



AKR/MA/2018/00001

AIKTC KALSEKAR TECHNICAL CAMPUS

INNOVATIVE TEACHING ERUBERAHY LEARNING

School of Architecture

School of Engineering & Technology

School of Pharmacy

Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2018-19/

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 | MEE701X | | | |
| 6 | | | | | |
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Note: SC – Softcopy, HC - Harcopy

(Shaheen Ansari)
Librarian, AIKTC

14

(3 Hours)

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

- Q1 Answer any **Four** from the following
- a) Explain how assumptions made in Lewis equation are taken into account during design. 5
 - b) Discuss advantages and disadvantages of rolling contact bearings over sliding contact bearings. 5
 - c) Explain the significance of pressure angle in cam and follower design. 5
 - d) Discuss the desirable properties of friction materials and list out at least two friction materials. 5
 - e) Discuss the advantages and disadvantages of belt drives as compare to the chain or gear drive. 5

Q2 It is required to design a two stage spur gear reduction unit with 20° full depth involute teeth. The input shaft is connected to 10KW, 1440 rpm motor through a flexible coupling. The speed of output shaft shall be approximately 180 rpm. The starting torque of motor is 150% of rated torque. The gears are made of plain carbon steel with ultimate tensile strength of 700 N/mm^2 and heat treated to a surface hardness of 340 BHN. Design the gear and specify the dimensions. 20

Q3 a) A worm and worm wheel drive is required to transmit power from an electric motor rated at 11KW and 1440 rpm with reduction ratio of 15. The power is supplied to a belt conveyor which operates for 12 hours per day. Selecting suitable material and stresses, design worm and worm wheel for strength and wear. Do not check for heat dissipation capacity. 10

Q3 b) A ball bearing mounted on 90 mm shaft operates on the following work cycle. 10

| No. | Radial load (KN) | Speed (rpm) | Duration in sec. |
|-----|------------------|--------------|------------------|
| 1 | 3 | 720 | 3 |
| 2 | 7 | 1440 | 4 |
| 3 | 5 | 900 | 3 |

Select a suitable bearing for a life of 10,000 hours with 93% probability of survival.

- Q4 a) The following data is given for 360° hydrodynamic bearing. 10
 Radial load = 10KN, Journal speed = 1450 rpm, L/D ratio = 1,
 Bearing length = 50mm, Radial clearance = 20 microns, Eccentricity = 15 microns
 Calculate
 1) The minimum oil film thickness
 2) The coefficient of friction
 3) Power lost in friction
 4) Viscosity of lubricant in Centipoise
 5) The total flow rate of the lubricant in liters per minute.
- Q4 b) Design a chain drive to meet following specifications 10
 Input Power = 3.5 KW
 Input speed = 300 rpm
 Output speed = 100 rpm
- Q5. A cone clutch is required to transmit 11 KW at 960 rpm. Design following 20
 components by selecting suitable materials and design stresses.
 1) The Cone 2) The Cup 3) The Spring 4) The driven shaft
 Draw neat sketches of above components and indicate dimensions. Assuming that the
 time for each engagement = 0.125 seconds and 30 engagements takes place per hour,
 Determine steady state temperature of the cup outer surface. Consider that the entire
 heat generated during engagement is transferred to the cup and heat dissipation takes
 place from the outer surface of cup.
- Q6 a) A rotary disc cam with central translatory roller follower has following motion. 10
 Forward stroke of 25 mm in 120° of cam rotation with SHM motion, Dwell of 60° of
 cam rotation and return stroke of 25 mm in 100° of cam rotation with SHM.
 Remaining dwell to complete the cycle. Mass of the follower is 1 Kg and Cam shaft
 speed is 500 rpm. The maximum pressure angle during forward stroke and return
 stroke is limited to 25° . The external force during forward stroke is 300 N and that of
 return stroke is 50 N,
 1. Draw Displacement, Velocity and Acceleration time diagram
 2. Find prime circle radius, Base circle radius
 3. Calculate radius of curvature of pitch curve and Cam profile
 4. Determine width of the cam
- Q6 b) Determine size of a rubber canvas flat belt to transmit 5.5 KW from an electric motor 10
 rotating at 960 rpm to an intermediate shaft of machine tool. The reduction ratio is
 2.8 approximately and Expected life is 1200 hours.

