SECTION – A

There are FOUR questions in this section. Answer Q. No. 1 and any TWO from the rest.

1. (a) What kind of control valves are used in Grinding machine? Explain the control mechanism of that valve with necessary diagrams. (16)

(b) Write down the connection between generatrix/directrix, tool/workpiece, tool-work motions and sources of generatrix and directrix with proper justification for Fig. 1(b). (16½)

(c) Consider Fig. 1(c) which represents hydraulic cylinder used in grinding machine. The two cylinders move as a unit. Speed of these two cylinders is same in their forward and return stroke? Justify your answer with quantitative formulation. (14)
2. (a) What is the basic difference between withworth mechanism and oscillating lever mechanism. Explain with their application and necessary schematics.
   (b) Hydraulic pumps are used in machine tools like grinding machines, gear shaper, gear hobber etc. What do you mean by sizing of hydraulic pump and how would you approach to determine it? How does volumetric efficiency have an effect on sizing of pump?
   (c) Wuelfel Kop Tourator is an infinitely variable mechanical drive as represented by Fig. 2(c) which is used in conventional machine tools. Cite the name of each labeled component in Fig. 2(c). What do the different states (i, ii, iii) of component labeled as 4 along with that of 3 imply?

(d) Once, while working with a lathe machine in a machine-tools lab, a worker suddenly presses a foot pedal for avoiding a terrific circumstance. All the motions of the machine suddenly stopped. What mechanism has happened there to enact such sudden stoppage? Explain with necessary schematic showing disruption in motion transmission line.

3. (a) Consider a layout of gearbox which consists triple cluster gear in input shaft, double cluster gear in intermediate shaft and finally a triple cluster gear in output shaft. Corresponding to the layout of the gearbox just considered, draw a ray diagram from which obtained different speeds will follow a geometric progression ratio with maximum speed 1500 rpm and speed range ratio 30. Your ray diagram must be concave in shape, must meet transmission range ratio of a group, i.e. ig<=8 while using a dc motor of speed about 1000 rpm.

Contd .......... P/3
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Contd... Q. No. 3

(b) Why CNC lathe machine does not require the long gear train like the conventional one? Also mention the usability of AP/GP/LP series in CNC lathe with proper reasoning. (11 3/4)

(c) A machine tool gear drive follows GP series for its transmission. Prove that volume of that gearbox is inversely proportional to the speed of any gear for a given horsepower. Also write down the basic principles for designing sliding type cluster gear. (9+4=13)

4. (a) Derive the equations to calculate the average pressure acting on the mating surfaces of the slide-ways during oblique cutting. Also write down the assumptions you made during the derivation. (10+2=12)

(b) What do you understand by the acceptance tests of machine tools? With suitable sketches, describe the different alignment tests that are done in machine tool. What influence do stiffeners have on the machine tool structure? (14)

(c) Classify different types of slideways. Give suitable example of each with necessary sketches. (10)

(d) Differentiate between idle-run test and load test. Write down the objectives of malfunction diagnostic system. (5 3/4)

(e) Mention the application of self-aligning roller bearing in traditional machine tools along with schematics. (5)

SECTION – B

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

5. (a) Do you think that a lathe machine can perform turning and threading if the machine possesses only the lead screw? Justify your answer. (13 3/4)

(b) Where do you find reversing mechanism in feed movement gear train in lathe machine? Explain its mechanism and purpose with necessary sketches. (11)

(c) Discuss two different methods of taper turning where you need to rotate the swivel plate of lathe machine. (11)

(d) What do you mean by precision threads? How do they cut? Explain briefly. (11)

Contd .......... P/4
6. (a) What do you mean by standard accessories of a lathe machine? Name them. Explain lathe dog and face plate with necessary sketches. 

(b) What are the advantages of Bar type turret lathe over chucking type? Explain different types of collet chucks with necessary sketches. 

(c) Why do the gear cutting by milling machine is not suitable for high performance gear manufacture? Justify your answer. 

