AIKTC/KRRC/SoET/ACKN/QUES/2019-20/ **Date:** 15/01/2020

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 Operations Research	MEE701X		✓	02
6					

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

BE-sem-VII - CBGS - Mech

Paper / Subject Code: 42801 / Machine Design - II

14/11/19

[Time: 03 Hours] [Total marks: 80]

N.B.: 1. Question No **1** is **compulsory**

2. Solve **Any Three** questions from the remaining **Five** questions.

3. Assume any **suitable data** if necessary with justification.

4. Use of **Standard Data Book** is permitted

5. Figures to the right indicate full marks.

Q1. Attempt any **Four** of the following. 20

(a) With neat sketch explain force analysis of Bevel Gear? 05

(b) Derive Levis Beam Strength Equation? 05

(c) Why it is necessary to dissipate the heat generated when clutch operate? 05

(d) How various factors influence the life of a bearing? 05

(e) What is the significance of Pressure angle in cam and follower? 05

Q2. A pair of spur gear is used to transmit power at 8kW from a motor rotating at 960 rpm to a machine with approximate reduction ratio of 3.7 **20**

i) Select suitable material for pinion and gear.

ii) Determine the module and face width of the gear to satisfy strength and wear.

iii) Check the gear for dynamic load using Buckingham's formula

Describe the constructional details of gear and pinion.

Q3. (a) A worm reduction unit is required to transmit 15 kW power from an electric motor operating at 1440rpm. The output speed is 72 rpm and the load is with mild shock, normal duty. Determine **15**

a. Selecting suitable material and design stresses

b. Design worm and worm wheel for strength and wear

c. Check for heat dissipation capacity

(b) Discuss the polygon effect in chain drive. 05

Q4. A rotating disc cam and central translatory follower has following follow motion : **20**

Forward stroke of 25 mm is 120^0 rotation of cam with SHM. Dwell of 60^0 of cam rotation return stroke of 25 mm with SHM is 100^0 of cam rotation remaining dwell to complete the cycle. Mass of the follower is 1 kg and the cam shaft rotates at 500 rpm. Maximum pressure angle is 25^0 during forward stroke. The external force is 300 N during forward stroke and 50 N during return stroke.

i) Determine Base Circle Radius

ii) Design Cam

iii) Design spring

iv) Calculate the maximum cam shaft torque.

Q5. (a) A radial load on 360° hydro dynamically lubricated self-contained bearing supports 20kN. The journal rotates at 1200 rpm. Assuming journal length to it diameter as 1 and suitable fit between journal and bearing. Design average clearance, check bearing heat dissipation bearing pressure must not exceed 1.5N/mm^2. **12**

(b) 75 kW power is transmitted by multi-plate clutch at 3000 rpm. The plates run in oil and coefficient of friction is 0.07. Axial intensity of pressure is not to exceed 0.15 N/mm^2. Due to space limitation external radius is restricted to 125 mm. Assuming number of springs as 6. Design Input and Output Shaft. **08**

6. (a) A flat belt drive is used to transmit 6 kW power from an electric motor rotating at 1440 rpm to the blower operating at 400 rpm for 10 hours/ day and the expected life of belt is two and half years approximately. Centre to centre distance is 950 mm. Find **12**

a. Driving and Driven pulley diameter.

b. Considering Rubber Canvas Material for the belt, determine the thickness and width of the belt.

Determine driving and driven shaft diameter considering torque only.

(b) DGBB is selected for a intermediate shaft of helical gear box which is subjected to an axial load of 5 KN and radial load of 12KN when operating on 600 rpm. Select suitable bearing is it required to have life of 20000 hours with probability of survival 92%. **08**

(3)

BE - sem- VII - CBSGS - Mech

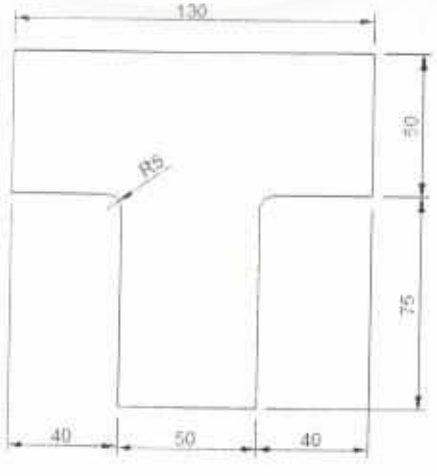
18/11/19

[3 Hours] [Total Marks : 80]

