

**B.Tech. Degree VII Semester Examination November 2013**

**ME 701 OPERATIONS RESEARCH**  
(2006 Scheme)

Time : 3 Hours

Maximum Marks : 100

**PART A**  
(Answer **ALL** questions)

(8 × 5 = 40)

I. (a) Define:

- (i) Euclidean space
- (ii) Linear dependence
- (iii) Spanning set

(b) Explain lines and hyper planes.

(c) Write steps involved in two phase simplex method.

(d) Explain graphical method to solve LPP.

(e) State the assignment model, describe an algorithm for the solution of the assignment problem.

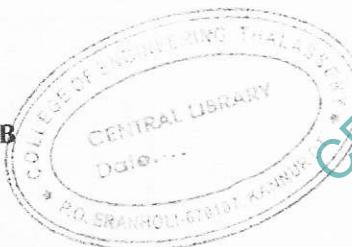
(f) Explain the concept of degeneracy in transportation problem.

(g) What do you understand by zero-sum and nonzero-sum games? Explain strategy, dominance and saddle point.

(h) Explain Monte-Carlo simulation.

**PART B**

(4 × 15 = 60)



II. Test for consistency and find the solution if it exists.

$$3x + 3y + 2z = 1$$

$$x + 2y = 4$$

$$10y + 3z = -2$$

$$2x - 3y - z = 5$$

OR

III. Find  $A^{-1}$  if

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$$

IV. Maximize  $Z = 4x_1 + 3x_2 + 6x_3$

Subject to  $2x_1 + 3x_2 + 2x_3 \leq 440$

$$4x_1 + 3x_3 \leq 470$$

$$2x_1 + 5x_2 \leq 430$$

$$x_1, x_2, x_3 \geq 0$$

OR

(P.T.O.)

V.

Maximize  $Z = x_1 + 2x_2 + 3x_3 - x_4$   
 Subject to  $x_1 + 2x_2 + 3x_3 = 15$   
 $2x_1 + x_2 + 5x_3 = 20$   
 $x_1 + 2x_2 + x_3 + x_4 = 10$   
 $x_1, x_2, x_3, x_4 \geq 0$

- VI.
- A firm marketing a product has four salesmen  $S_1, S_2, S_3$  and  $S_4$ . There are three customers  $C_1, C_2$  and  $C_3$ . The probability of making a sale to a customer depends upon the salesman-customer support. The table below represents the probability with which each of the salesmen can sell to each of the customers.

		$S_1$	$S_2$	$S_3$	$S_4$	Salesmen
Customer		$C_1$	0.7	0.4	0.5	0.8
		$C_2$	0.5	0.8	0.6	0.7
	$C_3$	0.3	0.9	0.6	0.2	

If only one sales man is to be assigned to one customer what combination of salesmen and customers shall be optimal? Profit obtained by selling one unit to  $C_1$  is ₹500/-, to  $C_2$  is ₹450/- and to  $C_3$  is ₹540/-. What is the total expected profit?

OR

- VII.
- Solve the following transportation problem where cell entries are unit costs.

		$D_1$	$D_2$	$D_3$	$D_4$	$D_5$	Available
O <sub>1</sub>	68	35	4	74	15	18	
	57	88	91	3	8	17	
	91	60	75	45	60	19	
	52	53	24	7	82	13	
	51	18	82	13	7	15	
Required		16	18	20	14	14	

- VIII.
- Solve the following  $3 \times 3$  game by the method of matrices.

		B		
		1	2	3
A	1	1	-1	-1
	2	-1	-1	3
	3	-1	2	-1

OR

- IX.
- AT what average rate must a clerk in a super market work inorder to ensure a probability of 0.90 that a customer will not have to wait longer than 12 minutes? Customer arrive at the counter in Poisson fashion with mean rate of 15 per hour. Service time has exponential distribution.