(d) Why does the index plate rotate in differential indexing? Discuss related mechanism in detail. 

7. (a) Explain Generating principle of gear cutting with necessary sketches. 

(b) What are the motions involved in gear shaper? Explain them briefly. 

(c) Discuss the motions involved and hob cutter setting for cutting helical gear in gear hobber. 

(d) Explain different types of grinding machine. 

8. (a) What are the motions involved in drilling machine? Explain briefly. 

(b) What are the main features of scroll plate? Discuss its role in three jaw self-centering chuck. 

(c) What do you mean by Fly cutting? Discuss its application in detail. 

(d) Discuss the clapper box mechanism in detail. Also mention its necessity in retaing the tool in shaping operation. 

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SECTION – A

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

1. (a) The aim of CAD is to apply computers to both the modeling and communication of design – Explain.
   
   (b) CAD software normally comprises a number of different elements or functions that process the data stored in the database. Discuss these elements with necessary block diagram.
   
   (c) With examples discuss the differences among 2D, 2.5D and 3D models. Which modeling scheme is widely used in ship building or aircraft manufacturing? Explain why.

2. (a) What is the difference between CSG and B-rep solid modeling techniques? Conversion from CSG to B-rep is relatively straight forward, but the reverse is difficult – Explain why.
   
   (b) What are the results of applying the Boolean intersection, union and difference operations to the two primitives shown in Fig. for Q. 2(b)? Prepare a three view orthographic projection of the result of a union operation.
   
   (c) Why are cubic polynomials popular as a basis for computational geometry? Draw the basis/blending functions for Hermit and Bezier cubic curves. A cubic Bezier curve is defined by the points (1,1), (2,3), (4,4) and (6,1). Calculate the parametric midpoint of the curve, and verify that its gradient $(dy/dx)$ is $\sqrt{7}$ at this point. Use the information to sketch the curve.

3. (a) What do you understand by topological consistency and geometric consistency of a solid model? Explain with necessary sketches. For the component shown in Fig. for Q. 3 (a)
   
   - Show that it conform Euler-Poincare formula
   
   - Show that it can be constructed using CSG method
   
   - Suggest how spatial occupancy might be used to model the shape.
   
   (b) What are the four essential steps for transformation from design model to display? Explain in short. An arc is defined in the Ox_y plane of a coordinate system $Ox_0y_0z_0$ and centred at (100, 100, 0). $Ox_0y_0z_0$ is rotated by 30° clockwise about the $Ox_0$ axis with respect to system $Ox_yz_0$. The origin of $Ox_yz_0$ is at (50, 0, 0) in $Ox_0y_0z_0$, and the Ox axes of the systems are coincident. Find the transformation matrix to represent any point of $Ox_yz_0$ in $Ox_0y_0z_0$. Also find the coordinate of the arc center in $Ox_0y_0z_0$.

Contd ... P/2
4. (a) What is the difference between coordinate transformation and object transformation? (5)
(b) Requirements of CAD systems to support interactive modeling imposed significant constraints on the design of data structure of CAD software. Do you agree? Explain why. (10)
(c) How various entity data is stored in a typical table of entities? Briefly explain with a sketch of a table structure. (10)
(d) For Figure. for Q. 4(d), determine the transformation matrix required to find mirror point coordinates of any point with respect to the line drawn in the Oxy plane. (10)

SECTION-B
There are FOUR questions in this section. Answer any THREE.