Note:

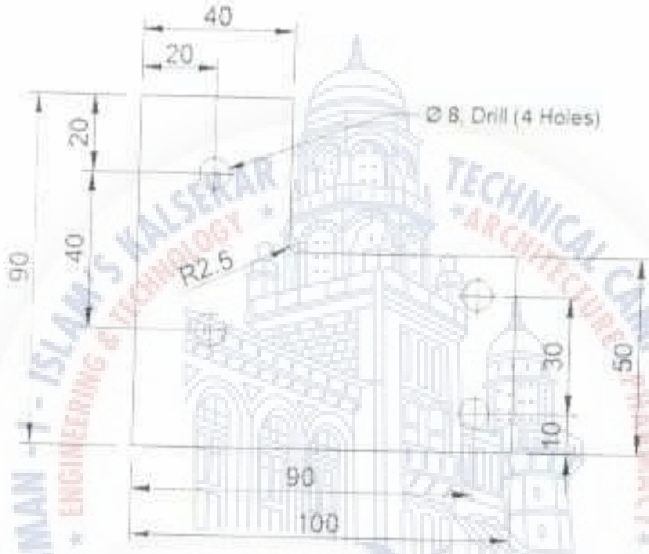
1. **Question 1 is Compulsory**
2. Solve any three from remaining five
3. Figures to right indicate full marks
4. Assume suitable data if necessary

Question No.		Max. Marks
Q.1	Explain any **Four**:	20
	a) Constructive Solid Geometry	
	b) Benefits of Artificial Intelligence	
	c) Velocity Feedback Devices	
	d) Obstacles for implementing CIM	
	e) Application of RP in MEMS	
Q.2	a) Explain Laminated Object Manufacturing with its advantages, disadvantages and application.	10
	b) A triangle with vertices A (1 , 1) , B(2 ,1) and C (2 , 3) has to be rotated by 30° counter clockwise about a point P (3 , 2). Determine the composite transformation matrix and the new coordinates of the triangle.	10
Q.3	a) Plot a Beizer curve defined by the points (1, 1), (2, 3), (4, 4), and (6, 1).	10
	b) Parametric representation of curves and its benefits.	10
Q.4	a) Write a APT program to machine the component as shown in figure. Assume the component to be 15mm thick. The mill used is 10mm in diameter. Assume spindle speed as 800 rpm and feedrate as 240 mm/min.	10



b) Find the transformation matrix which aligns vector V=ai+bj+ck in three dimension space along positive Z-axis. 10

Q.5 a) Write a CNC part program using G and M codes for drilling and milling an L – Bracket as shown in figure. Assume a 5mm diameter milling cutter and necessary drill sizes for drilling operation. Assume bracket thickness as 10mm, cutter speed as 15m/min and feedrate as 0.2 mm/rev. 10



b) Explain Concept of Future CIM Systems. 10

Q.6 Write short note on: 20

a) Hidden Line removal Algorithm

b) Knowledge based Engineering

c) Turning Canned Cycle

d) Joints for Kinematic Analysis

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) Assume suitable data if required

Q.1 Solve any four (20)

a) Derive the equation for work done per kg of air in case of a single stage reciprocating compressor without clearance.

b) Explain the working of an axial flow compressor with neat labeled diagram.

c) Explain the working of gear pump.

d) Describe the function of air vessel in reciprocating pump with the help of neat sketch.

e) Write a note on the leak detection techniques in compressed air network.

Q.2 a) Explain the construction and working of a centrifugal pump with nest sketch. Why is priming necessary in a centrifugal pump. (10)

b) A single acting reciprocating pump has a plunger of 80 mm diameter and a stroke of length 150 mm. It takes its supply of water from a sump 3 m below the pump through a pipe 4.5 m long and 30 mm diameter. It delivers water to a tank 12 m above the pump through a pipe 25 mm diameter and 15 m long. If separation occurs at 78 kN/m^2 below atmospheric pressure, find the maximum speed at which the pump may be operated without separation, assume the plunger to have simple harmonic motion. (10)

Q.3 a) Why inter-cooling is used in multi-stage compressor? Derive an expression for intermediate pressure in a two-stage compressor when inter-cooling is perfect. (10)

b) An axial flow compressor with an overall isentropic efficiency of 90% draws air at 25°C and compresses it in the pressure ratio of 3:1. The mean blade speed and flow velocity are constant throughout the compressor.

