Reg. No. ☐☐☐☐☐☐☐☐☐☐☐☐☐

**B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023**
Fourth Semester
**ME18402 – MACHINE TOOLS AND MACHINING PROCESSES**
*(Mechanical Engineering)*
**(Regulation 2018 / 2018A)**

TIME: 3 HOURS            STATEMENT            MAX. MARKS: 100

| COURSE OUTCOMES | STATEMENT | RBT LEVEL |
|---|---|---|
| CO 1 | The students will be able to estimate the cutting force during machining, identify the type of chips for a given material and will justify the tool angles for a given single point cutting tool | 3 |
| CO 2 | The students will be able to elucidate the construction details and will prepare the operation planning sheet for a given part diagram | 3 |
| CO 3 | Students will choose appropriate gear manufacturing process and its associate machine tools for gear manufacturing | 3 |
| CO 4 | Students can classify and choose among the finishing processes as per requirement | 3 |
| CO5 | Students will be able to choose appropriate non – traditional machining processes based on their principle and limitation | 3 |

**PART- A (10 x 2 = 20 Marks)**
(Answer all Questions)

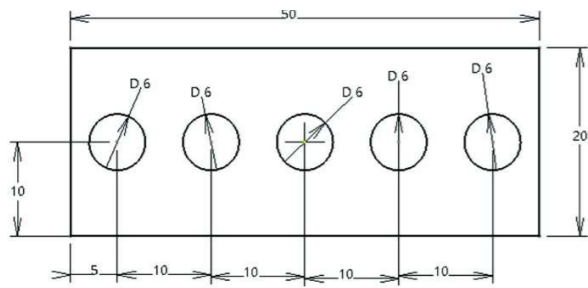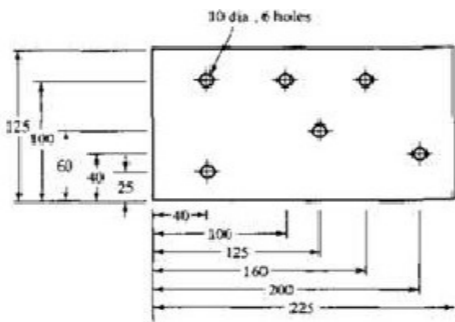| | | CO | RBT LEVEL |
|---|---|---|---|
| 1. | You have got a job order for machining cast iron and aluminium. As a machinist which one will be easier to machine and what are the challenges to be overcome while machining these materials? | 1 | 3 |
| 2. | Why machining at higher cutting speeds yields lesser tool life? Suggest some cutting tools that can be selected for machining at higher cutting speeds. | 1 | 3 |
| 3. | A cylindrical job of φ 250 X 1250 mm length has to be machined. What specification of the lathe must be referred and justify. | 2 | 3 |
| 4. | A larger diameter workpiece has to be machined in batch production. Which machine has to be selected and justify? | 2 | 3 |
| 5. | A lathe headstock has spur gears for changing the spindle speed. One of the spur gear teeth has broken. What gear parameters must be referred to manufacture the gear and what machine tool you will select to manufacture the broken gear? Justify. | 3 | 3 |
| 6. | A round rod has to be converted into polygon having 6 surfaces. What machine tool can be selected and how to do this operation in an economical way? | 3 | 3 |
| 7. | While referring to the product diagram how will you decide whether finishing or superfinishing is required or not? Justify with an example. | 4 | 3 |
| 8. | What programming mode has to be selected for machining the parts shown in Figure 1 and 2 respectively? Justify and what is the respective G codes. | 4 | 3 |



Figure 1          Figure 2

| | | | |
|---|---|---|---|
| 9. | Identify the mechanism of material removal, transfer media and energy source for EDM. | 5 | 2 |

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| | | | |
|---|---|---|---|
| 10. | List the applications of WJM process. | 5 | 2 |

**PART- B (5 x 14 = 70 Marks)**

| | | | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|---|---|
| 11. (a) | (i) | In an orthogonal cutting operation, following observations were made Cutting speed = 25m/min, Width of cut =2.5 mm, feed – 0.24 mm/rev, Chip thickness =0.4 mm, cutting force = 1400 N, feed force = 400 N, Tool rake angle = $5^0$ Calculate: 1. Shear angle 2. Friction angle 3. Chip flow velocity 4. Shear strain, 5. Power consumed at tool in kW | | (10) | 1 | 3 |
| | (ii) | What is the difference between a tool signature and a tool nomenclature? | | (4) | 1 | 2 |