5. (a) CMM has 4 different types of probe- briefly explain those with applications. (12)
(b) How can you distinguish “Modal” from “Non-Modal” command? Provide example for each. (6)
(c) Write a G-code to machine a complete circle using R-command. (5)
(d) Probe type edge finder is better than Electronic and Mechanical ones – Justify with the working principle of each using neat sketches. (12)

6. (a) What are the factors affecting the accuracy of CMM? (5)
(b) Briefly explain three different types of Phase-change fixture along with their working principle. (12)
(c) Write a G-code in machining the part shown in Fig. Q. 6(c) using any suitable tool: (18)

7. (a) Briefly describe three different types of tool positioning mode with example. (10)
(b) Do you think that continuous path controller addresses both straight and curved path cutting? Justify your answer. (7)
(c) Open loop control system uses stepper motor while closed loop control system uses servo motor – why? (8)
(d) Write down the machining profile of G-code for turning the cylindrical component in Fig Q. 7(d): (10)

8. (a) What do you understand by “Joint Space” and “World Space” methods of representing the position and orientation of a robot manipulator’s end-of-arm? Explain with the help of “OO” and “RR” robots. (10)
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Contd... Q. No. 8

(b) Elaborate the following terms:
(i) Control resolution
(ii) Accuracy
(iii) Repeatability

(c) Given the world coordinates for the TRL: R robot in Fig Q. 8(c) as \( x = 300 \text{ mm}, \ y = 0, \ z = 500 \text{ mm} \) and \( \alpha = 45^\circ \); and given that the links have values \( L_o = 0, \ L_1 = 400 \text{ mm}, \ L_3 \) has a range from 200 mm to 350 mm, and \( L_4 = 25 \text{ mm} \), determine the joint values \( \theta_1, \theta_2, \lambda_3, \theta_4 \).

(5\times3=15)

(10)
Fig A. 6 (c)
[All dimension in mm]

Fig A. 7(d)
[All dimension in mm]
**G-code List 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</td>
</tr>
<tr>
<td></td>
<td>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</td>
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<tr>
<td></td>
<td>reference point</td>
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<tr>
<th>G-code</th>
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<td>Tool (nose) radius compensation cancel</td>
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<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>
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<tr>
<th>G-code</th>
<th>Description</th>
</tr>
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<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>
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**M-code List for CNC Milling/Turning Operations**

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<th>Description</th>
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<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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<table>
<thead>
<tr>
<th>M-code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M06</td>
<td>Tool change</td>
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<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>
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SECTION – A

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

1. (a) Explain the role of management as a speciality in the time and human relationships. (12)  
   (b) What are the rewards and challenges of being a manager? (15)  
   (c) What environmental factors influenced the development of schools of management theory such as scientific management theory? (8)

2. (a) Which theories have been developed to overcome the limitations of F.W. Taylor’s philosophy? (12)  
   (b) What is Hawthorne effect and why is it important to managers? (12)  
   (c) How can an approach in which we say “it depends on the situation,” be useful to managers? Discuss. (11)

3. (a) What are the key considerations in choosing a span of management? (7)  
   (b) Why is organizational structure important? Would you rather work in a mechanistic organization or an organic organization? Why? (12)  
   (c) What types of skills would a manager need to effectively work in a project structure? (8)  
   (d) Researchers are now saying that efforts to simplicity work tasks actually have negative results for both companies and their employees. Do you agree? Why or why not? (8)

4. (a) Discuss the advantages of delegation. Why do managers hesitate to delegate? Explain the key guidelines for effective delegation. (12)
   (b) Define leadership and explain how it is similar to and different from management. (6)
   (c) Outline the basic idea of the Tannenbaum and Schmidt model. What factors should influence a manager’s style, according to this model? What are some of the practical considerations the model suggests managers must take into account in selecting a style? (17)
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SECTION – B

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

5. (a) What are the benefits of realistic job previews from the perspective of both the organization and the employee? (6)
(b) Briefly explain the significance of orientation programs for newly recruited employees. (6)
(c) Discuss the factors that influence employee compensation and benefits. (11)
(d) Describe the different performance appraisal methods. (12)

6. (a) Explain managerial decision making process with an example. (10)
(b) Depict a practical scenario where performance simulation is more appropriate than conventional written examination as a selection device. (12)
(c) How can managers blend the guidelines for making effective decisions in Today’s world with the rationality and bounded rationality models of decision making, or can they? Explain. (13)