Assuming 50% reaction blading and taking blade velocity as 200 m/s. Take $\alpha 1=12°$, $\beta 1=42°$. Calculate: (i) Flow velocity (ii) Number of stages (10)

Q.4 a) The impeller of a centrifugal pump having external and internal diameters 500 mm and 250 mm respectively, width at outlet 50 mm and running at 1200 r.p.m works against a head of 48 m. The velocity of flow through the impeller is constant and equal to 3 m/s. The vanes are set back at an angle of 40° at outlet. Determine: (i) Inlet vane angle (ii) workdone by impeller on water per second and (iii) manometric efficiency. (10)

b) Write a note on the energy conservation opportunities in pumping system. (10)

Q.5 a) A single-stage reciprocating compressor takes 1m^3 of air per minute at 1.01325 bar and 15°C and delivers at 7 bar. Assume that law of compression is $PV^{1.35}$=constant, and that clearance is negligible. If this compressor is driven at 300 rpm, stroke to bore ratio of 1.5:1 and single acting, calculate the indicated power, the cylinder bore required, the power required to drive the compressor, if the mechanical efficiency is 85% and that of motor transmission is 90% and the iso-thermal efficiency of this compressor. (12)

b) What is cavitation? State the effects of cavitation and what precautions should be taken against cavitation. (08)

Q.6 Solve the following. (Any four) (20)

a) What do you mean by net positive suction head and its significance?

b) Applications of compressed air in industry.

c) Enumerate the losses which occur when a centrifugal pump operates.

d) What is octopus network and its limitations?

e) Draw and comment on performance characteristics of centrifugal pump.

BE-sem-VII – CBSGS-mech

22/11/19

Paper / Subject Code: 42804 / Production Planning & Control

(3Hours) **Total Marks 80**

N.B:

1. Question No.1 is compulsory
2. Attempt any three out of remaining questions
3. Draw neat sketches to illustrate your answers
4. Figures to the right indicate full marks.

Q 1. Write short notes on : 20

a) Two-bin system

b) MRP-I and MRP-II

c) Dispatching

d) Delphi Method

Q 2. a) How the size of an organization affects the various factors that influence PPC? 20

b) Define the terms : lead time, safety stock, reorder point and maximum inventory.

Q 3. a) Discuss the prerequisites of PPC. 20

b) Why process planning is needed? Explain Computer aided process planning.

Q 4. a) Explain 1. Computer integrated process planning, 2. JIT system 20

b) What is Linear programming? Discuss the areas of applications of Linear programming.

Q 5. a) Explain any two types of Qualitative forecasting models. 20

b) Explain the factors influencing scheduling.

Q 6. a) There are five jobs, each of which must go through machines A, B, and C in the order ABC. Processing times on the machines are given in the following table. 20

Jobs	Processing times (Hours)		
	Machines		
	A	B	C
1	8	5	4
2	10	6	9
3	6	2	8
4	7	3	6
5	11	4	5

Determine the sequence for processing of these five jobs on three machines for which the entire process will be completed in the minimum possible time.

b) A small project is composed of 7 activities whose completion time estimates are given in the following table. Activities are identified by their beginning and end node numbers.

Activity (i - j)	Optimistic time to (in weeks)	Most likely time tm (in weeks)	Pessimistic time tp (in weeks)
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

i) Draw the project network
ii) Find the expected duration and variance for each activity.
iii) What is the expected project length
iv) Calculate the variance and standard deviation of the project length.

****

BE-sem-VII -CBGS-Mech

(6)

Paper / Subject Code: 42813 / 9)Operations Research

26/11/19

Time :-3 HRS Marks : - 80

Instructions
1. **Question No 1 is compulsory.**
2. **Attempt any Three out of remaining Five Questions.**
3. **Assume suitable data wherever necessary**
4. **Figures to the right indicate full marks.**

Q.1 Explain **Any 4** **20**

a. Prove that the dual of the dual of given primal is primal.

b. State the assumptions made in determination of economic order quantity for inventory management.

c. Explain Monte Carlo simulation technique for solving

d. Discuss Bellman's principle of optimality and Dynamic programming as a multistage problem

e. State the assumptions made in game theory.