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## B.Tech. Degree VII Semester Examination November 2013

### ME 702 VIBRATION AND NOISE CONTROL (2006 Scheme)

Time : 3 Hours

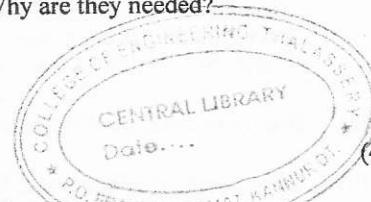
Maximum Marks : 100

#### PART A (Answer ALL questions)

(8 x 5 = 40)

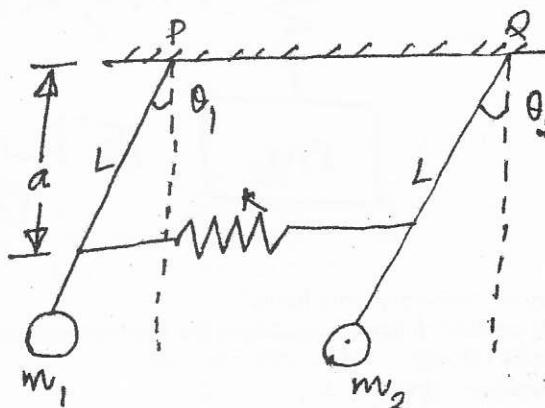
- I. (a) What do you mean by logarithmic decrement? Derive an expression for logarithmic decrement.  
(b) What is transmissibility ratio? Obtain a relation for it.  
(c) Determine the response of an undamped, single degree of freedom, spring-mass system when subjected to an excitation of the form  $F(t) = F_0 e^{-\alpha t}$   
(d) Derive equations of motion for a two degree of freedom system.  
(e) Determine the normal functions for free longitudinal vibration of a bar of length 'L' and uniform cross section. One end of the bar is fixed and other end free.  
(f) Briefly explain, the Rayleigh's energy method.  
(g) Explain the terms A,B and C weighting networks. Why are they needed?  
(h) Write a short note on impulse noise.

#### PART B



(4 x 15 = 60)

- II. (a) Briefly explain the basic principles of viscous damping.  
(b) A vibratory system in a vehicle is to be designed with the following parameters:  
 $K = 100 \text{ N/m}$ ,  $C = 2 \text{ N - Sec/m}$ ,  $m = 1 \text{ Kg}$ . Calculate the decrease of amplitude from its starting value after three complete oscillations and the frequency of oscillation.  
OR
- III. (a) Based on the principle of support excitation, explain the basic idea of a seismometer.  
(b) A seismometer having the amplitude of vibration of the machine part as 0.4cm and damping factor,  $\varepsilon = 0.2$ , performs harmonic motion. If the difference between the maximum and minimum recorded value is 1cm, determine the natural frequency of vibrometer if the frequency of the vibration part is 12 rad/sec.
- IV. Determine the normal mode vibrations of the coupled pendulum as shown in the figure. (15)  
Assume  $m_1 = m_2 = m \text{ Kg}$  and  $\theta_1$  and  $\theta_2$  are very small.



OR

(P.T.O)

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- V. Determine the pitch (angular motion) and bounce (up and down linear motion) frequencies and the location of oscillation centers (nodes) of an automobile with the following data: (15)

Mass (m) = 1000 Kg

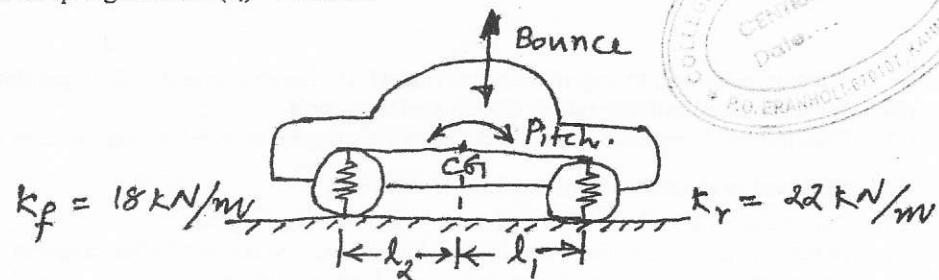
Radius of gyration ( $r$ ) = 0.9m

Distance between front axle and centre of gravity, C.G ( $\ell_2$ ) = 1m.

Distance between rear axle and centre of gravity, C.G. ( $\ell_1$ ) = 1.5m

Front spring stiffness ( $k_f$ ) = 18kN/m.

