Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, December 2019

SUBJECT: MANUFACTURING TECHNOLOGY [MTE 3101]

(__/12/2019)

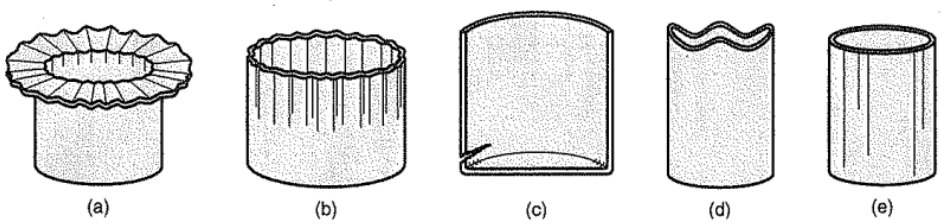
Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.

1A. How does very low or very high blank holding force in sheet metal drawing affects the final drawn product in each case? **02** **CO1**

1B. Identify the defects in sheet metal drawn parts in the figures (a), (b), (c), (d) and (e) given below and suggest the measures to prevent them. **04** **CO1**



1C. Plan the investment casting steps involved in manufacturing the parts as shown in Figure 1C with appropriate sketch. **04** **CO1**

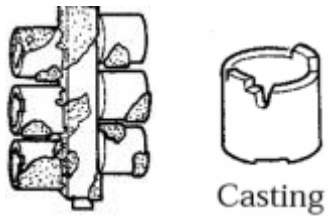


Figure Q1C Six identical parts ..

2A. Determine the appropriate punch and die sizes, and blanking force required for a blanking operation. The operation is to be performed on 2.0 mm thick cold rolled steel with a=0.075. The part is circular with diameter = 75.0 mm. The steel has a shear strength of 350 MPa and tensile strength 450 Mpa **03** **CO1**

2B. MIG welding process is used to weld titanium alloys. Enumerate its advantages and disadvantages as compared to other welding process. **03** **CO1**

2C. A businessman wants to establish a manufacturing unit for making ball and roller bearing races as well as steel wheels for railroads. Which deformation process will you choose for the manufacturing? Discuss the procedure and advantages of that process. **04** **CO1**

3A. Compare Welding, Soldering and Brazing process in the context of their strength, heat, final joint quality, material and application. **05** **CO1**

3B. A flexible machining system consists of a load/unload station and two machining workstations. Station 1 is the load/unload station. Station 2 performs milling operations and consists of two servers (two identical CNC milling machines). Station 3 has one server that performs drilling (one CNC drill press). The stations are connected by a part handling system that has four work carriers. The mean transport time is 3.0 min. The FMS produces two parts A and B. The part mix fractions and process routings for the two parts are presented in the table Q3B. The operation frequency f_{ijk} = 1.0 for all operations. Determine: **05** **CO3**

(a) maximum production rate of the FMS,

(b) corresponding production rates of each product,

(c) utilization of each station, and

(d) number of busy servers at each station.

Table Q3B

Part (j)	Part Mix (P_j)	Operation (k)	Description	Station (i)	Process Time (t_{ijk}) min.
A	0.4	1	Load	1	4
		2	Mill	2	30
		3	Drill	3	10
		4	Unload	1	2
B	0.6	1	Load	1	4
		2	Mill	2	40
		3	Drill	3	15
		4	Unload	1	2

4A. A flexible manufacturing system (FMS) is being planned. It has a ladder layout as pictured in Figure Q4A. It uses a rail guided vehicle (RGV) system to move parts between stations in the layout. All workparts are loaded into the system at station 1, moved to one of three processing stations (2, 3, or 4), and then brought back to station 1 for unloading. Once loaded onto its RGV, each workpart stays onboard the vehicle throughout its time in the FMS. Load and unload times at station 1 are each 1.0 min. Processing times are: 5.0 min at station 2; 7.0 min at station 3; and 9.0 min at station 4. Hourly production of parts through the system is: 7 parts through station 2; 6 parts through station 3 and; 5 parts through station 4. (a) Develop the from-to Chart for trips and distances; (b) Develop the network diagram. (c) Determine the number of rail guided vehicles that are needed to meet the requirements of the flexible manufacturing system, if vehicle speed = 60 m/min and the anticipated traffic factor = 0.85. Assume reliability = 100%. **05** **CO3**