(3 Hours)

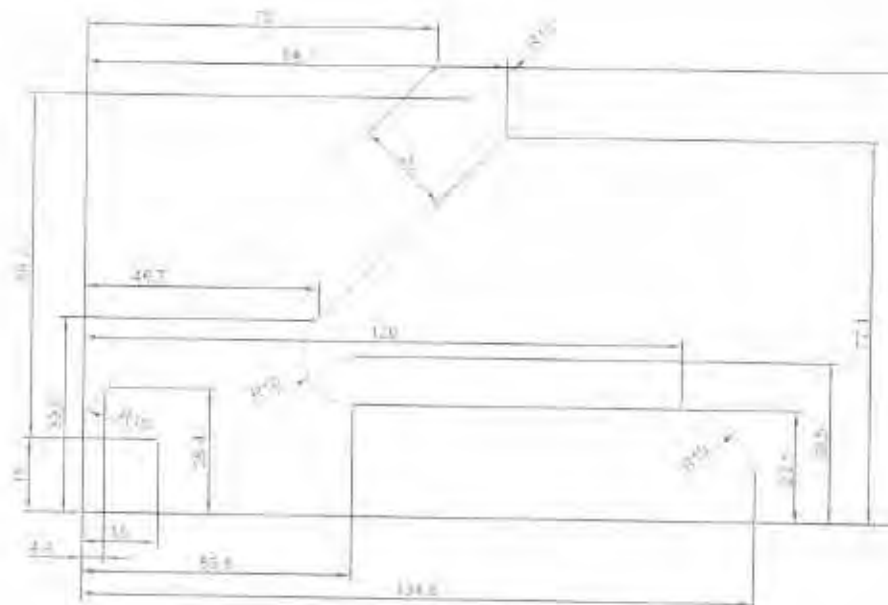
Max. Marks: 80

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 an algorithm for hidden surface removal | 5 |
| | b) Explain reflection with respect to 3D transformation | 5 |
| | c) Explain the significance of rapid prototyping in product development and testing | 5 |
| | d) Explain the roughing and finishing canned cycle for turning. | 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 Fused Deposition Modelling | 10 |
| Q.3 | a) Write a complete part program to machine the external contour for the component shown. | 10 |



- b) Explain Adaptive control system by explaining ACC and ACO. 10
- Q.4 a) A rectangle ABC has vertices A (5, 10), B (20, 10) and C (20, 20). This triangle is to be reflected about a line P (25, 20) and Q (10, 30). Determine the new triangle position. 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) Explain the basic components of CIM system. 10
- Q.6 Write short note on any **Four**: 20
- Benefits of AI
 - Constructive solid geometry and Boundary representation
 - Feedback Devices
 - Advantages of Computer aided part programming as compared to manual part programming
 - Photolithography

(25)

BE - sem - VII - CBSGS - Mech

17/5/19

Paper / Subject Code: 42803 / Mechanical Utility Systems

(Revised course)

Time duration: 3 Hours

[Total Marks: 80]

- Note: 1) Question no. 1 is compulsory.
2) Attempt any three questions out of the remaining five questions.
3) Clearly mention the assumptions made if any.

Q 1. Attempt any 4 of the following; (20)

- Differentiate between reciprocating compressor and centrifugal compressor
- Explain external gear pump with diagram.
- Explain methods of improving isothermal efficiency of reciprocating compressor.
- A double acting reciprocating pump takes in water from 3m and delivers at 45 m when running at 50 rpm. Its diameter and stroke are 18 cm and 36 cm respectively. Find the power required to drive the pump if mechanical efficiency is 85%. Also find the discharge of pump. Neglect the area of piston rod.
- Write a note on load-unload test.

Q 2. a) Explain construction and working of multi-stage reciprocating air compressor with intercooler with help of neat labelled schematic diagram and PV diagram. (8)

b) A centrifugal pump discharges $0.15 \text{ m}^3/\text{s}$ of water against a head of 12.5 m, the speed of the impeller being 600 rpm. The outer and inner diameters of impeller are 500 mm and 250 mm respectively and the vanes are bent back at 35° to the tangent at exit. If the area of flow remains 0.07 m^2 from inlet to outlet, calculate: (i) Manometric efficiency of the pump, (ii) Vane angle at inlet, and (iii) Loss of head at inlet to impeller when the discharge is reduced by 40% without changing the speed. (12)

Q 3. a) Explain construction and working of axial compressor with neat labelled diagram. (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 the blade at 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 blades at outlet. (12)

Q 4. 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) The LP cylinder of a two-stage double-acting reciprocating air compressor running at 120 rpm has a 50 cm diameter and 75 cm stroke. It draws air at a pressure of 1 bar and 20°C and compresses it adiabatically to a pressure of 3 bar. The air is then delivered to the inter-cooler.

