

(3 Hours)

[Total Marks : 80]

- NB:** 1) **Question No. 1 is compulsory.**
 2) Solve **Any Three** from remaining **Five** questions.
 3) Use of standard data book is permitted.
 4) Assume suitable data if necessary, giving justification.

Answer any **Four** from the following

1. (a) Explain how assumptions made in Lewis equation are taken in to account during design? **05**
 (b) Explain how the following factors influence the life of a bearing **05**
 (a) Load (b) Speed (c) Temperature
 (c) What are the advantages and disadvantages of V-belt drive over flat belt drive? **05**
 (d) Why it is necessary to dissipate the heat generated when clutches operate? **05**
 (e) Define the following terms used in worm gearing. **05**
 (a) Lead (b) Lead angle (c) Normal pitch (d) Helix angle.
2. Design a Two-stage spur gear reduction unit with 20° F.D involute teeth. **20**
 The input shaft is connected to 9.5 KW, 1400 rpm motor through a flexible coupling. The output shaft speed shall be approximately 200 rpm. The gears are made up of plain carbon steel. Find dynamic load and check for wear load. Decide the constructional details of the gear and pinion showing neat sketch.
3. (a) Design a hydrodynamic bearing for a centrifugal pump to support a load of 8 KN when operating at 1600 rpm. Write assumptions if required and analyze the performance. **12**
 (b) A multiple disc clutch, steel on bronze, is to transmit 8 KW at 800 r.p.m. **08**
 The inner radius of the contact is 40 mm and outer radius of the contact is 70 mm. The clutch operates in oil with an expected coefficient of 0.1. The average allowable pressure is 0.5 N/mm^2 . Use uniform wear theory.
 1. The total number of steel and bronze discs
 2. The actual axial force required
 3. The actual average pressure
 4. The actual maximum pressure

TURN OVER

4. (a) A rotary disc cam and central translator follower has following motion:- **20**
 Forward stroke = 22 mm in 100° rotation of cam with SHM, dwell to complete the cycle.
 Return stroke = 22 mm with SHM in 100° of cam rotation remaining dwell to complete.
 Mass of follower is 1 Kg and cam shaft rotates at 500 rpm and maximum pressure angle is 25° during forward stroke. The external force is 310 N during forward stroke and 55 N during return stroke. Determine
1. Base circle radius
 2. Design the cam
 3. Design the spring
 4. Calculate maximum cam shaft torque.
5. A pair of bevel gear is required to transmit 8 KW power from a pinion shaft rotating at 400 rpm with reduction ratio 3.5. The shaft angle is 90° and drive is subjected to moderate shock and operates at 12 hrs/day. Design stresses for pinion are 380 MPa and 1100 MPa. Design and check pair in strength and wear and also perform arm design. **20**
6. (a) A V- Belt drive is to transmit 15 KW to a compressor. The motor speed is 1100 rpm and compressor pulley runs at 400 rpm. The coefficient of friction between the belt and pulley is 0.25. The compressor operates for 10-12 hrs/ day. Design the drive for above application. Design should include following : **12**
1. Section of V-Belt material
 2. Exact centre distance
 3. Belt size
 4. Number of belts
 5. Life of belt.
- (b) An angular contact ball bearing is used for gear shaft to support a radial load of 9 KN and 6 KN along the axial direction. The shaft rotates at 50 rpm. Select suitable size of bearing, if it is required to have a life of 30000 hrs with a probability of survival of 93%. Check selected bearing is safe for given application. **08**

4E21DEFB9D6DC36590CFF89B87236EF2

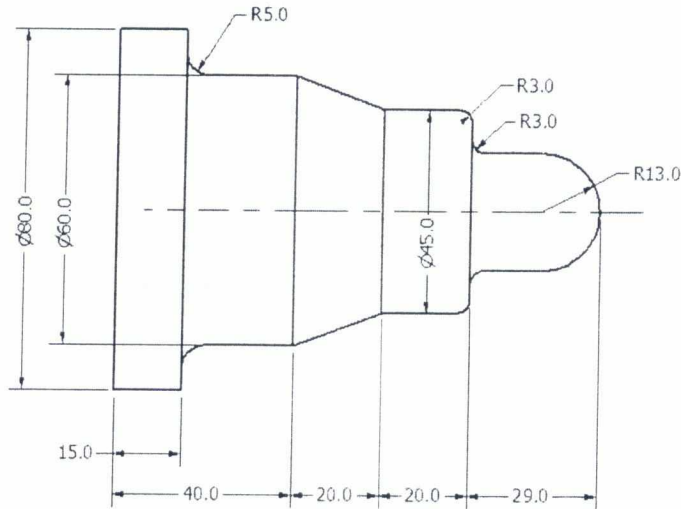
8

Note:

