

Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2017-18/

Date: _____

School: SoET-CBSGS

Branch: MECH. ENGG.

SEM: VII

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following [✓]Semester/[✓]Unit Test-I/Unit Test-II (Reg./ATKT) question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Machine Design -II	MEC701		✓	02
2	CAD/CAM/CAE	MEC702		✓	02
3	Mechanical Utility Systems	MEC703		✓	02
4	Production Planning and Control	MEC704		✓	02
5	Elective- I <i>Operations Research</i>	MEE701X		✓	02
6					

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

Paper / Subject Code: 42801 / Machine Design - II

[3 Hours]

[Total Marks : 80]

- N.B.** 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

- Q1 Answer any **Four** from the following
- a) Prove theoretically, in gear design tangential force transmitted is directly Proportional to beam strength? **5**
- b) Enumerate the factors that influence most the formation and maintenance of the thick oil film in hydrodynamic bearings **5**
- c) State the characteristics of the chain drive and discuss the polygon effect. **5**
- d) How much reduction in loading of a roller bearing will cause the expected life to be fifty percent more? **5**
- e) Justify the significance of Pressure angle in gear tooth design. **5**
- Q2 A rotary disc cam and central translator follower has following motion:- **20**
 Forward stroke = 25 mm in 100° rotation of cam with SHM, dwell to complete the cycle.
 Return stroke = 25 mm with SHM in 90° of cam rotation remaining dwell to complete.
 Mass of follower is 1 Kg and cam shaft rotates at 850 rpm and maximum pressure angle is 25° during forward stroke. The external force is 200 N during forward stroke and 50 N during return stroke.
 Determine
1. Base circle radius
 2. Design the cam
 3. Design the spring
 4. Calculate maximum cam shaft torque.
- Q3 A V- Belt drive is to transmit 15 KW to a compressor. The motor speed is 1200 rpm and compressor pulley runs at 550 rpm. The coefficient of friction between the belt and pulley is 0.25. The compressor operates for 12 hrs/ day. Design the drive for above application. Design should include following **20**
1. Section of V-Belt material
 2. Exact centre distance
 3. Belt size
 4. Number of belts
 5. Life of belt.

- Q4 Design a helical gear pair for the first stage of gear box having following specifications. **20**
Power = 20 kW
Input speed = 1440 rpm
Output speed = 90 rpm
(Design should include, module selection, checking for dynamic Load and contact stresses and construction type and constructional details of gear)
- Q5 A worm and worm wheel pair is to be design for a following specifications,
Power = 15KW, Worm speed = 960RPM, Velocity ratio = 28.
- i) Find the number of start and number of teeth on the gear. **4**
 - ii) Select suitable material and find the axial module of the worm based on wear criteria. **6**
 - iii) Check design for bending and dynamic load **5**
 - iv) Check the design for thermal conditions. **5**
- Q6 a) Select suitable Deep groove ball bearing for following specification: **10**
Shaft diameter = 40mm, Radial load = 850N, Axial load = 700N, Speed = 760rpm,
Expected life = 5000hrs, Reliability = 92%
- Q6 b) Design a chain based on bearing failure and check for tensile failure for the following specification. **10**
- Rated power : 22 KW
 - Input speed : 1200 rpm
 - Output speed : 250 rpm
 - Nature of load and duty: mild shock and 8 - 10 hrs
- (Design should include, Number of teeth on sprockets, centre distance, pitch, number of link and chain length)
-

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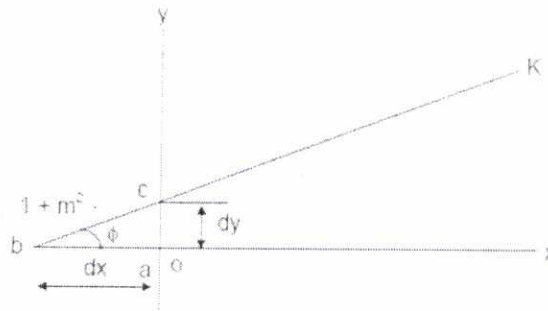
(3 Hours)

Max. Marks: 80

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

- Q.1**
- a) Explain Cohen-Sutherland Line clipping algorithm. 5
 - b) Explain the roughing and finishing canned cycle for turning. 5
 - c) Explain rotation with respect to 3D transformation. 5
 - d) Explain the significance of rapid prototyping. 5
- Q.2**
- a) Plot the bezier curve having end points $P_0 (1, 1)$ and $P_3 (3, 1)$. The other control points are $P_1 (2, 1)$ and $P_2 (4, 3)$. Also find the midpoint of the curve. 10
 - b) Explain Feature based Modeling 10
- Q.3**
- a) Describe the transformation M_K of an object about a link K which makes an angle ϕ with x -axis. It has slope m and y intercept as $(0, C)$ with y -axis as shown in Figure. 10