TURN OVER

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where it is cooled at constant pressure to 35°C and is then further compressed polytropically (index $n=1.3$) to 10 bar in HP cylinder. Determine the power required to drive the compressor. The mechanical efficiency of the compressor is 90% and motor efficiency is 86%. (12)

Q 5. a) Two geometrically similar centrifugal pumps are running at the same speed of 1000 rpm. One pump has an impeller diameter of 0.3 meter and lifts water at rate of 20 liters per second against a head of 15 meters. Determine the head and impeller diameter of the other pump to deliver half the discharge. (6)

b) An axial-flow compressor of 50% reaction has a blade outlet angle of 30° . The flow velocity is 0.5 times the mean blade velocity. The speed of the rotor is 7500 rpm. The stagnation condition of air at the entry is 1.013 bar and 5°C and the static pressure at this section is 0.91 bar. Draw the velocity triangle and find the power required to run the compressor, mass-flow rate and mean diameter of rotor. The mean flow area is 0.35 m^2 . (8)

c) Explain working of a single-stage reciprocating air compressor with neat labelled diagram. (6)

Q 6. Attempt any four of the following: (20)

- a) Trouble shooting in centrifugal pump
- b) Variable speed drive
- c) Screw pump
- d) Air vessels
- e) Choking and surging in centrifugal pump
- f) Methods of improving efficiency of pumping system

6

(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. Define the term Production Planning and Control and list down its need. (5)
B. What are subsidiary orders? How do they differ from work orders? Give its examples. (5)
C. What are the different types of inventories? (5)
D. List down the details which a process sheet should contain. (5)
E. Differentiate between CPM and PERT. (5)

Q2. A. What are the functions of PPC system? (10)

- B. With the help of neat sketch, derive the equation for EOQ with instantaneous stock replenishment. (Basic inventory model) (10)

Q3. A. Classify the following items into ABC and draw the ABC curve. (10)

| Item No. | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 |
|--------------------|-----|------|-----|------|-----|------|-----|-----|-----|-----|
| Annual consumption | 300 | 2800 | 30 | 1100 | 40 | 2200 | 150 | 800 | 600 | 80 |
| Unit Price (Rs) | 10 | 15 | 10 | 5 | 5 | 10 | 5 | 5 | 15 | 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 Use graphical method to minimize the time required to process the following jobs on the machines. Calculate the total elapsed time to complete both the jobs. (10)

| Job 1 | Sequence | A | B | C | D | E |
|-------|------------|----|---|---|----|----|
| | Time (Hrs) | 6 | 8 | 4 | 12 | 4 |
| Job 2 | Sequence | B | C | A | D | E |
| | Time (Hrs) | 10 | 8 | 6 | 4 | 12 |

{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. What are the advantages and limitations of linear programming methods? (10)

A firm produces three products. These products are processed on three different machines. The time required to manufacture one unit of each of three products and the daily capacity of the three machines are given in the table below.

It is required to determine the daily number of units to be manufactured for each product. The profit per unit for product 1, 2, and 3 is Rs. 4, 3 and 6 respectively. It is assumed that all the amounts produced are consumed in the market. **Formulate** the mathematical linear programming model that will maximize the daily profit.

| Machine | Time per unit (minutes) | | | Machine capacity (mins/day) |
|---------|-------------------------|-----------|-----------|-----------------------------|
| | Product 1 | Product 2 | Product 3 | |
| M1 | 2 | 3 | 2 | 440 |
| M2 | 4 | - | 3 | 470 |
| M3 | 2 | 5 | - | 430 |

- B. List of activities for a job is given below. Job A must precede all others while job E must follow others. Apart from this, jobs can run concurrently. (10)

| Jobs | Normal | | Crash | |
|------|-----------------|-----------|-----------------|-----------|
| | Duration (days) | Cost (Rs) | Duration (days) | Cost (Rs) |
| A | 5 | 3000 | 4 | 4000 |
| B | 6 | 1200 | 2 | 2000 |
| C | 4 | 1000 | 3 | 1800 |
| D | 5 | 1200 | 3 | 2000 |
| E | 3 | 1600 | 3 | 1600 |

- Draw the network and identify the critical path.
- Crash the network fully to find out minimum duration.
- If indirect costs are Rs. 300 per day, determine time cost trade off for the project

Q6. Write Short Notes on:-

- Pre-requisites of PPC. (5)
- JIT and its seven wastes. (5)
- Two bin system. (5)
- Forward scheduling and backward scheduling. (5)