1. Question 1 is Compulsory
2. Solve any three from remaining five
3. Figures to right indicate full marks
4. Assume suitable data if necessary

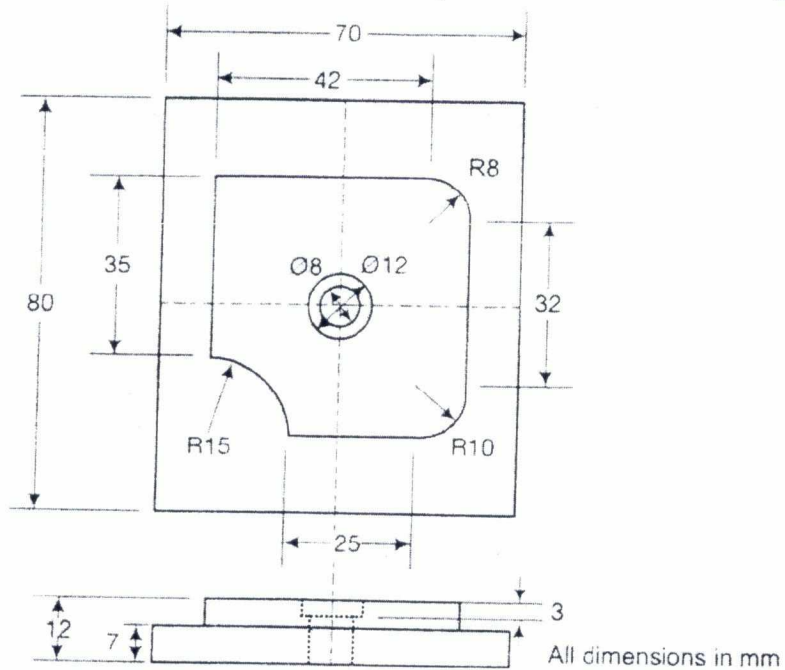
Question	Marks
Q.1	
a) Explain the convergence in FE analysis.	5
b) Explain application of RP in MEMS.	5
c) Explain the significance of Graphic Standards.	5
d) Briefly explain the advantages and disadvantages of NC machines.	5
Q.2	
a) A triangle PQR with vertices P(2,5), Q(6,7) and R(2,7) is to be reflected about the line $y=0.5x+3$. Determine the final transformation matrix and the coordinates of the reflected triangle.	12
b) How do you set work part zero, zero on a CNC machine?	04
c) What are the feedback devices used in NC/CNC machine?	04
Q.3	
a) Write a program in C++ using object oriented concept for 2D transformation which includes function for rotation.	08
b) What do you mean by complex engineering problem? With suitable example, explain the complexities involved and the tools chosen to solve it.	08
c) Enlist CIM hardware and software.	04
Q.4	
a) What do you mean by Synthetic curves? What are the different types of synthetic curves and their continuity conditions?	10
b) Write a manual part program in G - M codes for generating a part as shown in Figure 1 (on next page). Size of raw material is $\phi 85\text{mm}$ by 112mm . Explain each code. Assume suitable data if required. Use canned cycle code for Facing, Turning, and Taper Turning operations.	10

{TURN OVER



(Fig. 1 The component to be machined. All dimensions are in mm.)

- Q.5 a) Explain the steps used in Rapid Prototyping process. 10
 b) Write a complete APT part program to machine the outline of the geometry shown in fig.2 the top view up to a depth of 5 mm in one cut. The end mill used is 20 mm diameter. Assume suitable speed and feed for machining. Fig.2



(Fig.2 The component to be machined.)

- Q.6 Write a note on the following (any four) 20
 a) Cohen-Sutherland Clipping Algorithm.
 b) Major steps of FEM.
 c) Fused Deposition Modelling(FDM)
 d) Absolute versus incremental positioning in NC Machine tools.
 e) Affine Transformation and its properties.

(3 Hours)

[Total Marks : 80]

Note:

1. Question No.1 is compulsory.
2. Attempt any three questions from remaining five questions.
3. Assume suitable data if required.

