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10ME72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. Derive the expression for workdone by Harmonic force. **(08 Marks)**

b. Determine the Fourier series representation for the periodic excitation shown in Fig.Q.1(b).

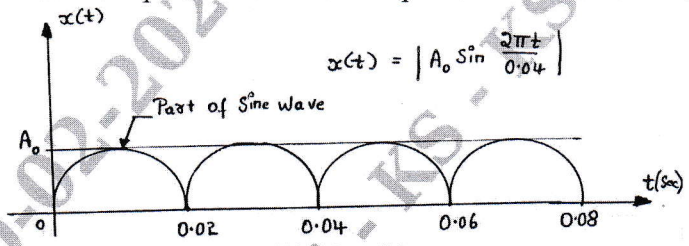

Fig.Q.1(b)

(12 Marks)

2 a. Derive the natural frequency of a spring mass system considering the effect of the mass of spring. **(08 Marks)**

b. Determine the natural frequency of the system shown in Fig.Q.2(b). **(12 Marks)**

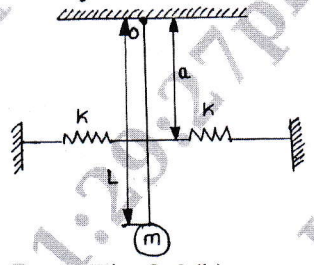

Fig.Q.2(b)

3 a. Define logarithmic decrement and also derive the expression for the same, when the system executes 'n' cycles. **(10 Marks)**

b. A shock absorber is to be designed so that its overshoot is 10% of the initial displacement when released. Determine the damping factor. If the damping factor is reduced to one half of this value, what will be the overshoot? **(10 Marks)**

4 a. The spring of an automobile trailer is compressed 0.1m under its own weight. Find the critical speed when the trailer is travelling over a road with a profile approximated by a sine wave of amplitude 80mm and wave length 14m. What will be the amplitude of vibration at 60km/hr? **(08 Marks)**

b. A machine of mass one tonne is acted by an external force 2450N at a frequency of 1500rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping factor of 0.2 are used. Determine:

i) Force transmitted to the foundation
ii) Amplitude of vibration of the machine
iii) Phase lag of the transmitted force with respect to the external force. **(12 Marks)**

PART – B

5 a. A vibrometer having the amplitude of vibrations of the machine part as 4mm and $\xi = 0.2$ performs harmonic motion. If the difference between maximum and minimum recorded value is 10mm, determine the natural frequency of vibrometer if the frequency if the vibrating part is 12rad/sec. **(10 Marks)**

b. Derive the expression for critical speed of shaft when the damping is present in the form of air resistance. **(10 Marks)**

6 a. Derive the expression for natural frequencies and hence determine the two natural frequencies for the system shown in Fig.Q.6(a), when $m_1 = m$, $m_2 = 2m$ and $L_1 = L$ and $L_2 = 3L$ **(10 Marks)**

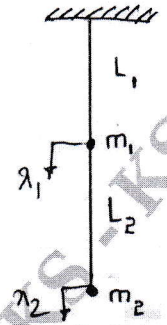

Fig.Q.6(a)

b. Find the natural frequency of vibration for the system shown in Fig.Q.6(b) and show that this is a semi-definite system. **(10 Marks)**

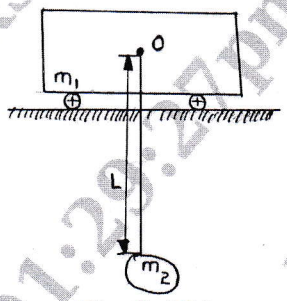

Fig.Q.6(b)

7 Find the lowest natural frequency for the system shown in Fig.Q.7 by stadola method. Assume $K = m = 1$ unit. **(20 Marks)**

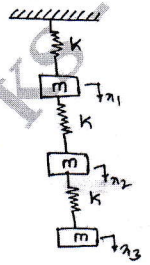

Fig.Q.7

8 a. Define condition monitoring of a machine and also explain the monitoring techniques considered in achieving the most effective, safe and efficient operations. **(10 Marks)**

b. Explain dynamic testing of machines and also explain the different methods used for dynamic testing of a structure. **(10 Marks)**

