SECTION – A

There are FOUR questions in this section. Answer any THREE.

All notations have their usual meaning.

1. (a) Discuss the relative advantages and disadvantages of wire frame geometry and solid model. (6)
   
   (b) Why do we use parametric representation in geometric modeling instead of exact forms? (6)
   
   (c) For a Bézier curve \( P_0 = (1, 1), P_1 = (2, 3), P_2 = (4, 4), P_3 = (6, 1) \)
   
   i) Find the values of the blending function at \( u = 0, 0.25, 0.5, 0.75, 1.0 \). (16)
   
   ii) Make a sketch of the blending functions.
   
   iii) Find the co-ordinates of the points on the curve at \( u = 0, 0.25, 0.5, 0.75, 1.0 \).
   
   iv) Make a sketch of the control polygon and the curve.
   
   (d) Compare between Bézier surfaces and B-spline surfaces with necessary sketches. (7)

2. (a) Check the topological consistency of the following solid model: (15)

   ![Diagram of a solid model]

   Contd ………. P/2
(b) Draw the following solid model using constructive solid geometry. (8)

(c) What is the difference between cell decomposition and spatial occupancy enumeration? Explain with neat sketches. (8)

(d) Define saturation, hue, lightness and brightness. (4)

3. (a) Differentiate between the following with examples –
   
   (i) Vector image vs. raster image
   (ii) Vector display vs. raster display
   (iii) Vector plotter vs. raster plotter
   (iv) LCD vs. LED display
   
   (b) What is the use of z-buffer algorithm in visual realism? Explain briefly. (4)

   (c) In a two dimensional drafting system the maximum display tolerance is 1.5 mm. Calculate the number of lines required to display the following figure within this tolerance and calculate the screen co-ordinates for points A, D and E. Also calculate the screen co-ordinate for any of the adjacent point of E. (15)

   Here, the window bounds are (0, 0) and (120, 100) and the viewpoint bounds are at pixel locations (50, 50) and (500, 600).
4. (a) What are the five sections of an IGES file for data transfer? (5)

(b) What is meant by Object Oriented Programming? What are the defining concepts of object orientation? Explain briefly. (10)

(c) The Fig. for Q. 4(c) shows the triangle ABC in OXaYaZa co-ordinate system. Here, the vertices are A(10, 50, 0), B(45, 50, 0) and C(25, 25, 0). (20)

(i) Find the mirror triangle A'B'C' of ABC about the line DE in OXaYaZa co-ordinate system. (Here, D(22, 5, 0)).

(ii) Find the co-ordinates of the vertices of the triangle A'B'C' according to the coordinate system OXbYbZb.

5. (a) Mention the benefit of CNC machining center over NC machine. (6)

(b) Write a G-code block to machine a complete circle using R command. (5)

(c) How can you distinguish 'Modal' code from 'Non-modal' code? Provide examples. (6)

(d) Briefly explain the measurement technique of CMM machine using a touch probe. (10)

(e) What is the difference between the following two blocks with respect to machine movement?

\[
\begin{align*}
G 00 & \quad X 50 \quad Y 100 \quad Z 80 \\
G 01 & \quad X 50 \quad Y 100 \quad Z 80 \quad F 100.0 \\
\end{align*}
\]

(Maximum machine travel speed 100 mm/min) (8)

6. (a) Servo motor with feedback control system is used for CNC machine travel. How is this system beneficial compared to stepper motor? (7)

(b) Mention three different types of motion control with appropriate application. (7)
(c) Turret ATC is less convenient compared to Carousal and Chaintype ATC – why? (6)

(d) Write a G-code for machining the part in Fig. Q. 6(d):

7. (a) Work offset can be set by three different types of Edge finder. Briefly explain working principle for each. (9)

(b) What is backlash in leadscrew? How does it affect the accuracy of a machined part? (8)

(c) "Dry run" is very important for any kind of CNC machining – why? (6)

(d) Write a G-code for turning the following part (profile only) in Fig. Q. 7(d):

(d) Write a G-code for turning the following part (profile only) in Fig. Q. 7(d): (12)
8. (a) Your company is going to launch a new product "Digital Medication Reminder" to the market.
   (i) Perform the design process according to Pahl and Beitz model. What are the limitations of this model? (15)
   (ii) How can you overcome these limitations? Explain. (12)
(b) What are the components of CAD system architecture? (8)
List of G-code for CNC Milling/Turning Operations