7. (a) Describe the three major types of corporate strategies. (10)
(b) Explain what managers do during the six steps of the strategic management process. (12)
(c) How might the process of strategy formulation, implementation, and evaluation differ for (i) large businesses (ii) small businesses (iii) not-for-profit organizations, and (iv) global businesses? (13)

8. (a) Write a short note on Equity theory of Motivation. (10)
(b) Compare and contrast early theories of motivation. (12)
(c) Many job design experts who have studied the changing nature of work say that people do their best work when they are motivated by a sense of purpose rather than by the pursuit of money. Do you agree? Explain your position. (13)
SECTION – A

There are FOUR questions in this section. Answer any THREE. Assume reasonable values for missing data.

1. (a) What are the things that are marketed? Give examples of each of them. (10)
   (b) Illustrate the stages in the business buying-decision process. (15)
   (c) How can we evaluate customer lifetime value? Explain it with a numerical example. (10)

2. (a) Conjoint analysis, a quantitative analysis applied to market research, is used to examine which factors or attributes are valued by customers. Suppose, you are working as a marketing manager of a personal computer manufacturing company, and you want to position your new personal computer brand in a market. Your market research team has identified the following attributes and the level of attributes by gathering data from the market. (20)
   
   **Key Attributes and Levels of Attributes**
   
   (i) Speed (1X, 2X, 3X)
   (ii) Software (None, Limited, Extensive)
   (iii) Price (Current, 20% Higher, 40% Higher)
   (iv) Supplier (Compaq, Packard Bell, Toshiba)

   Assuming reasonable values, perform conjoint analysis and compute the attractiveness of each of the existing supplier in the market. Now, comment on the inclusion or exclusion of new attributes for positioning your new personal computer brand in the market.
   
   (b) Briefly explain the strategic planning, implementing and control processes with an appropriate figure. (15)

3. (a) What do you mean by market demand functions? (10)
   (b) How can we apply the chain-ratio method to determine the market potential of a product? Justify your answer with a numerical example. (10)
   (c) What is a marketing dashboard? How to prepare and chart it? (10)
   (d) How can you distinguish the Likert scale from rating scale approach to scaling responses in market research? (5)

4. (a) What is the Bass diffusion model? Explain its significance. (10)
   (b) Define brand awareness. How to numerically evaluate it? Show computations. (10)
   (c) Describe the dimensions of holistic marketing with appropriate examples. (15)

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

5. (a) Illustrate the stimulus-response model of consumer behavior with the help of a flowchart. (12)
(b) Write down the factors leading to less price sensitivity? (10)
(c) "Branding can be a powerful means to secure a competitive advantage" — Explain. (6)
(d) Suppose, a watch manufacturing company invested 5,000,000 BDT to include a new product line. The company wants to set a price to earn 50% return on investment (ROI) with the sales of first 5000 units. If the unit cost of each watch is 750 BDT, what is going to be the selling price? (7)

6. (a) Describe the VALS psychographic segmentation system. (14)
(b) Discuss briefly about "Brand revitalization". (7)
(c) Describe the six types of perceived risk which can modify, postpone, or avoid a consumer's purchase decision. (8)
(d) Write down the name of the dimensions in which product can be differentiated. (6)

7. (a) What are the requirements for successful co-branding? Discuss the advantages and disadvantages of co-branding. (15)
(b) What are the ways to lengthen product line by stretching? Discuss them elaborately. (10)
(c) What are the six criteria for choosing brand elements? Discuss in brief. (6)
(d) What are major risks involved in "Experience-curve pricing"? (4)

8. (a) Discuss in brief six different situations of product mix pricing. (12)
(b) What are the steps in setting a pricing policy? Discuss in details five major objectives of setting price of a product or service. (12)
(c) What are the personal factors those can influence a buyer's decision? Discuss in brief. (8)
(d) "Demand sets a ceiling on the price the company can charge for its product while costs set the floor" — Justify this statement. (3)