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10ME73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Hydraulics and Pneumatics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. Define a hydraulic power system. With a neat sketch explain the structure of a hydraulic system. **(07 Marks)**

b. Mention the classification of pumps used in a hydraulic power system. Explain the working of a balanced vane pump with a neat sketch. **(08 Marks)**

c. A pump has displacement volume of $100cm^3$. It delivers $0.0015m^3/s$ at 1000rpm and 70 bars. If the prime mover input torque is 120Nm. Determine overall efficiency and theoretical torque required to operate the pump. **(05 Marks)**

2 a. Mention the classification of a actuator. Explain with a neat sketch the construction and working of a double acting cylinder. **(08 Marks)**

b. A hydraulic motor has a $82cm^3$ volumetric displacement. If it has a pressure rating of 70 bars and it receivers oil from a $0.0006m^3/s$ theoretical flow rate pump. Find the motor speed, theoretical torque and theoretical power. **(06 Marks)**

c. Explain with a neat sketch bent axis type piston motor. **(06 Marks)**

3 a. Explain with a neat sketch, working of a pressure relief value. **(06 Marks)**

b. Mention the function and symbolic representation of the following values:
   i) 4/3 direction control value
   ii) Pressure reducing value
   iii) Sequence value
   iv) Pressure compensated flow control value. **(08 Marks)**

c. Explain with a neat sketch the working of a poppet value. **(06 Marks)**

4 a. Explain with a neat sketch different types of accumulator. **(08 Marks)**

b. Explain the working of a double pump hydraulic circuit and mention its application. **(06 Marks)**

c. Explain with a circuit diagram, the speed control of a hydraulic motor. **(06 Marks)**

PART – B

5 a. Name the four problems of a hydraulic system and mention the four causes for each problem. **(10 Marks)**

b. Explain the desirable properties of hydraulic fluid and explain any four types of hydraulic fluid. **(08 Marks)**

c. Mention the different types of scaling devices. **(02 Marks)**

6 a. Explain with a neat sketch end cushioning of a pneumatic cylinder. **(08 Marks)**

b. Explain a FRL unit of a pneumatic power system. **(06 Marks)**

c. Mention the advantages and limitations of a pneumatic system. **(06 Marks)**

7 a. Explain the working of a quick exhaust value with a neat sketch. **(06 Marks)**

b. Explain with a circuit diagram direct and indirect actuation of pneumatic cylinder. **(08 Marks)**

c. Explain supply air throttling and exhaust air throttling of pneumatic cylinder. **(06 Marks)**

8 a. Explain the sequential motion control of two cylinders with a neat diagram. **(12 Marks)**

b. Explain the working of radial piston pump with a neat sketch. **(08 Marks)**

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10ME74

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Briefly explain the scope of Operation Research. **(04 Marks)**

b. A toy company manufacturer manufactures two types of dolls a basic version-doll "A" and a deluxe version-doll "B". Each doll of type B takes twice as long to produce as one of the type A, and the company would have time to make a maximum of 2000 per day. The supply of plastic is sufficient to produce 1500 dolls per day (Both A and B combined). The deluxe version requires a fancy dress of which there are only 600 per day available. If the company makes a profit of Rs.3.00 and Rs.5.00 per doll respectively on doll A and doll B than how many of each doll should be produced per day in order to maximize the total profit. **(08 Marks)**

c. Solve the following LP problem graphically:
$Z_{max} = 8000x_1 + 7000x_2$
Subject to : $3x_1 + x_2 \le 66$
$x_1 + x_2 \le 45$
$x_1 \le 20$
$x_2 \le 40$
$x_1, x_2 \ge 0$ **(08 Marks)**