<table>
<thead>
<tr>
<th>G-code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G00</td>
<td>Rapid traverse</td>
</tr>
<tr>
<td>G01</td>
<td>Linear interpolation</td>
</tr>
<tr>
<td>G02</td>
<td>Clockwise circular interpolation</td>
</tr>
<tr>
<td>G03</td>
<td>Counterclockwise circular interpolation</td>
</tr>
<tr>
<td>G20</td>
<td>Inch data input</td>
</tr>
<tr>
<td>G21</td>
<td>Metric data input</td>
</tr>
<tr>
<td>G28</td>
<td>Automatic return to the reference point</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>G-code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G40</td>
<td>Tool (nose) radius compensation cancel</td>
</tr>
<tr>
<td>G41</td>
<td>Tool (nose) radius compensation left</td>
</tr>
<tr>
<td>G42</td>
<td>Tool (nose) radius compensation right</td>
</tr>
<tr>
<td>G54-59</td>
<td>Workpiece coordinate system 1-6 selection</td>
</tr>
<tr>
<td>G90</td>
<td>Absolute command programming</td>
</tr>
<tr>
<td>G91</td>
<td>Incremental command programming</td>
</tr>
<tr>
<td>G92</td>
<td>Zero offset setting</td>
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<table>
<thead>
<tr>
<th>G-code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G50</td>
<td>Maximum spindle speed command</td>
</tr>
<tr>
<td>G80</td>
<td>End of shape designation</td>
</tr>
<tr>
<td>G81</td>
<td>Start of longitudinal shape designation</td>
</tr>
<tr>
<td>G82</td>
<td>Start of traverse shape designation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G-code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G85</td>
<td>Call for rough bar turning cycle</td>
</tr>
<tr>
<td>G87</td>
<td>Call for finishing turning cycle</td>
</tr>
<tr>
<td>G96</td>
<td>Constant cutting speed</td>
</tr>
<tr>
<td>G97</td>
<td>Fixed RPM</td>
</tr>
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</table>

List of M-code for CNC Milling/Turning Operations

<table>
<thead>
<tr>
<th>M-code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M02</td>
<td>End of program</td>
</tr>
<tr>
<td>M03</td>
<td>Spindle clockwise</td>
</tr>
<tr>
<td>M04</td>
<td>Spindle counterclockwise</td>
</tr>
<tr>
<td>M05</td>
<td>Spindle stop</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>M-code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M06</td>
<td>Tool change</td>
</tr>
<tr>
<td>M08</td>
<td>Coolant on (spray)</td>
</tr>
<tr>
<td>M09</td>
<td>Coolant off</td>
</tr>
<tr>
<td>M30</td>
<td>End of program</td>
</tr>
</tbody>
</table>
SECTION A

There are four questions in this section. Answer any three.

1. (a) List the main dimensions of turret lathes. [6\frac{2}{3}]
   (b) In which method of taper turning you need to swivel the swivel plate of a lathe machine? Describe the method. [8]
   (c) With neat sketches, explain the working mechanisms of pull-in and push-out collet chucks. [15]
   (d) The kinematic diagram of model 16K20 engine lathe is shown in Figure 1(d). Explain the process of cutting non-standard threads by this model. [17]

2. (a) Show the generatrix, directrix, direction of cutting motion and direction of feed motion of planning operation performed in a planer machine. [6\frac{2}{3}]
   (b) What are the purposes of using multiple collars on the arbor of a horizontal knee-and-column type milling machine? [6]
   (c) What is the function of the feed engaging levers of a milling machine? [6]
   (d) Kinematic diagram of model 6P82 universal knee-type milling machine is shown in Figure 2(d). Find the spindle speed range and the vertical feed range. [28]

3. (a) The schematic diagram of setting up a universal dividing head for differential indexing is shown in Figure 3(a). Explain how you can modify this setup for simple indexing and for milling helical grooves. [8\frac{2}{3}]
   (b) The kinematic diagram of a shaper machine is shown schematically in Figure 3(b). Explain how the straight reciprocating movement of the ram carrying the tool and the intermittent cross movement of the table per double stroke of the ram are achieved. [16]
   (c) The kinematic diagram of model 2H135 vertical drill press is shown in Figure 3(c). If the motor rpm is 1450, show that the minimum spindle speed is 30.82 rpm, and the maximum feed rate is 1.6 mm/rev. [22]