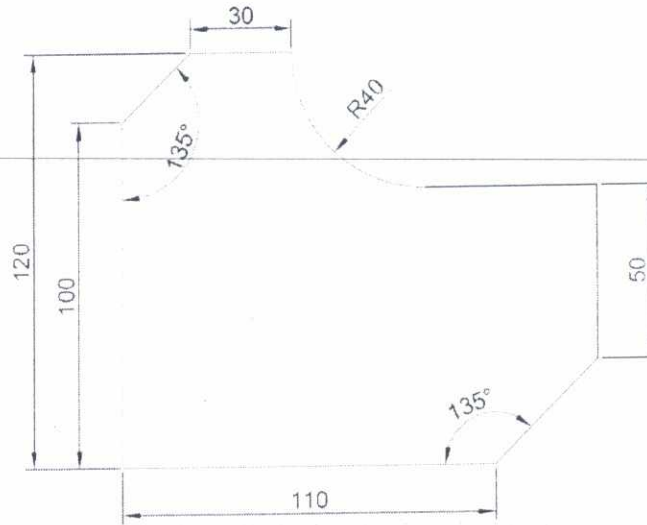


- a) Explain Direct Numerical Control(DNC) 10
- Q.4**
- a) What is the need for concatenation of transformation? Explain with example why the homogeneous coordinate system is generally used in graphics, in particular for software implementation. 10
 - b) Explain the procedure of kinematic analysis of a structural system with an example. 10

Q.5

a) Write a part program in APT for the component shown in Fig using end mill cutter of 20mm diameter. Clearly show the axes system chosen with a sketch and the direction of the cutter for the motion statements.

10



b) Socio-Techno-Economic aspects of CIM.

10

Q.6

Write short note on any **Four**:

20

- a) Use of CAE in Engineering Analysis.
- b) Constructive solid geometry and Boundary representation
- c) Automated Storage/Retrieval System(AS/RS)
- d) 3D Printing
- e) APT statements

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BB-sem-VII - CBSEs - Mech

3/12/18

Paper / Subject Code: 42803 / Mechanical Utility Systems

(3 Hours)

(Maximum Marks – 80)

Note:

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

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- Q.1 Solve any four (20)
- a. Differentiate reciprocating compressors and rotary compressor.
 - b. Illustrate the working of air vessel in reciprocating pump.
 - c. Describe working of any two type of casings used in centrifugal pump.
 - d. Illustrate flow control by throttling method and trimming of impeller method in pumping system.
 - e. Find the percentage saving in work input by compressing air in two stages from 1 bar to 7 bar instead of one stage. Assume a compression index of 1.35 in both the cases and complete intercooling in a two stage compressor.
- Q.2 a) Derive an expression for work done by the impeller of a centrifugal pump on liquid per second per unit weight of liquid. (8)
- b) A centrifugal compressor running at 1440 rpm, handles air at 101 KPa and 20°C and compresses it to a pressure of 6 bar isentropically. The inner and outer diameters of the impeller are 14 cm and 28 cm respectively. The width of blade at the inlet is 2.5 cm. The blade angles are 16° and 40° at entry and exit. Calculate mass flow rate of air, degree of reaction, power input and width of blade at outlet. (12)
- Q.3 a) The plunger diameter and stroke length of a single acting reciprocating pump are 300 mm and 500 mm respectively. The speed of the pump is 50 r.p.m. The diameter and length of delivery pipe are 150 mm and 55 m respectively. If the pump is equipped with an air vessel on the delivery side at the center line of the pump, find the power saved in overcoming friction in the delivery pipe. Take friction co-efficient, $f = 0.01$. (10)
- b) State at least 4 advantages of multistaging in reciprocating compressor. Derive an expression for intermediate pressure in a two stage compressor when inter cooling is imperfect. (10)
- Q.4 a) A single stage, single acting reciprocating air compressor receives air at 1.013 bar, 27°C and delivers it at 9.5 bar. The compressor has a bore = 250 mm, stroke = 300mm and it runs at 200 rpm. The mass flow rate of air is 200 kg/h. Calculate the volumetric efficiency of the compressor. (08)