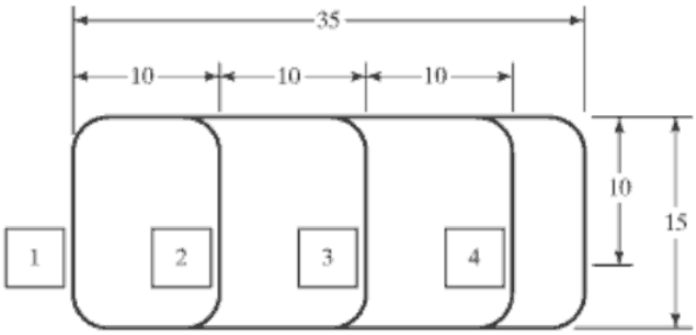
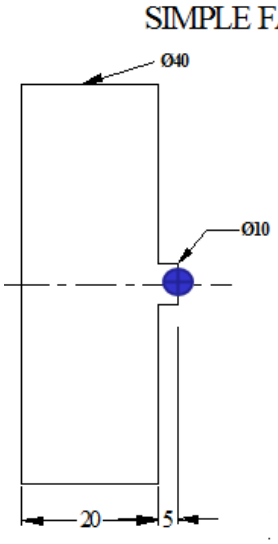


Figure Q4A.

4B. In the figure Q4B, CNC lathe program and part design are given. Write a program to reduce the size of this program using Box facing cycle with block (G94 X_ Z_ F60) keeping initial preparatory and ending commands intact. **03** **CO2**




```
O1002
G21 G98
G28 U0 W0
M06 T0101
M03 S2000
G00 X41 Z1
G00  X41 Z-1
G01 X10 Z-1 F30
G01 X10  Z1
G00 X41 Z1
G00 X41  Z-2
G01 X10 F30
G01 Z1
G00 X41
Z-3
G01 X10 F30
G01 Z1
G00 X41
Z-4
G01 X10 F30
G01 Z1
G00 X41
Z-5
G0I X10 F30
G01 Z1
G28 U0 W0
M05
M30
```

4C. Where is the relevance of canned cycle function and what is its complete syntax for drilling a hole of radius "R" **02** **CO2**

5A. An engineer was given a task of analyzing static, dynamic and thermal load conditions of a CNC machine. What design considerations would you suggest so that CNC machine can sustain individual loads. **03** **CO2**

5B. For Rectangular pocketing, the programming block given below is used. State what does each letter represents. **02** **CO2**

```
G172 I1  J1  K1  R  P1  Q  X  Y  Z1
G173 I2  K2 P2  T  S   R  F  B  J  Z2
```

5C. Write a CNC program for turning a cylindrical bar of diameter 22mm and length 60 mm into a part design shown in the figure Q5C. **05** **CO2**

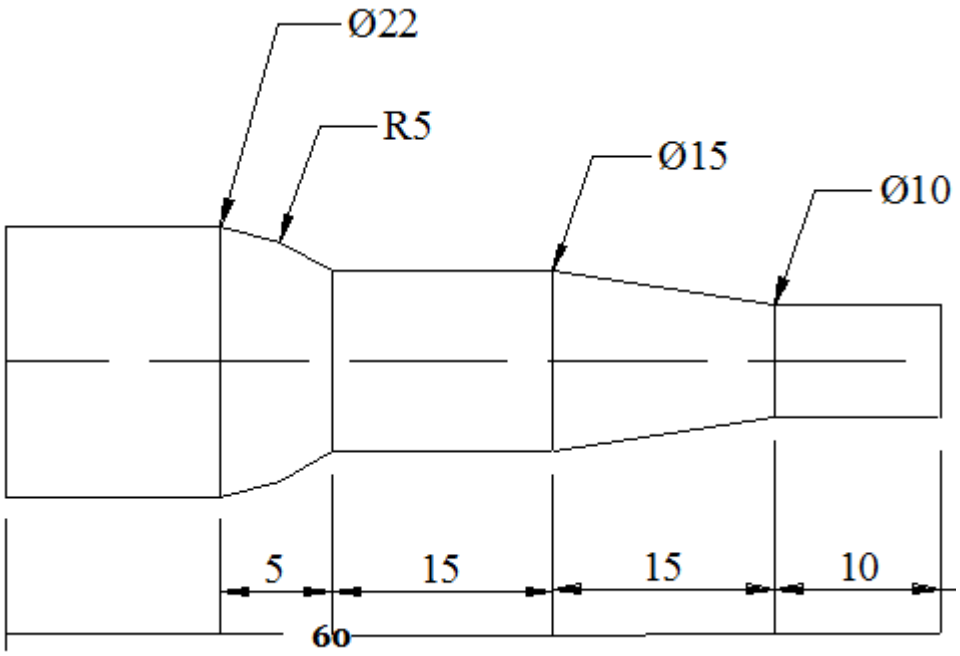


Figure Q5C.