**(OR)**

| | | | | | | |
|---|---|---|---|---|---|---|
| (b) | (i) | The following cutting speed of cutting time observations have been noted in a machining process. (16) | | (10) | 1 | 3 |

| Cutting speed , V | 28 m/min | 41 m/min |
|---|---|---|
| Cutting time, T | 75 min | 18 min |

Calculate
     a) n and C
     b) Suggest the cutting speed for a tool life of 50 minutes
     c) Calculate the tool life for a cutting speed of 50 m/min
     d) Calculate the percentage increase in tool life for a cutting speed of 20 m/min in comparison with the tool life at 50 m/min.

| | | | | | | |
|---|---|---|---|---|---|---|
| | (ii) | How the wear rate varies with respect to the cutting time for various cutting speed? Explain graphically. | | (4) | 1 | 2 |
| 12. (a) | (i) | A lathe has four steps of cone pulley, the diameter of each being 90mm, 130mm, 170 mm and 210 mm respectively. The counter shaft pulley which is connect to the motor runs at 100 rpm. The gears A, B, C and D have 16, 48, 16 and 48 teeth respectively. Draw the arrangement and find the various speeds of the spindle. If the cutting speed for turning and threading operation is 40m/min and 10m/min respectively what should be spindle speed to be selected for each operation if the diameter of the workpiece is 40 mm. | | (10) | 2 | 3 |
| | (ii) | Identify the operation performed in Figure 3-6. | | (4) | 2 | 2 |
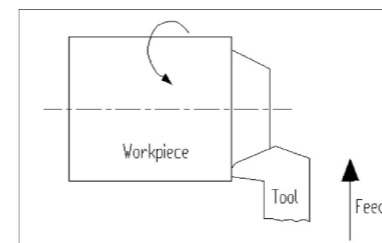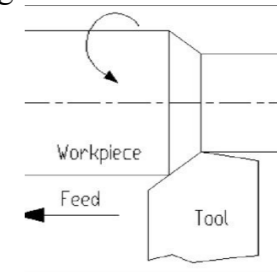


Figure 3          Figure 4



Figure 5          Figure 6

**(OR)**

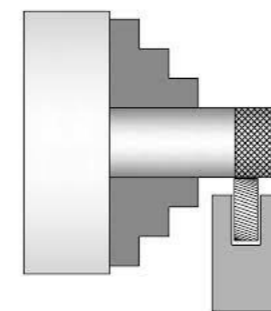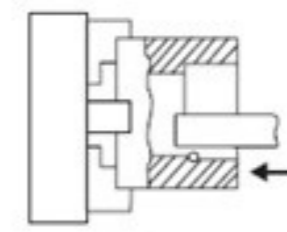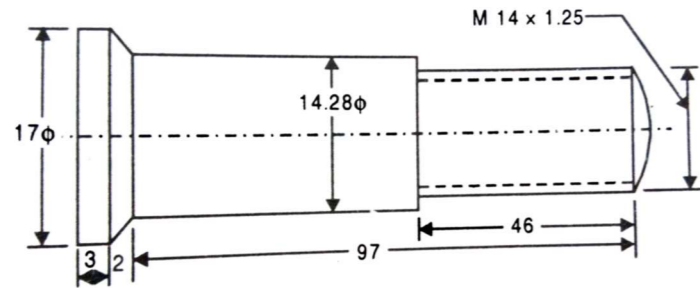| | | | | | |
|---|---|---|---|---|---|
| **(b)** | **(i)** | For repetitive manufacturing of the component shown in the figure 7 <br> 1. Suggest a suitable machine tool <br> 2. List out the sequence of machining operations <br> 3. Cutting tools required and <br> 4. Position the cutting tools at appropriate place on the machine tool and show it with a neat sketch. | **(10)** | **2** | **3** |



Figure 7 (All dimensions are in millimeter)

| | | | | | |
|---|---|---|---|---|---|
| | **(ii)** | What is the purpose of a feed rod and lead screw in a lathe? | **(4)** | **2** | **2** |
| **13. (a)** | **(i)** | What mechanism are employed in a shaper for converting a rotary into a reciprocating motion? Explain how a quick return tool motion is achieved in a shaper. | **(10)** | **3** | **3** |
| | **(ii)** | A component shown in the figure 8 has to be manufactured and the job order quantity is small. Select a suitable machine, list the sequence of operations and also the associated cutter. **(Drill size standards are 6, 8.50, 12 mm)** | **(4)** | **3** | **3** |
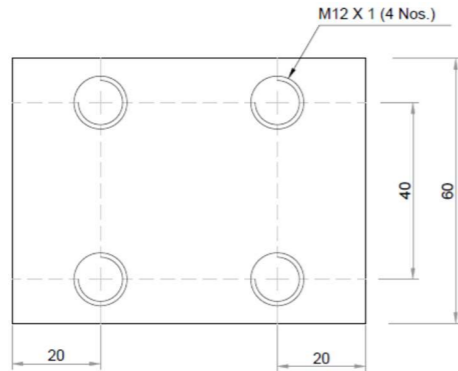