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- b) Derive an expression for the work done in case of a single-acting reciprocating pump (12) considering the effect of acceleration and friction in suction pipe only. Start from basic assumptions.
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- Q.5 a) Draw a neat sketch of various components of the centrifugal compressor and show the (10) variation of pressure and velocity of air being compressed.
- b) A centrifugal pump has diameter 17.5 cm, width at outlet 5 cm, outlet angle 22° . Head (10) characteristics are given by $H = 40 - 140Q - 1200Q^2$, where Q is in m^3/s , H in m. pump is used to deliver water through a pipe of diameter 15cm, 75 m long. $H_{static} = 31$ m, $N = 2880$ rpm, volumetric efficiency = 0.96 and mechanical efficiency = 0.96. Determine input power to pump.
- Q.6 Solve any four (20)
- Illustrate working of compressed air system?
 - What is cavitation? How can we avoid it in reciprocating pump?
 - What is octopus network? And its limitations.
 - What do you mean by priming? Why is it necessary?
 - Draw and comment on performance characteristics of pump.
-

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(3 Hours)

Total Marks: 80

- N.B. 1) Question No.1 is compulsory.
 2) Attempt any three questions out of the remaining five questions.
 3) Figures to the right indicate full marks.
 4) Assume suitable data wherever required but justify the same.

Q1. Attempt any four

- A. What is the status of PPC dept. depending upon the company's manufacturing processes? (5)
- B. What do you understand by degree of centralization? (5)
- C. What are ordering cost and inventory carrying cost? Explain the relationship between the two with the help of a neat sketch. (5)
- D. List down the details which a process sheet should contain. (5)
- E. Define the term dummy activity with respect to network diag. with the help of an example. (5)

- Q2. A. Illustrate different manufacturing methods. Give characteristics with one example of each. (10)
- B. What do you understand by work order and subsidiary order? What are the rules for raising the work order? (10)

- Q3. A. An automobile manufacturer purchases 2400 castings over a period of 360 days. This requirement is fixed and known. These castings are subject to quantity discounts. Ordering cost is Rs. 70,000/order and storage cost per day is 0.12% of the unit cost. Determine the optimal purchase quantity if the supplier has offered the following unit prices for the castings.
 Unit price = Rs. 1000 for $q < 1000$
 = Rs. 950 for $q \geq 1000$. (10)

- B. An investigation into the demand for water pumps manufactured by Joy Engineering Pvt. Ltd. resulted into the following historical data. (10)

Year	2012	2013	2014	2015	2016	2017
Sale (in hundreds)	28	33	37	48	54	68

Project the trend of sales for next 3 years.

- Q4. A. The processing times of 100 gears for the three conversion processes are given below; (10)

Gear	Processing time (Hours)		
	Blanking	Gear Cutting	Gear Shaving
G1	25	16	20
G2	26	20	19
G3	24	17	18
G4	22	20	21
G5	24	21	17
G6	28	18	13

- (a) In what sequence should gears be scheduled to minimize processing time of all gears.
- (b) Determine the elapsed time.
- (c) Find percentage utilization of the machines in the first 100 hours.

{TURN OVER}

- B. A workshop has four machines and four tasks for completion. Each of the machines can perform each of the four tasks. Time taken at each of the machines to complete each task is given in the table below. How should the tasks be assigned to machines to minimize requirement of machine hours? (10)

Task	Machine			
	A	B	C	D
Processing time (Hrs.)				
I	51	77	49	55
II	32	34	59	68
III	37	44	70	54
IV	55	55	58	55

- Q5. A. Solve the LPP, (10)
 Maximize $Z = 4X_1 + 3X_2 + 6X_3$

Subject to,

$$2X_1 + 3X_2 + 2X_3 \leq 440$$

$$4X_1 + 3X_3 \leq 470$$

$$2X_1 + 5X_2 \leq 430$$

$$X_1, X_2, X_3 \geq 0$$

- B. The activities and three time estimates in days for the activities are given in the table below. (10)

Activity	1-2	2-3	2-4	3-4	3-5	3-6	4-5	4-6	5-6
t_o	2	1	0.5	0	1	1	6	3	4
t_m	2	1.5	2.5	0	2.5	2.	7	4	6
t_p	8	11	7.5	0	7	3	8	11	8

- Draw the network diagram.
- Determine the critical path.
- What is the probability that the project will be completed in 20 days?