- Q.1 Solve any four (20)
- a. Enumerate the various components of reciprocating air compressor.
 - b. What is the function of air vessel in reciprocating pump?
 - c. Distinguish clearly between NPSH available and NPSH required and discuss the factor that affect them.
 - d. What are the methods of energy conservation in pumping system?
 - e. Explain the working of centrifugal compressor.
- Q.2 a) Why inter cooling is used in multistage compressor? Derive an expression for intermediate pressure in a two stage compressor when inter cooling is perfect. (10)
- b) A rotary air compressor receives air at a pressure of 1 bar and 17° C and delivers it at a pressure of 6 bar. Determine, per kg of air delivered, work done by the compressor and heat exchanged with the jacket water when the compression is isothermal, isentropic and by the relation $pv^{1.6} = \text{constant}$. (10)
- Q.3 a) The piston diameter and the stroke length of a single acting reciprocating pump are 150 mm and 300 mm respectively. The center of the pump is 5.0 m above the water level in the sump and 33 m below the delivery water level. Both the suction and delivery pipes have the same diameter of 75 mm and are 6.5 m and 39 m long respectively. If the pump is working at 30 rpm, determine (12)
- (i) The pressure head on the piston at the beginning, middle and the end of both suction and delivery strokes, and
 - (ii) The power required to drive the pump.
- Take atmospheric pressure head = 10.3 m of water and friction co-efficient, $f = 0.01$ for both the pipes.
- b) Explain the methods to balance axial and radial thrust in centrifugal pump. (08)
- Q.4 a) In a three-stage compressor, air is compressed from 98 kPa to 20 bar. Calculate for 1m^3 of air per second (10)
1. Work under ideal condition for $n = 1.3$
 2. Isothermal work
 3. Saving in work due to multi staging.
 4. Isothermal efficiency.
- b) How does the acceleration head and pipe friction affect the indicator diagram and work done? (10)

[TURN OVER

QP CODE : 793300

2

- Q.5 a) Draw a neat sketch of various components of the centrifugal compressor and show the variation of pressure and velocity of air being compressed. (10)
- b) 3 m^3 of water per second is lifted to a height of 30 m with an efficiency of 75% by single stage centrifugal pump. The impeller diameter is 300 mm and it is rotating at 2000 rpm. Find the number of stages and diameter of each impeller of a similar multi-stage pump to lift 5 m^3 of water per second to a height of 200 m when rotating at 1500rpm. (10)
- Q.6 Solve any four (20)
- What do you mean by priming? Why is it necessary?
 - What is cavitation? How can we avoid it in reciprocating pump?
 - What is closed loop network? And its advantages?
 - What are the methods of energy conservation in compressed air system?
 - Draw and comment on performance characteristics of pump.

01/06/17

Q. P. Code : 793400

(3 Hours)

Total Marks 80

- N.B. : (1) Question No. 1 is compulsory.
 (2) Answer any **three** questions out of the remaining **five** questions.
 (3) Figures to the right indicate full marks.
 (4) Illustrate answers with neat sketches where ever required.
 (5) Answers to the questions should be grouped and written together.
 (6) Assume suitable data if required.

- Q 1. Answer any four
- | | | |
|-----|---|---|
| (a) | What is Production planning and control? | 5 |
| (b) | Describe Work Order. | 5 |
| (c) | Define: Cost of Carrying the inventory; Cost of Holding the inventory; Lead Time and Economic Order Quantity | 5 |
| (d) | What problems are faced in case of lack of product planning? | 5 |
| (e) | A firm produces three products A, B and C and their unit contributions are Rs. 5/- ; Rs. 10/- and Rs. 8 respectively. Each unit of product A requires 3 kg of material, 5 machine hours and 2 labour hours; each unit of product B requires 4 kg of material, 4 machine hours and 4 labour hours and each unit of product C requires 2 kg of material, 4 machine hours and 5 labour hours. Everyday 60 kg of material 72 machine hours and 100 labour hours are available. From the above information formulate linear programming problem. | 5 |
| (f) | List the differences between PERT and CPM. | 5 |
- Q 2. (a) Explain in detail job, batch and continuous production? 10
 (b) Discuss the prerequisites of PPC. 10
- Q 3. (a) Automatic gear, manufacturers a wide variety of gears for the replacement market. Since variety is large it allows orders to accumulate before undertaking manufacture of any gear. The firm estimates that back orders cost on the average Rs. 5/ unit for record keeping. 10
- i. How many units should the firm produce in each production run of a gear for which following data is available
- Annual consumption = 18,000 units
 Manufacturing cost per unit = Rs. 48/-
 Set up cost per production run = Rs. 480/-
 Inventory carrying cost as a percentage of average inventory = 18% of investment
- ii. Determine the units that can be back ordered at the indicated shortage cost
- iii. How much will the company lose if no stock outs are permitted?

[TURN OVER]

- (b) Write short notes on any three 10
- I. ABC Analysis
 - II. MRP I
 - III. MRP II
 - IV. ERP
- Q 4. (a) What do you understand by process planning? Compare Manual Process planning with Computer Aided Process Planning. 10
- (b) Estimate the Sales Forecast for the Year 2016, using Exponential Smoothing Forecast. Take $\alpha = 0.5$ and 0.8 The forecast for the year 2011 is 160×10^5 units. 10

Year	2011	2012	2013	2014	2015
Sales in Rs. ($\times 10^5$)	180	168	159	170	188

Compare the two forecasts.