4. (a) Differentiate between idle-run test and load test of machine tools. [6\frac{2}{3}]
   (b) With neat sketch, show the various movements in a vertical spindle grinder with a rotary table. [8]
   (c) With neat sketches, show how the setting of gear hobs changes with change in left-hand and right-hand hob, and left-hand and right-hand gear during cutting helical gears. [10]

Contd .......... P/2
(d) The kinematic diagram of the model 5122 gear-shaping machine is shown in Figure 4(d). Write down the kinematic-balance equation for circular coarse feed of the cutter.

Suppose, you are using this model to produce a spur gear. The required circular finish feed (rotation of the cutter) is 0.045 mm/double stroke of the cutter spindle. Determine the teeth numbers of the pick-off gears. Module of the circular gear cutter is 3 with 25 teeth. Available gears on the spare gearbox have the following teeth numbers:

10, 20, 30, 40, 50, 60, 70, 80, 90

SECTION – B

There are FOUR questions in this section. Answer any THREE.

5. (a) What is slide-ways? Why is it necessary? Briefly discuss different requirements of slide-ways that must be satisfied for machine tools.

(b) With neat sketches explain the working principle of Hydrostatic slide-ways. Write down the advantages and disadvantages of hydrostatic slide-ways.

(c) Write down the advantages and disadvantages of numerical control machine tools.

6. (a) What are the requirements of machine tool? Briefly explain.

(b) What is progression ratio? With the help of saw diagram, prove that progression ratio in GP series is constant.

(c) Which one is the best among GP, AP and LP series? Justify your answer showing calculations and tabulating them.

7. (a) Using the structural formula, draw four ray diagrams for \( Z = 18 \) and transmission ratio \( = 1.41 \). Also calculate the speeds for any one of the four diagrams.

(b) Draw the working mechanism of the flowing drive systems:

(i) Sliding key method

(ii) Tumbler gears

(iii) Sliding type cluster gears

8. (a) How does an external supply type vane pump work? Explain it with necessary sketches.

(b) In an axial piston pump, piston displacement is 50 cm. Radius of the piston circle is 25 cm. Angle of inclination of the swash plate is 30°. Cylinder bore diameter is 5 m., number of piston 12 and rotor speed 450 rpm. Calculate the supply rate of axial piston pump?

(c) Why infinitely variable drive is better than discrete form of drives? Give example to illustrate this.
Figure 3(a)

Figure 3(b)

Figure 3(c)
\[ z = 45 \quad z = 50 \]

\[ n = 940/1440 \text{rpm} \]

\[ N = 2.1/3 \text{KW} \]

\[ \text{Circular-feed change-gear train} \]

\[ \text{Indexing change-gear train} \]

\[ z = 40 \quad z = 32 \]

\[ z = 46 \quad z = 24 \]

Figure 4(d)
SECTION – A

There are FOUR questions in this section. Answer any THREE.

1. (a) Briefly describe four building blocks of an Organization. (8)
   (b) "Management is undoubtedly one of humankind's most important inventions." Do you agree with this statement? Why or why not? (7)
   (c) What were the findings of "Fiedler Model" of Leadership? (12)
   (d) Compare Programmed Versus Non-programmed Decisions. (8)

2. (a) Explain ERG theory and Maslow's Need theory in brief. Write the differences between these two theories. (12)
   (b) Briefly describe the "Hersey and Blanchard's" Situational Leadership model. (8)
   (c) Describe the structures and techniques organizations use as they go international. (8)
   (d) Explain how communication can flow most effectively in organizations. (7)

3. (a) Internet file sharing programs are popular among university students. These programs work by allowing non-organizational users to access any local network where desired files are located. Because these types of file sharing programs tend to clog bandwidth, local users' ability to access and use a local network is reduced. What ethical and social responsibilities does a university have in this situation? What guidelines might you suggest for university decision makers? (7)
   (b) How can you create an innovative culture in a mechanistic organization? (8)
   (c) Briefly explain seven steps of decision making process in purchasing a vehicle. (10)
   (d) Explain different stages of Group Development. (10)

4. (a) What are the factors that affect the width of span to control organizational staff? (7)
   (b) Name three different skills of a manager to perform his job successfully. How can you relate these skills of different management levels with the level of importance? (8)
   (c) Describe the three major types of corporate strategies and how the BCG matrix is used to manage those corporate strategies. (10)
   (d) What are the different types of "justice" as per Equity theory of motivation? Explain. (10)

Contd .......... P/2
SECTION – B

There are FOUR questions in this section. Answer any THREE.

