Reg. No.										

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

V SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2019

SUBJECT: MANUFACTURING TECHNOLOGY [MTE 3101]

(14/11/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.

1A. List out the reasons for machining allowances in the casting process and suggest the factors on which amount of machining allowance depends on. **02** **CO1**

1B. Identify the different casting defects in each of the figures Q1B. (a), (b), (c), (d) given below and suggest the measures to prevent them. **04** **CO1**

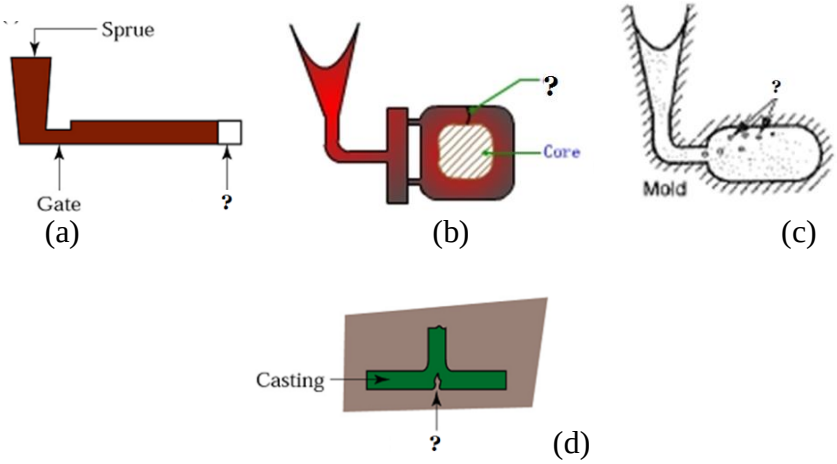

Figure Q1B (a) (b) (c) (d)

1C. Show your analysis for Ram force and die angle relation, shown in figure Q1C, through a graph and suggest the reasons and consequences for such nature of ram force dependency on the die angle. **04** **CO1**

.

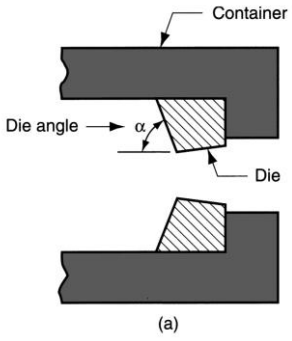

Figure Q1C

2A. The force requirement in a blanking operation of low carbon steel sheet is 5.0 kN. The thickness of the sheet is 't' and the diameter of the blanked part is 'd'. For the same work material, if the diameter of the blanked part is increased to 1.5 d and thickness is reduced to 0.4 t, determine the new blanking force. **02** **CO1**

2B. Determine the maximum shear force and actual work done in the shear cutting operation for a sheet of 5mm thickness which is cut along a length of 200 mm. The cutting blade is 400 mm (figure Q2B) and shear angle is provided on the edge. The ultimate shear strength of the sheet is 100MPa and penetration to thickness ratio is 0.2. Neglect friction. **04** **CO1**

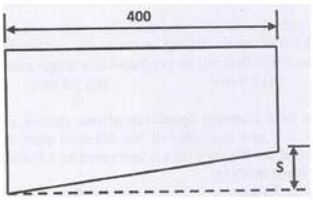

Figure Q2B

2C. Determine the heat generated due to current, the heat required for melting and melting efficiency when two metallic sheets, each of 2.0 mm thickness, are welded in a lap joint configuration by resistance spot welding at a welding current of 10 kA and welding time of 10 millisecond. The spherical fusion zone extending up to the full thickness of each sheet is formed. The properties of the metallic sheets are given as: **04** **CO1**

Ambient temperature = 293 K

Melting temperature = 1793 K

Density =7000 kg/m^3

Latent heat of fusion=300 kJ/kg

Specific heat =800 J/kg K

The contact resistance along sheet—sheet interface is 500 micro-ohm and along electrode—sheet interface is zero.

Note:- There is no conductive heat loss through the bulk sheet materials; and the complete weld fusion zone is at the melting temperature.

3A. Compare Grinding, Lapping and Honing process in the context of their tool, process, final surface quality, material and application. **5** **CO1**

3B. An FMS consists of four stations. Station 1 is a load/unload station with one server. Station 2 performs milling operations with three servers (three identical CNC milling machines). Station 3 performs drilling operations with two servers (two identical CNC drill presses). Station 4 is an inspection station with one server that performs inspections on a sampling of the parts. The stations are connected by a part handling system that has two work carriers and whose mean transport time = 3.5 min. The FMS produces four parts. A, B, C, and D. The part mix fractions and process routings for the four parts are presented in the table 3B. Determine: **5** **CO3**

(a) the maximum production rate of the FMS,

(b) The corresponding production rate of each part,

(c) utilization of each station in the system,

(d) The overall FMS utilization and

(e) The number of busy servers at each station.

Table 3B.

Part (j)	Part Mix (Pj)	Operation (k)	Description	Station (i)	Process Time (t_{ijk}) min.	Frequency F_{ijk}
A	0.3	1	Load	1	4	1.0
		2	Drill	3	23	1.0
		3	Inspect	4	8	0.5
		4	Unload	1	2	1.0
B	0.4	1	Load	1	4	1.0
		2	Mill	2	30	1.0
		3	Inspect	4	12	0.333
		4	Unload	1	2	1.0

4A. An AGVS will be used to satisfy the material flow indicated in from-to chart in the table Q4A which shows deliveries per hour between stations (above the slash) and distances in metres (below the slash). Moves indicated by "L" are trips when the vehicle was loaded and the one indicated by "E" are trips when the vehicle is empty. Traffic factor = 0.85, Availability A = 0.90, speed of vehicle = 0.9 m/s. If load handling time per delivery is 1 minute, Draw a suitable layout for the given problem and determine the following. Average delivery and empty distance, Total cycle time per delivery, the number of vehicles needed to satisfy indicated deliveries per hour. **5** **CO3**

Table Q4A.