Q6. Write Short Notes on:-

- Relationship of PPC department with other departments. (5)
- Two bin system. (5)
- Forward Scheduling and Backward Scheduling. (5)
- MRP I and MRP II. (5)

24/12/18

(Time: 3 Hours)

[Total Marks : 80]

N.B:

- 1) Question No. 1 is compulsory
- 2) Attempt any THREE questions from remaining.
- 3) Figures to the right indicate full marks
- 4) Answers to questions should be grouped & written together

- Q1 a How do you detect an unbounded solution in the simplex procedure 5
- b How do you identify the presence of multiple optima in the simplex method? 5
- c The following table gives the sales potential when different number of salesman allocated to four cities. The management has decided that at least one salesman has to be assigned to any territory. Advice, how the salesmen should be deployed to maximize sales. What will be the maximum sales volume. 10

City	Sales with number of salesman						
	1	2	3	4	5	6	7
A	5	6	10	16	20	22	24
B	4	5	8	12	15	18	20
C	6	8	10	14	16	19	22
D	7	9	12	15	18	22	24

- Q2 a Use two phase simplex method to solve following problem 10
- Maximize $Z = 5 X_1 - 4 X_2 + 3 X_3$
- Subject to the constraints $2X_1 + X_2 - 6 X_3 = 20$
- $$6X_1 + 5 X_2 + 10 X_3 \leq 76$$
- $$8X_1 - 3 X_2 + 6 X_3 \leq 76$$
- $$X_1, X_2, X_3 \geq 0$$
- b A small furniture factory manufactures tables and chairs. It takes 2 hours to assemble a table and 30 minutes to assemble a chair. 4 workers on the basis of a single 8 hours shift per day carry out assembly. Customers usually buy 4 chairs with each table, meaning that factory must produce at most four times as many chairs as tables. The sale price is Rs 1500 per table and Rs. 500 per chair. Determine the daily production mix of chairs and tables that would maximize the total daily revenues to the factory and comment on the significance of the obtained solution. 10

Q3 a Solve the following problem by Dual simplex method 10

Maximize $Z = -3 X_1 - 2 X_2$

$$X_1 + X_2 \geq 1$$

$$X_1 + X_2 \leq 7$$

$$X_1 + 2 X_2 \geq 10$$

$$X_1, X_2 \geq 0$$

b Solve the following transportation problem 10

	R1	R2	R3	Supply
G1	8	3	5	20
G2	4	6	3	45
G3	6	8	4	30
G4	8	6	9	25
Demand	30	40	45	

Q4 a Determine the job sequence that minimizes the total processing time(in min) of the following six jobs on three machines in the order M_1, M_2 and M_3 10

Job no.	J_1	J_2	J_3	J_4	J_5	J_6
M_1	22	18	20	14	20	18
M_2	4	12	6	12	14	8
M_3	12	10	6	16	4	18

b In a departmental store one cashier is there to serve the customers. And the customers pick up their needs by themselves. The arrival rate is 9 customers for every 5 minutes and the cashier can serve 10 customers in 5 minutes. Assuming Poisson arrival rate and exponential distribution for service rate, find: 10

(a) Average number of customers in the system.
 (b) Average number of customers in the queue or average queue length.
 (c) Average time a customer spends in the system.
 (d) Average time a customer waits before being served.

Q5 a A company uses annually 50,000 units of an item each costing Rs. 1.20 Each order costs Rs 45 and inventory carrying cost is 15% of the annual average inventory value. 10

- a) Find economic order quantity EOQ
- b) If the company operates 250 days a year, the procurement time is 10 days and safety stock is 500 units, find reorder level, maximum, minimum and average inventory.

- b Find the mixed strategies for players A and B and also the value of the following game. 10

	B			
A	3	2	4	0
	3	4	2	4
	4	2	4	0
	0	4	0	8

- Q6 a Best-ride airlines that operates seven days a week has the following timetable. 10
Crews must have a minimum layover of 5 hours between flights. Obtain pairing of flights that minimizes layover time away from home. For any given pairing, the crew will be based at the city that results in the smaller layover. For each pair also mention the city where crew should be based.

Flight No.	Mumbai - Delhi	
	Departure	Arrival
101	8:00 am	9:00 am
102	9:00 am	10:00 am
103	12:00 noon	1:00 pm
104	5:00 pm	6:00 pm

Flight No.	Delhi - Mumbai	
	Departure	Arrival
1	7:00 am	8:00 am
2	8:00 am	9:00 am
3	1:00 pm	2:00 pm
4	6:00 pm	7:00 pm

- b A manufacturer is offered two machines A and B. A is priced at Rs.5,000 and running costs are estimated as Rs.800 for each of the first five years, increasing by Rs.200 per year in the sixth and subsequent years. Machine B which has the same capacity as A, costs Rs 2500 but will have running costs of Rs.1200 per year for six years, increasing by Rs.200 per year thereafter. If money is worth 9 % per year, which machine should be purchased? Assume scrap value to be negligible. 10