Q.2 a A boat company makes three different kinds of boats. All boats can be made profitably but the company's monthly production is constrained by limited amount of labour, wood and screws available each month. The director will choose the combination of the boats that maximizes his revenue in view of the information given in the following table:

Input	Row Boat	Canoe	Keyak	Monthly Availability
Labour (Hrs)	12	7	9	1,260 Hrs.
Wood (Board Feet)	22	18	16	19,008 Board Feet
Screws (KG)	2	4	3	396 KG
Selling Price	4, 000	2, 000	5,000	

1) Formulate the problem as LPP **(05)**

2) Write the dual of the LPP. **(05)**

b Solve the following problem by Dual simplex method **10**

Maximize $Z = -3X_1 - 2X_2$

$$X_1 + X_2 \geq 1$$

$$X_1 + X_2 \leq 7$$

$$X_1 + 2X_2 \geq 10$$

$$X_1, X_2 \geq 0$$

Q.3 a There are seven jobs, each of which has to go through the machined A and B in the order AB. Processing times in hours are given as **10**

Job no.	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

Determine the sequence of these jobs that will minimize total elapsed time T and idle time for a machine if any.

78261

b The DREAM - DRINK Company has to work out a minimum cost transportation schedule to distribute crates of drinks from three of its factories X, Y, and Z to its three warehouses A, B, and C. The required particulars are given below. Find the least cost transportation schedule. Transportation cost in Rs per crate. **10**

From/To	A	B	C	Crates Available
X	75	50	50	1040
Y	50	25	75	975
Z	25	125	25	715
Crates required	1300	910	520	2730

Q.4 a. An educational institute is contemplating to replace zeroxing machine with a heavy duty printer or a cyclostyling machine. Supplier has submitted the quotation for the same for both printer and cyclostyling machine and is as follows **10**

Printer has the cost price of Rs. 1,25,500/- plus 18% GST. The annual maintenance cost is Rs. 5000 per year. The warranty covers repair or replacement of spare parts for first two years and beyond two years it will be charged and it will be at an average of ten percent of the AMC cost per year.

Cyclostyling machine has the cost price of Rs. 1,75,500/- plus 18% GST. The annual maintenance cost is Rs. 2000 per year. The warranty covers repair or replacement of spare parts for first three years and beyond three years it will be charged and it will be at an average of twenty percent of the AMC cost per year.

The specifications of the machines satisfy requirements of the institute. As a head of the institute, you have to advice management which machine should be purchased by giving justification. Assume the life of both machines is six years and resale value at the end of life is Rs 10,000 for printer and Rs 18000 for cyclostyling machine. Take discount rate of money as 10%.

b. A receptionist attends customer querries regarding connectivity problems in a front office of telecom operator company. The arrival as well as service times are at random and estimated probability distribution is given below **10**

Inter arrival time in time units	1	2	3	4	5
Probability	0.1	0.2	0.35	0.3	0.05
Service time in time units	1	2	3	4	
Probability	0.1	0.3	0.4	0.2	

For next ten arrivals, simulate the system by Monte Carlo Simulation and find the proportion of the time the receptionist is idle and average waiting time for the customers.

Use following random numbers.

Arrival	7884	5611	6517	8468	9495	4436	8589	3899	3712	4949
Service	5218	5441	4741	2264	6377	9517	6164	3582	8081	7537

Q.5 a. Use dynamic programming approach to solve the following problem **10**

Maximize $Z = 8X_1 + 7X_2$

$$2X_1 + X_2 \leq 8$$
$$5X_1 + 2X_2 \leq 15$$

$X_1, X_2 \geq 0$ and integer.

b Customers arrive at a video game centre at the rate of 5/hour (Poisson) and spend on an average 30 minutes (exponential). **10**

1) How many terminals should the shop have such that the expected number in the queue is less than or equal to 1.
2) Compute the probability that a person enters immediately gets a terminal to play.

Q.6 a. A stockiest has to supply 400 units of a product every Monday to his customers. He gets the product at Rs. 50/- per unit from the manufacturer. The cost of ordering and transportation from the manufacturer is Rs. 75 per order. The cost of carrying inventory is 7.5% per year of the cost of the product. Find (*i*) Economic lot size, (*ii*) The total optimal cost (including the capital cost). **10**

b. I. Solve the following problem graphically. The pay off is for player A **05**

	B_1	B_2
A_1	6	9
A_2	7	6
A_3	6	8

II. Find the optimum value of the following two person zero sum game. **05**

	B_1	B_2	B_3
A_1	10	40	40
A_2	5	5	5
A_3	20	5	20

****