2 a. Find the dual of
$Z_{max} = 5x_1 - 6x_2 + 4x_3$
Subject to : $3x_1 + 4x_2 + 6x_3 \ge 9$
$x_1 + 3x_2 + 2x_3 \ge 5$
$-7x_1 + 2x_2 + x_3 \ge -10$
$x_1 - 2x_2 + 4x_3 \ge 4$
$x_1, x_2, x_3 \ge 0$ **(08 Marks)**

b. Solve the following LPP by using Big M method
$Z_{min} = 4x + y$
Subject to : $3x + y = 3$
$4x + 3y \ge 6$
$x + 2y \le 3$
$x, y \ge 0$ **(12 Marks)**

3 a. There are three factories A, B and C which supply goods to four dealers D_1, D_2, D_3 and D_4. The production capacities of these factories are 1000, 700 and 900 units per month respectively. The requirements from the dealers are 900, 800, 500 and 400 units per month respectively. The per unit return (excluding transportation cost) are Rs.8.00, Rs.7.00 and Rs.9.00 at the three factories respectively. The following table gives the unit transportation costs from the factories to the dealers.

	D_1	D_2	D_3	D_4
A	2	2	2	4
B	3	5	3	2
C	4	3	2	1

Determine the optimum solution to maximize the total returns. **(12 Marks)**

b. Solve the travelling salesman problem in the matrix shown below

	A	B	C	D	E
A	∞	6	12	6	4
B	6	∞	10	5	4
C	8	7	∞	11	3
D	5	4	11	∞	5
E	5	2	7	8	∞

(08 Marks)

4 a. Briefly explain Gomory's cutting plane method of IPP. **(06 Marks)**

b. Find the optimum integer solution to the following LPP

$Z_{max} = x_1 + x_2$

Subject to : $3x_1 + 2x_2 \leq 5$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ **(14 Marks)**

PART – B

5 a. List out the differences between PERT and CPM. **(06 Marks)**

b. A project schedule has the following characteristics

Activity	Time (min)	Activity	Time (min)
1-2	2	4-5	6
1-3	7	4-6	5
1-4	3	5-6	9
2-7	8	7-8	5
3-5	4	6-8	4

i) Draw the network

ii) Find the project duration time and critical path

iii) Find the E_s, E_f, L_s, L_f and total float. **(14 Marks)**

6 a. Explain the different types of service mechanisms in queuing. **(08 Marks)**

b. A post office has three windows providing the same service. It receives on an average 30 customers per hour. Arrivals are poisson distributed and service time is exponentially distributed. Each window serves as an average 12 customers per hour.

i) What is the probability that a customer will be served immediately?

ii) What is the probability that a customer will have to wait?

iii) What is the average member of customers in the system?

iv) What is the average total time a customer must spend in the post office? **(12 Marks)**

7 a. Explain clearly the following terms:
i) Pay off matrix ii) Saddle point iii) Pure strategy iv) Mixed strategy. **(04 Marks)**

b. Solve the game by using dominance principle

PLAYER "A"	PLAYER "B" I	II	III	IV	V	VI
1	4	2	0	2	1	1
2	4	3	1	3	2	2
3	4	3	7	-5	1	2
4	4	3	4	-1	2	2
5	4	3	3	-2	2	2

(10 Marks)

c. Reduce the following game to 3×2 by dominance principle and solve it by graphical method

PLAYER "A"	PLAYER "B" B_1	B_2	B_3	B_4
A_1	19	6	7	5
A_2	7	3	14	6
A_3	12	8	18	4
A_4	8	7	13	-1

(06 Marks)

8 a. List out the assumptions made for sequencing problems. **(06 Marks)**

b. There are five jobs each of which must go through three machines A, B and C in the order ABC. Processing times (hour) are given in the following table. Determine the optimum sequence of the job that minimizes the total elapsed time. Also find the idle times of machine A, B and C. The matrix is given below.

Machines	JOBS 1	2	3	4	5
M/C A	8	10	6	7	11
M/C B	5	6	2	3	4
M/C C	4	9	8	6	5

(10 Marks)

c. Briefly explain
i) Total elapsed time
ii) Idle time on a machine. **(04 Marks)**

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