	To:	1	2	3	4
From:	1	0/0	9L/90	7L/120	5L/75
	2	5E/90	0/0	0/NA	4L/80
	3	7E/120	0/NA	0/0	0/NA
	4	9E/75	0/NA	0/NA	0/0

4B. For the figure Q4B, study the CNC code given for machining it then create a smaller and simpler program for the same Figure using box turning block G90 X_ Z_ F_. **3** **CO2**

.

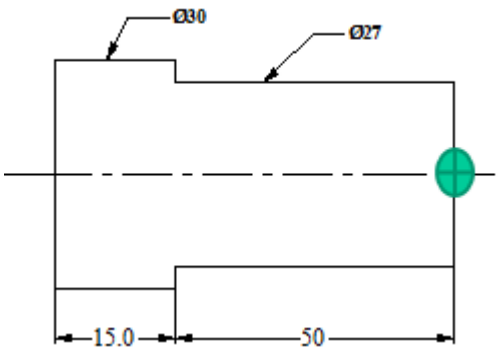

Figure Q4B.

```
O1000
G21 G98
G28 U0 W0
M06 T0101
M03 S2000
G00 X30 Z1
G00 X29 Z1
G01 X29 Z-50 F50
G01 X30 Z-50
G00  X30 Z1
G00 X28 Z1
G01 X28 Z-50
G01 X30 Z-50
    G00 X30 Z1
     G00 X 27 Z1
      G01 X27 Z-50
     G01 X30 Z-50
     G00 X30 Z1
     G28 U0 W0
     M05
     M30
```

4C. Where do you find the sub-programming relevant and what does code M98 P0015000 indicates about the sub-program **02** **CO2**

5A. Classify the types of antifriction bearings and enumerate the applications of these type of bearings. **02** **CO2**

5B. In figure Q5B, tool radius is 5mm, circular profile radius is 20mm, for movement of tool from point 4 to point 5, fill in the blank for the code block N015 G91 G02 X_ Y_ I_ J_. **03** **CO2**

Suggest the CNC code block to simplify the given code using radius instead of center co-ordinates.

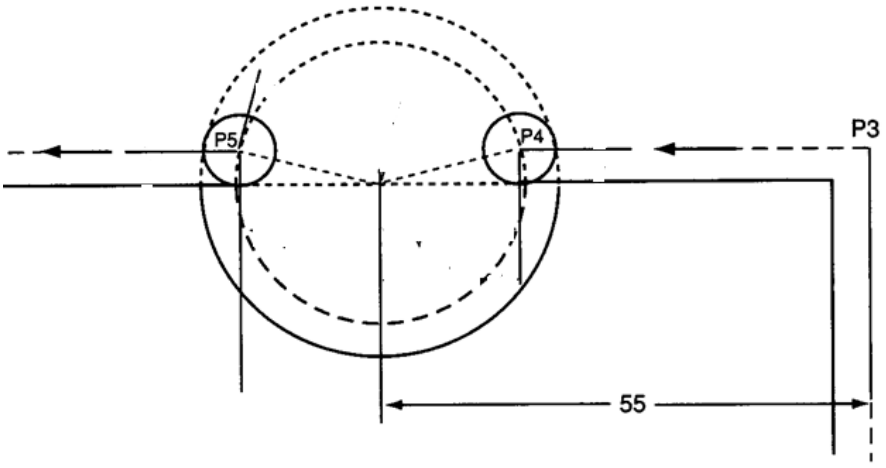

Figure Q5B.

5C. Write a CNC programme for turning a cylindrical bar of diameter 32mm and length 70 mm into the shape given in the figure Q5C. **5** **CO2**

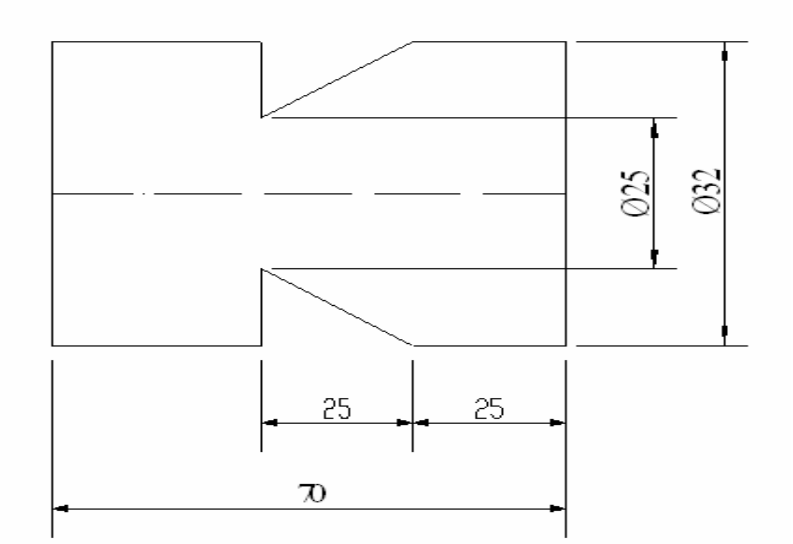

Figure Q5C.