5. (a) If a company is experiencing severe financial crisis, which competitive strategy would you suggest to implement and why? Explain in detail.
   (15)

   (b) Differentiate functional organizational structure from the dedicated structure along with their relative advantages and disadvantages.
   (15)

   (c) Mention the challenges of turning individuals into team players.
   (5)

6. (a) "Mechanistic structure paves the way for creativity and freedom of employees" – do you agree? Justify your position.
   (10)

   (b) Briefly explain the five competitive forces model in industry analysis.
   (10)

   (c) Mention the relative advantages and disadvantages of different performance appraisal methods.
   (15)

7. (a) Mention the barriers to effective interpersonal communication. How can we overcome these barriers? Explain.
   (15)

   (b) Depict the functions of human resource management in a neat flow chart.
   (10)

   (c) How are work teams advantageous than work groups? Describe.
   (10)

8. (a) Explain the concept of Management by Objectives (MBO).
   (10)

   (b) Describe different decision-making styles and discuss how biases affect decision-making.
   (15)

   (c) Describe the major components that determine group performance and satisfaction.
   (10)
1. (a) Suppose, you will join a software company after graduation as a system engineer. The software company would like to manufacture and market different softwares such as antivirus for computers, ERP software for mobile operators in Bangladesh, and softwares for mobile banking. Apply and design McCarthy's four Ps of marketing for these three categories of products. Assume reasonable quantitative values if necessary. 

(b) According to Michael Porter, there are five forces that determine the long-run profitability of a market or market segment. Illustrate the five forces with reference to the context of 1(a).

2. (a) Consider a scenario wherein a sale representative of 'Delta Life Insurance Company Limited' wants to motivate you to purchase an insurance plan appropriate to students of public universities. Which marketing concept does the representative of the company would like to apply to convince you to the insurance plan? Explain the concept with its merits and demerits.

(b) How to assess strategic planning gap for a manufacturing firm? Justify your answer by providing with a suitable example and a diagram. Explain the terminologies used in the diagram.

(c) How can you develop a threat matrix for the example firm as you mentioned in 2(b)?

3. (a) How can you apply the concept of conjoint analysis in market research? Illustrate your answer by providing a suitable hypothetical example.

(b) What do you mean by marketing intelligence?

(c) How can you apply the expectancy-value model to evaluate a brand or a product? Demonstrate your answer with a practical example.

4. (a) Show the diagram of the five stage model of the consumer buying process? Explain the last stage of the model and, relate it with the product's environmental impact.

(b) How can you distinguish 'Likert Scale' from 'Importance Scale' in making questionnaire for market research?

(c) What do you mean by demand states and market demand functions?

Contd ............ P/2
There are FOUR questions in this section. Answer any THREE.

5. (a) Define the term brand equity. Explain role of brands in expanding the market of a company with the example of Coca-cola.  
(b) Hindustan Unilever Limited has become successful in creating brand portfolio. Explain brand portfolio with the examples of Hindustan Unilever Limited.

6. (a) What is Customer-Value Hierarchy? Draw the different product levels and explain it with an example.  
(b) What do you know about Co-branding and Ingredient branding? Give an example of Co-branding and ingredient branding practiced in Bangladesh.  
(c) Packaging, Labeling, Warranties and Guarantees are important part of product strategy – explain it.

7. (a) What are the distinctive characteristics of services? What measures can be taken to overcome the problem associated with these characteristics.  
(b) What are the advantages and disadvantages of brand extensions?

8. (a) Which participants in business make the buying center?  
(b) Suppose you are the procurement manager in a plastic manufacturing company. You want to buy some injection molding machines for the company. Now discuss the stages of buying process for injection molding machines of the company.  
(c) Mention some bases for segmenting business markets.