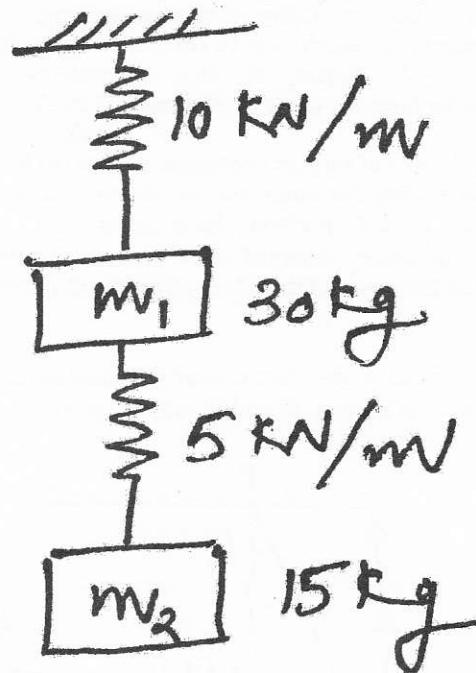
Rear spring stiffness ( $k_r$ ) = 22kN/m.



- VI. Derive the governing equation for transverse vibration of the string (wave equation). Obtain the solution of wave equation. (15)

OR

- VII. (a) Briefly explain, the Dunkerley's method and Rayleigh-Ritz method. (10)  
 (b) Using Dunkerley's method, find the natural frequency of the system shown in the figure. (5)



shown in the figure.

- VIII. (a) Write a note on "noise exposure limits". (8)  
 (b) A worker is exposed to noise according to the following schedule. (7)

Exposure level [dB(a)]	: 92	95	97	102
Period of exposure (Hrs)	: 3	2	2	1

Does the daily noise dose is exceeded as per OSHA standards?

OE

- OR

IX. Briefly explain : (i) Noise control at the source  
                          (ii) Noise control along the path  
                          (iii) Noise control at the receiver (15)

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## B.Tech. Degree VII Semester Examination November 2013

### ME 703 MACHINE DESIGN II (2006 Scheme)

Time : 3 Hours

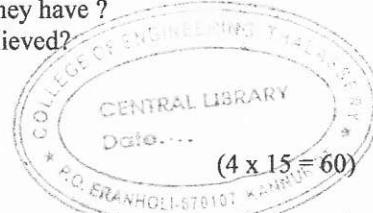
Maximum Marks : 100

#### PART A (Answer ALL questions)

(8 x 5 = 40)

- I. (a) How are brakes rated and classified?  
(b) What is a V-belt, where is it used and what are its advantages?  
(c) What are the common curves used for tooth profile? Compare them.  
(d) Compare the bevel gear with helical gear.  
(e) Discuss the advantages and disadvantages of ball and roller bearings over journal bearings.  
(f) What are the various bearing materials and what property should they have ?  
(g) What are stresses developed in a welded joint and how are they relieved?  
(h) Explain the various symbols used to indicate the surface finish.

#### PART B



- II. (a) A multi disk clutch is required to transmit 75Nm torque with a possibility of overload of 25% occasionally during operation. The limiting values of outer and inner diameter of clutch are 100mm and 60mm respectively. Design the clutch dimensions and the operating force required. Range of operating pressure = 0.6 Mpa, coefficient of friction = 0.08.  
(b) Compare belt and chain drives. (5)

#### OR

- III. A simple band brake is applied to a rotating drum of 350mm diameter. The angle of lap of the band is 265deg. One end of the band is attached to the fulcrum and the other end is attached to the lever at a distance of 75mm from the fulcrum. The braking force of 90N is applied at a distance of 500mm from the fulcrum. The coefficient of friction is 0.25. Find the braking force when the drum rotates in a clockwise direction, anticlockwise direction and also determine the cross section of the band if the permissible stress = 30MPa and thickness = 3mm. (15)

- IV. Design a pair of spur gear pinion and gear made of cast steel and cast iron respectively. The diameter of pinion is 140mm and it transmits 30kW at 1250 rpm. The gear ratio is 3:1 and the teeth are 20 deg full depth involute. Check the design for wear and dynamic tooth load. (15)

#### OR

- V. Design 20 deg involute worm and gear which will transmit 15 kW between the shafts that are 300mm apart. The speed reduction = 10.5:1 and the driving shaft is turning at 1200 rpm. (15)

- VI. A shaft rotating at 1440 rpm is supported by two bearings. The forces acting on each bearing are 6000N radial load and 3500N axial load. Select a suitable bearing if the diameter of the shaft is 40mm and the expected life = 500 hours. Also select a suitable bearing for the same loading conditions and data given above if the required reliability is 99 percent. (15)

