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

IV SEMESTER B. TECH (INDUSTRIAL & PRODUCTION ENGINEERING)

END SEMESTER (GRADE IMPROVEMENT) EXAMINATION, AUGUST 2021

SUBJECT: MANUFACTURING AUTOMATION ENGINEERING (MME 2256)

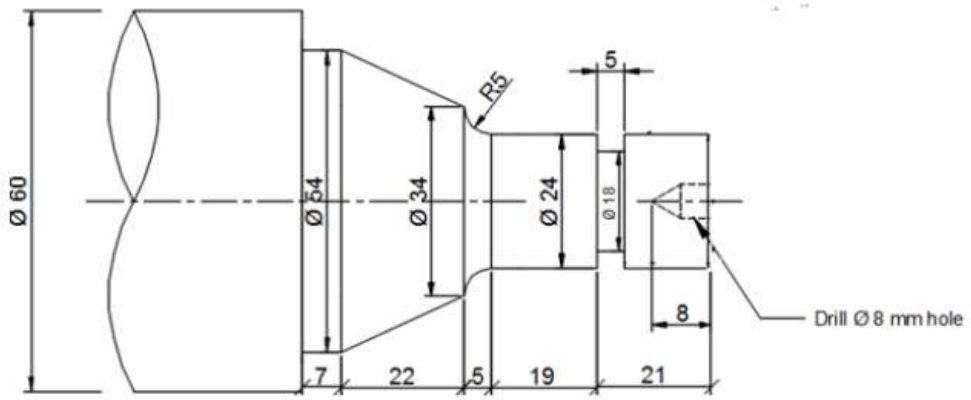
REVISED CREDIT SYSTEM

Time: 120 Minutes **MAX. MARKS: 40**

Note: Answer ANY FOUR FULL questions.

1A	A double acting cylinder guides cylinder pins towards a measuring device. The pins are separated by means of a continuous to and fro movement. The oscillating motion can be started by means of a valve with selector switch. The duration of forward stroke and return stroke of the cylinder is to be adjustable. The cylinder is to remain in the forward end position for t = 5 seconds. Design a pneumatic circuit to automate the process.	**4**
1B	With a neat sketch explain the working of a pneumatic pressure regulator.	**3**
1C	With a neat sketch explain the construction and working of a 3/2 direction control valve used in pneumatic systems.	**3**
2A	A station uses conveyor system to check the presence of lids on cans. If a can without a lid is encountered, then the can must be pushed aside from the conveyor into a bin by a pneumatic cylinder. The lids and cans are interrogated by means of sensors. Design an electro pneumatic circuit for the process.	**4**
2B	With the help of electro pneumatic circuit explain the latching circuit.	**3**
2C	Identify and explain with a neat sketch the working of the component used in electro pneumatic systems which is used to detect the advanced and retracted end positions of the piston rod in linear actuators.	**3**

3A	An electro pneumatic system requires a sensor to detect the presence of non-metallic parts in the shop floor. Identify and explain the working of the component with the help of a neat sketch.	**4**
3B	With the help of a pneumatic circuit explain the working of a one-way flow control valve.	**3**
3C	What are the advantages of using compressed air in pneumatic systems?	**3**
4A	With a neat sketch explain cylindrical and tapered roller bearing.	**4**
4B	List and explain any three types of material handling equipment.	**3**
4C	Sketch and explain loop layout group machine cell with semi – integrated handling system.	**3**
5A	Write a CNC part program for the workpiece shown in Fig. 1.	**4**

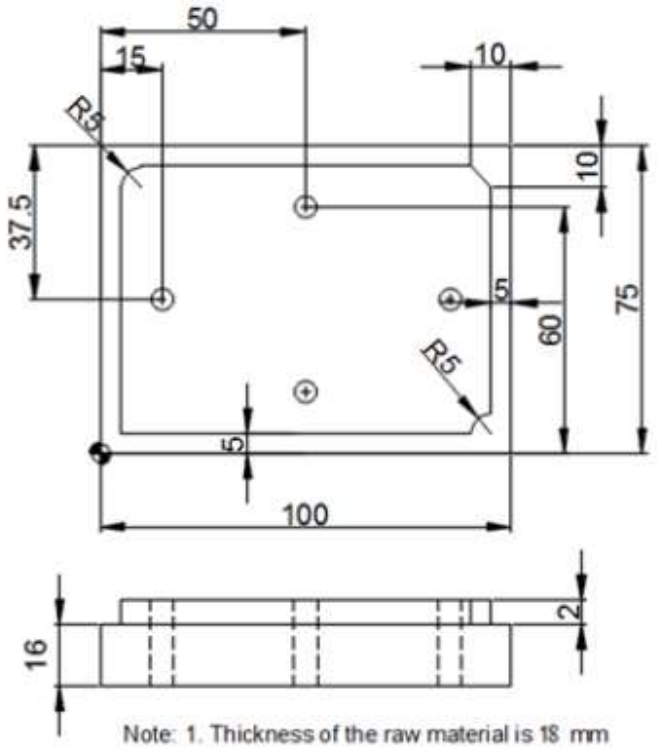


Note: 1. Blank dia = 60 mm
2. Use grooving tool width 3 mm

Figure 1

5B	List and explain Flexible Manufacturing System data files.	**3**
5C	With a neat sketch explain the working of timing belt.	**3**
6A	Write a short note on Material Requirement Planning.	**4**
6B	Write a short note on multi-class part classification and coding system.	**3**