- Q 5. (a) Solve the LPP 10
- Maximize $Z = 7X_1 + 9X_2$
- Subject to
- $-X_1 + 3X_2 \leq 6$
- $7X_1 + X_2 \leq 35$
- $X_1, X_2 \geq 0$
- (b) Company has one surplus truck in each of the cities A, B, C, D, E and one deficit truck in each of the cities 1,2,3,4,5,6. The distance between the cities in Km. is shown in the matrix below. Find the assignment of trucks from cities surplus to cities in deficit so that the total distance covered by vehicles is minimum. 10

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

[TUEN OVER]

Q. P. Code : 793400

3

- Q 6. (a) Five jobs are lined up to be processed through a multi spindle automat in the plant. They are labeled as A, B, C, D and E in order they enter the plant. The respective processing times and due dates are given in the table below : 10

Job	Processing Time (days)	Due Date (days)
A	09	55
B	32	50
C	28	28
D	03	24
E	05	20

From the above information prepare the table showing :

Average completion time, Average number of jobs in the system and average job lateness based on FCFS, SPT, LPT and EDD sequencing rules.

- (b) The following table showing details of a project -- 10

Activity	Immediate Predecessor	Normal		Crash	
		Time Days	Cost (Rs.x 10 ³)	Time Days	Cost (Rs.x 10 ³)
A	--	10	20	7	30
B	--	8	15	6	20
C	B	5	8	4	14
D	B	6	11	4	15
E	B	8	9	5	15
F	E	5	5	4	8
G	A,D,C	12	3	8	4

Indirect Cost is Rs.400 Per Day. Find the optimum duration and the associated minimum Project Cost.

Q. P. Code : 793600

(3 Hours)

[Total Marks: 80]

- N.B.: (1) Question No. 1 is compulsory.
 (2) Answer any three from the remaining five questions.
 (3) Assumptions made if any should be justified.
 (4) Figures to the right indicate full marks.

1. Write short notes on any four of the following. 20
- Ash Handling System
 - Pressurized Water Reactor
 - Surge tank
 - Combined Cycle using PFBC
 - Load Curves
2. a) Discuss the various method of improving the performance of a gas turbine power plant. 10
- b) The following data relate to a 2000 kW Diesel power station: 10
- | | |
|--------------------------------|------------------|
| The peak load on the plant | = 1500 kW |
| Load factor | = 0.4 |
| Capital cost per kW installed | = Rs 1200 |
| Annual costs | = 15% of capital |
| Annual operating costs | = Rs 50000 |
| Annual maintenance costs: | |
| i) Fixed | = Rs 9000 |
| ii) Variable | = Rs 18000 |
| Cost of fuel | = Rs 0.45 per kg |
| Cost of lubricating oil | = Rs 1.3 per kg |
| C.V. of fuel | = 41800 kJ/kg |
| Consumption of fuel | = 0.45 kg/kWh |
| Consumption of lubricating oil | = 0.002 kg/kWh |
- Determine the following
- The annual energy generated.
 - The cost of generation per kWh.

[TURN OVER]

Q. P. Code : 793600

2

3. a) Draw the schematic layout of a Hydro Electric Power Plant and discuss the function of each component and operation of plant. 10
- b) Discuss Rankine cycle with the help of schematic, (T-s) and (h-s) diagram. 10
Write the expressions for efficiency, work ratio, heat rejected.
4. a) The data for monthly flow for a Hydel plant at a site for 12 months is given below. 10

Month	1	2	3	4	5	6	7	8	9	10	11	12
Flow in m ³ /sec	6	4	5.4	2	1.5	1	1.2	4.5	8	4	3	2

Find the size of the reservoir and possible rate of available flow. Also draw the hydrograph and flow duration curve.

- b) With the help of a neat diagram, explain working of Pulverized Coal system with its advantages and disadvantages. 10
5. a) Steam enters the high pressure turbine at 12 MPa and 600°C and is condensed in the condenser at a pressure of 10 kPa. If the moisture content of the steam at the exit of low pressure turbine is not to exceed 12 percent. Determine pressure at which the steam should be reheated upto temperature 600 °C and thermal efficiency of the cycle. 10
- b) With a neat diagram discuss the working of a Liquid Metal Sodium Graphite Reactor (LMSGR) power plant .Write its advantages and disadvantages. 10
6. a) What do you understand by the term tariff ? Explain the Blockmeter rate, Hopkinson demand rate, and Doherty rate of tariffs. 10
- b) Briefly explain CANDU Reactor and Dust Collection System. 10