#### OR

- VII. Design a self contained journal bearing for the crank shaft of a four stroke petrol engine to carry a radial load of 10kN. The journal diameter is 50mm and it rotates at 1000 rpm. SAE 30 oil may be used. (15)

- VIII. Briefly explain the design recommendations for rolled sections and casting. (15)

#### OR

- IX. (a) What are the salient features used in the design of forging? Explain. (8)  
(b) Discuss the various manufacturing methods of machine parts. (7)

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## B.Tech. Degree VII Semester Examination November 2013

### ME 704 REFRIGERATION AND AIR CONDITIONING (2006 Scheme)

Time : 3 Hours

Maximum Marks : 100

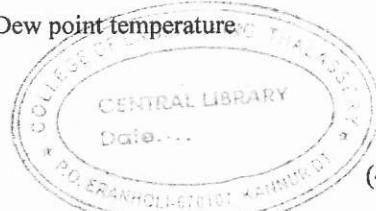
#### PART A

(Answer ALL questions)

(8 x 5 = 40)

- I. (a) Explain the unit of refrigeration.  
(b) Describe boot-strap air cooling system.  
(c) What are the advantages of vapour absorption system over compression system?  
(d) What are the desirable physical properties of an ideal refrigerant?  
(e) Explain the advantages of multi stage compression over single stage compression.  
(f) Explain flooded evaporator with a neat sketch.  
(g) Explain the following:  
(i) Saturated air (ii) Relative humidity (iii) Dew point temperature  
(h) Explain central air conditioning system.

#### PART B



(4 x 15 = 60)

- II. (a) Explain air refrigerator working on reversed Carnot cycle using P-V and T-S diagram and find the expression for C.O.P. (7)  
(b) Find the least power of a refrigerator, which makes 500 Kg of ice per hour at  $-4^{\circ}\text{C}$  from feed water at  $15^{\circ}\text{C}$ , if the system operates on reversed Carnot cycle. Take specific heat of ice as 2.095 KJ/Kg and latent heat as 335 KJ/Kg. (8)  
**OR**  
III. (a) Describe the working of a steam jet refrigeration system with the help of a neat sketch (8)  
(b) Explain the working of Bell-Coleman cycle and derive the expression for C.O.P. (7)
- IV. Describe the working of electrolux vapour absorption system with neat sketch. What are the merits and demerits of electrolux system? (15)
- V. An ammonia vapour compression refrigeration system is working between the temperature limits of  $-10^{\circ}\text{C}$  and  $30^{\circ}\text{C}$ . The vapour is 95% dry at the end of compression and the fluid leaving the condenser is at  $30^{\circ}\text{C}$ . And there is no under cooling of the refrigerant. Assuming actual C.O.P as 60% of the theoretical C.O.P, calculate the kilograms of ice produced per kilowatt hour at  $0^{\circ}\text{C}$  from water at  $10^{\circ}\text{C}$ . (15)
- VI. (a) Derive the expression for work done by a single stage reciprocating compressor with clearance volume. (8)  
(b) What are the advantages of centrifugal compressors over reciprocating compressors? (7)  
**OR**  
VII. (a) Describe the different types of water cooled condensers. (7)  
(b) Explain the process involved in expansion device and its function, with a suitable sketch. (8)
- VIII.  $800 \text{ m}^3/\text{min}$  of recirculated air at  $22^{\circ}\text{C}$  dry bulb temperature and  $10^{\circ}\text{C}$  dew point temperature is to be mixed with  $300\text{m}^3/\text{min}$  of fresh air at  $30^{\circ}\text{C}$  dry bulb temperature and 50% relative humidity. Determine the enthalpy, specific volume, humidity ratio and dew point temperature of the mixture. (15)  
**OR**  
IX. (a) Explain summer and winter air conditioning systems. (6)  
(b) What is meant by effective temperature? What are the factors governing optimum effective temperature? (9)

BTS – VII – 11.13 – 1115

## **B. Tech. Degree VII Semester Examination November 2013**

### **ME 705(D) QUALITY ENGINEERING** *(2006 Scheme)*

Time: 3 Hours

Maximum Marks: 100

#### **PART A** (Answer **ALL** questions)

(8 x 5 = 40)

