BT5** |
| 11 | a | Describe the factors that contribute to broaching force and explain why they do so. | **7** | **BT5** |
| | b | Describe the conditions under which broaching would be the preferred method of machining. | **6** | **BT5** |
| 12 | a | Describe the concept of surface integrity. | **7** | **BT2** |
| | b | Explain the generalised classification of broaching machines. | **6** | **BT2** |
| 13 | | Explain Surface and continuous broaching. Give the advantages and disadvantages of surface and continuous broaching. | **13** | **BT2** |
| 14 | | Explain the construction of a Push type and pull type broaching machine. | **13** | **BT2** |

**PART-C (15 Marks)**

| | | | | |
|---|---|---|---|---|
| 1 | | Describe as many parameters as you can that could affect the final surface finish in grinding. Include process parameters as well as setup and equipment. | **BT6** | **15** |
| 2 | | Jewellery applications required the grinding of diamonds into desired shapes. How is this done, since diamond is the hardest material known? | **BT6** | **15** |
| 3 | | Would you encounter any difficulties in grinding thermoplastics? Thermosets? If so, what precautions would you take? | **BT6** | **15** |
| 4 | | Would you recommend broaching a keyway on gear blank before or after machining the teeth? Why? | **BT6** | **15** |

## UNIT V CNC MACHINING

**Part-A (2 Marks)**

| | | |
|---|---|---|
| 1. | Define NC, DNC and CNC. | BT1 |
| 2 | Discuss about linear bearings. | BT2 |
| 3. | Explain the types of ball screws. | BT4 |
| 4. | Discuss about feed drives. | BT2 |
| 5. | Classify the types of motion control system used in NC machines. | BT3 |
| 6. | Describe APT language. | BT2 |
| 7. | Compare a closed loop NC system with open loop system. | BT4 |
| 8. | Describe preparatory function? How is it important in CNC programming? | BT2 |
| 9. | How are various functions timed in a NC machine. | BT1 |
| 10. | Explain a canned cycle. | BT5 |
| 11. | What is adaptive control? | BT1 |
| 12. | What are the classifications of NC machines? | BT3 |
| 13. | Distinguish a fixed zero and floating zero. | BT4 |
| 14. | Explain the role of computer for NC machine tool. | BT5 |
| 15. | Define point–to –point (PTP) system. | BT1 |
| 16. | Compare G-Codes and M-Codes with examples. | BT4 |
| 17. | List the commonly used coordinate systems of CNC machine tools. | BT2 |
| 18. | List the reason for development for micromachining process. | BT1 |
| 19. | Name the process involved in wafer forming. | BT1 |
| 20. | What is the difference between photo chemical blanking and chemical blanking? | BT1 |

**Part-B (13 Marks)**

| | | | | |
|---|---|---|---|---|
| 1 | a | Define CNC and DNC. With a help of a diagram explain the working of NC machine tool. | **7** | **BT2** |
| | b | Discuss the major elements of CNC machine tools | **6** | **BT4** |
| 2 | a | Discuss the design considerations of CNC machines. | **7** | **BT4** |
| | b | Discuss about slide ways used in CNC machine tools. | **6** | **BT4** |
| 3 | a | List the difference between manual and computer assisted part programming. | **7** | **BT1** |
| | b | Explain the various elements of NC machine with closed loop control system. | **6** | **BT3** |
| 4 | | Explain the following in CNC machining.<br>I. Linear Interpolation<br>II. Circular Interpolation<br>III. Cubic interpolation | **13** | **BT2** |
| 5 | a | Explain the main difference between point to point and continuous path of numerically controlled machine tools. | **7** | **BT2** |
| | b | Under what conditions of production the numerically controlled machine tools are employed. | **6** | **BT3** |

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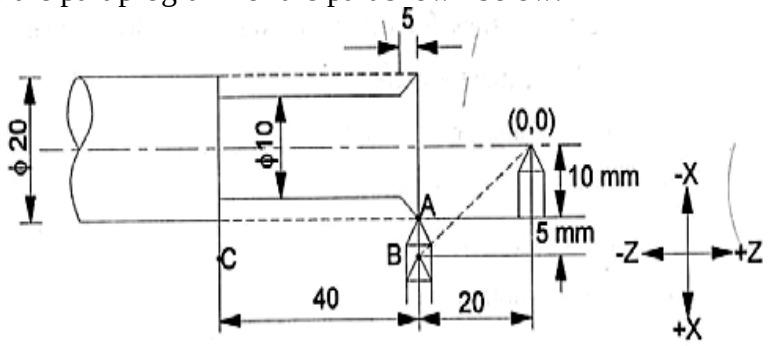
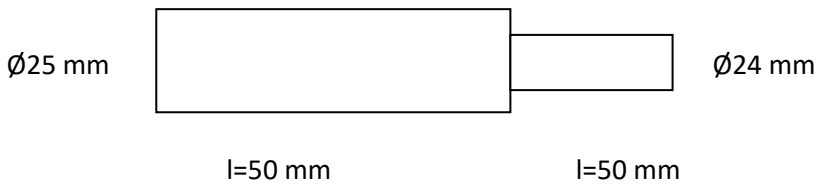
|---|---|---|---|---|
| 6 | | Explain the various statements used in APT language, with suitable examples. | **13** | **BT2** |
| 7 | | Describe the principle of numerical control of machines. What factors need for and development of numerical control? Name typical applications. | **13** | **BT5** |
| 8 | a | Describe the spindle and feed drives. State the requirement of the drives of CNC machine tools. | **7** | **BT5** |
| | b | Describe in brief the basic components of a tape operated NC machine tools | **6** | **BT5** |
| 9 | a | List any five motions and control statements of computer assisted NC programming and explain. | **9** | **BT1** |
| | b | State a few typical applications where the use of NC would be justified. | **4** | **BT4** |
| 10 | a | List and explain G-code and M-code for turning and milling operations. | **7** | **BT1** |
| | b | Is drilling and punching the only application for point to point system? Explain. | **6** | **BT6** |
| 11 | | Develop the part program for the part shown below.   | **13** | **BT6** |
| 12 | | List and explain factors that contribute to poor surface finish in micromachining process. | **13** | **BT1** |
| 13 | | The following fig shows the finished size of round bar. The original diameter of the bar was 28 mm. Make a part program for facing, Parting and reduction of diameter. Take feed =200 mm/min, spindle speed = 640 r.p.m and depth of cut = 2 mm/cut.   | **13** | **BT4** |
| 14 | | What do you understand by micromachining? Explain the various steps involved in micromachining. Also mention its applications. | **13** | **BT2** |

**PART-C (15 Marks)**

| | | | |
|---|---|---|---|
| 1 | How would you describe the principle of computer aided manufacturing to an older worker in a manufacturing facility who is not familiar with computers? | **BT6** | **15** |
| 2 | Are Deburring operations necessary for parts made by micromaching process. Explain and give any two examples. | **BT6** | **15** |
| 3 | Micro machining is an advanced machining process. Justify with examples. | **BT6** | **15** |
| 4 | Do you think you should be possible to produce spur gear by micromachining process, starting with a round blank? Explain | **BT6** | **15** |