6C Write a CNC part program for the workpiece shown in Fig. 2. **3**



Note: 1. Thickness of the raw material is 18 mm

Tools to be used: 1. Ø 20 mm end mill
2. Ø 5 mm drill tool

Figure 2

MME 2256: Manufacturing Automation Engineering

1. Hydraulic systems

1.1. Force on the piston in a linear actuator (piston cylinder assembly)

$F_E = p * A_P$

$F_R = p * (A_P - A_R)$

F_E & F_R = extension and retraction force (N)
p = fluid pressure (N/m^2)
$A_P = \frac{\pi D_P^2}{4}$ = piston area (m^2)
$A_R = \frac{\pi D_R^2}{4}$ = rod area (m^2)
D_P & D_R = piston and rod diameter (m)

1.2. Velocity of piston in a linear actuator

$V_E = \frac{Q}{1000 * A_P}$

$V_R = \frac{Q}{1000 * (A_P - A_R)}$

V_E & V_R = velocity of extension and retraction of the piston (m/min)
Q = Discharge (lpm)
$A_P = \frac{\pi D_P^2}{4}$ = piston area (m^2)
$A_R = \frac{\pi D_R^2}{4}$ = rod area (m^2)
D_P & D_R = piston and rod diameter (m)

1.3. Power generated by the actuator (kW)

$\text{Power} = \frac{F * v}{1000}$

F = Force (N)
v = velocity (m/s)

2. Computer Numerical Control and programming

2.1. Codes for Turning Centre

G Codes	M Codes
G00 - POSITIONING (RAPID TRAVERSE)	M00 - PROGRAM STOP
G01 - LINEAR INTERPOLATION (FEED)	M01 - OPTIONAL STOP
G02 - CIRCULAR INTERPOLATION (CW)	M02 - PROGRAM RESET
G03 - CIRCULAR INTERPOLATION (ACW)	M03 - SPINDLE FORWARD
G20 - INCH DATA INPUT	M04 - SPINDLE REVERSE
G21 - METRIC DATA INPUT	M05 - SPINDLE STOP
G28 - REFERENCE POINT RETURN	M06 - AUTO TOOL CHANGE
G70 - FINISHING CYCLE	M08 - COOLANT ON
G71 - STOCK REMOVAL IN TURNING	M09 - COOLANT OFF
G72 - STOCK REMOVAL IN FACING	M13 - SPINDLE FORWARD COOLANT ON
G73 - PATTERN REPEATING	M14 - SPINDLE REVERSE COOLANT ON
G74 - PECK DRILLING	M30 - PROGRAM RESET REWIND
G76 - THREAD CUTTING CYCLE	M38 - DOOR OPEN
G90 - TURNING CYCLE	M39 - DOOR CLOSE
G94 - FACING CYLCE	M98 - SUB PROGRAM CALL
G98 - FEED PER MINUTE	M99 - SUB PROGRAM END
G99 - FEED PER REVOLUTION	

2.2. Codes for Vertical Machining Centre

G Codes	M Codes
G00 - POSITIONING (RAPID TRAVERSE)	M00 - PROGRAM STOP
G01 - LINEAR INTERPOLATION (FEED)	M02 - PROGRAM RESET
G02 - CIRCULAR INTERPOLATION (CW)	M03 - SPINDLE FORWARD
G03 - CIRCULAR INTERPOLATION (ACW)	M04 - SPINDLE REVERSE
G20 - INCH DATA INPUT	M05 - SPINDLE STOP
G21 - METRIC DATA INPUT	M06 - AUTO TOOL CHANGE
G28 - REFERENCE POINT RETURN	M08 - COOLANT ON
G40 - TOOL NOSE RADIUS COMPENSATION CANCEL	M09 - COOLANT OFF
G41 - TOOL NOSE RADIUS COMPENSATION LEFT	M13 - SPINDLE FORWARD COOLANT ON
G42 - TOOL NOSE RADIUS COMPENSATION RIGHT	M14 - SPINDLE REVERSE COOLANT ON
G68 - CO-ORDINATE ROTATION	M30 - PROGRAM RESET & REWIND
G69 - CO-ORDINATE ROTATION CANCEL	M38 - DOOR OPEN
G73 - PECK DRILLING CYCLE	M39 - DOOR CLOSE
G76 - FINE BORING	M70 - MIRROR ALONG X ON
G80 - CANNED CYCLE CANCEL	M71 - MIRROR ALONG Y ON
G81 - DRILLING CYCLE	M80 - MIRROR ALONG X OFF
G82 - DRILLING CYCLE, COUNTER BORING	M81 - MIRROR ALONG Y OFF
G84 - TAPPING CYCLE	
G90 - ABSOLUTE DIMENSIONING	
G91 - INCREMENTAL COMMAND	
G94 - FEED PER MINUTE	
G95 - FEED PER REVOLUTION	
G98 - RETURN TO INITIAL POINT IN CANNED CYCLE	
G99 - RETURN TO R (Reference point) IN CANNED CYCLE	