- I. (a) Write one disadvantage of arithmetic mean. In spite of this it is still used as a measure of Central and Tendency in Quality Control work. Why?
- (b) Explain the method of constructing histogram and frequency polygon. Which out of these two is representative of frequencies of
  - (i) a particular group
  - (ii) whole group
- (c) An automatic screw machine turns out round headed bolts with a specified shank diameter of  $9.00 \pm 0.04$  mm. The process has been operating in control at an estimated  $\mu$  of 9.00mm and  $\bar{R}$  of 0.0206mm. The sub group size is 4. Compute the  $\bar{X}$  and R chart control limits.
- (d) Why R chart is generally used with  $\bar{X}$  chart?
- (e) Explain Producers Risk and Consumers Risk.
- (f) Write notes on: (i) AOQL (ii) LTPD
- (g) Distinguish between Reliability and Quality Control.
- (h) A filter and amplifier comprise a system that is to operate with a probability of success of 90% for 1000h. The amplifier has a probability of survival of 95% for 1000h. What probability of survival is required for the filter?



#### **PART B**

(4 x 15 = 60)

- II. A complex television component has 1000 joints soldered by a machine which is known to produce on an average one non conforming joint in forty ( $\rho = 0.025$ ). The components are examined and nonconforming joints connected by hand soldering. If the components requiring more than 35 connections are discarded. What proportion of components will be thrown away?

**OR**

- III. A company manufactures and distributes a product which sells at Rs.20,000/- . The marginal cost of production is Rs.11,000/- per unit and unavoidable manufacturing fixed cost are Rs.70,000/- a month. The company employs 128 salesmen and the chances of any salesman getting an order is 1 in 9, but there is no chance of getting more than one order. The firm does not wish to fall below break-even point more than 1 month in 6. How much can be allocated each month for directors' fee, consultancy fee etc.?

**(P.T.O.)**

- IV. Twenty samples of parts were taken from a production line for gauging each sample containing 100 parts. The following number of nonconforming found in each sample.

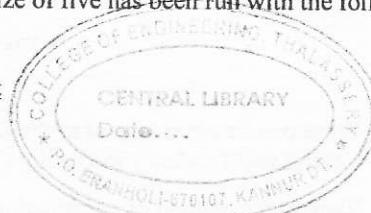
3	4	5	5	5	5	4	7	6	7
6	6	4	3	5		8	5	4	6

- (i) Calculate the fraction rejected ( $\bar{p}$ ) and 3 sigma control limits
- (ii) State briefly the main purpose of an attribute control chart

**OR**

- V. An average and range chart based on a sample size of five has been run with the following control limits.

Control limits	$\bar{X}$ Chart	R Chart
UCL	78.0	8.0
Average Value	75.8	3.8
LCL	73.6	0



How large an increase in the overall process average would have to occur in order to have 30% chance that a sample average will exceed the upper control limit.

- VI. In a double sampling plan,  $M = 5000$ ,  $M_1 = 100$ ,  $C_1 = 0$ ,  $M_2 = 200$  and  $C_2 = 1$ .

- (i) Use table G to compute the probability of acceptance of a 1% nonconforming lot.
- (ii) What is % A O Q.

**OR**

- VII. Production lot of 1000 units are inspected under the following plan: AQL = 1.0%, limiting quality plan, consumer's risk is 10% normal inspection, single sampling.

- (i) What is the size of the sample?
- (ii) What is the limiting quality in percent defective which corresponds to the Consumer's Risk of 10%?
- (iii) What are the accept and reject numbers for this plan?

- VIII. A vibration monitoring system consist of six sub-systems, all connected in series the predicted reliability as obtained from an analysis as follows:

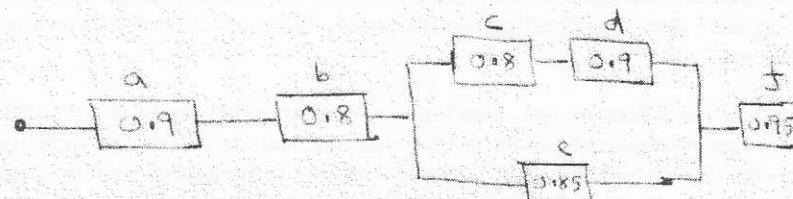
$$R_1 = 0.993 \quad R_2 = 0.996 \quad R_3 = 0.998$$

$$R_4 = 0.997 \quad R_5 = 0.987 \quad R_6 = 0.989$$

Calculate the system reliability.

**OR**

- IX.



A system consist of six elements as shown.

The predicted reliability of the components for a 10 hr period is also indicated. Calculate the system reliability.