Figure 8 (All Dimensions are in millimeter)

**(OR)**

| | | | | | |
|---|---|---|---|---|---|
| **(b)** | **(i)** | A helical gear of 93 teeth has to be manufactured by gear milling. Determine what indexing method can be used and calculate the hole spaces to be moved. <br> **(Use the index plate which has 21, 23, 27, 29, 31 and 33 hole circles)** | **(10)** | **3** | **3** |
| | **(ii)** | Shanti Gears in Coimbatore is manufacturing gears through the year. What kind of machine tools will be used for manufacturing gears? Justify your statement. | **(4)** | **3** | **3** |
| **14. (a)** | **(i)** | An engine cylinder has been manufactured by casting process. The bore has to be machined to the closer dimensional tolerance of 0.002 mm. What will be sequence of operations and explain the respective machine tools | **(10)** | **4** | **3** |
| | **(ii)** | A grinding wheel is specified as A 24 K 7 V. What does each letter indicates? | **(4)** | **4** | **3** |

**(OR)**

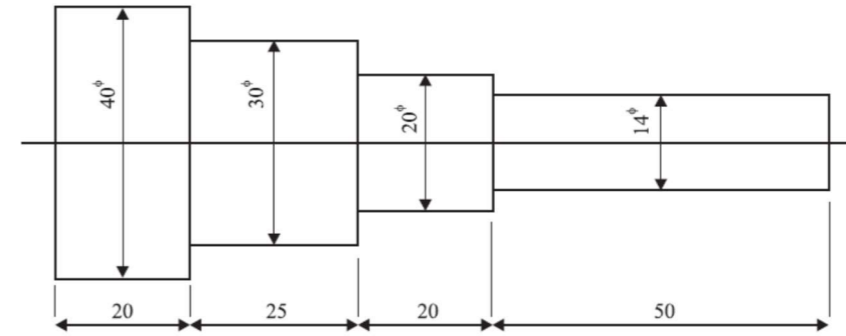| | | | | | |
|---|---|---|---|---|---|
| **(b)** | | Write a CNC part program for the component shown in the figure 9. Assume the raw material size as $\phi$ 42 x 116 mm | **(14)** | **4** | **3** |



Figure 9 (All dimensions are in millimeter)

| | | | | | |
|---|---|---|---|---|---|
| **15. (a)** | **(i)** | Write short notes on electrical discharge machining and list down its applications and advantages. | **(10)** | **5** | **2** |
| | **(ii)** | How the non-conventional machining processes are classified based on the energy sources? List them | **(4)** | **5** | **2** |

**(OR)**

| | | | | | |
|---|---|---|---|---|---|
| **(b)** | **(i)** | Explain the working principle of a Ultrasonic machining with a simple diagram and also list down the process parameters that affects the material removal rate. | **(10)** | **5** | **2** |
| | **(ii)** | List down the applications of abrasive jet machining. | **(4)** | **5** | **2** |

**PART- C (1 x 10 = 10 Marks)**
(Q.No.16 is compulsory)

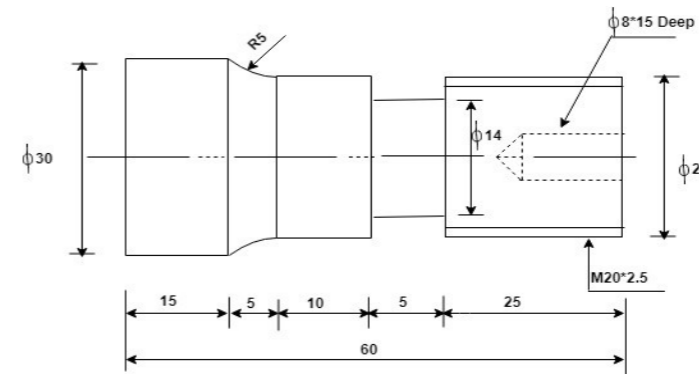| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **16.** | A component shown in the figure 10 has to be manufactured in a small quantity. What machine tool you will select, list down the sequence of operations, the corresponding tools and also the machining time. | **(10)** | **2** | **3** |



Figure 10 (All dimensions are in millimeter)