6E7111

Total No. of Questions : 22 Total No. of Pages : 04

Roll No. : .....

6E7111

B.Tech. VI-Sem. (Main/Back) Exam. - 2024

Mechanical Engineering

6ME3-01 / Measurement and Meterology

ME, AE

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10×2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. Differentiate accuracy and precision.

Q.2. What are different types of Gear error?

Q.3. What is Uncertainty?

Q.4. What is Calibration?

Q.5. Give the application of load cells?

Q.6. Classify Comparators.

Q.7. What is the application of Bevel Protractor?

Q.8. Differentiate between Sensitivity and Repeatability.

Q.9. Differentiate between Systematic and random error.

Q.10. What are the temperature measurement devices?

PART-B [5x4=20]

(Analytical/Problem-solving questions)

Attempt any five questions

Q.1. Explain the working principle of Pitot tube with suitable diagram.

Q.2. What are different methods of Surface finish measurement? Explain any one method.

Q.3. Explain mechanical Dynamometer with suitable diagram.

Q.4. Explain working principle of Thermocouple. State the advantages and disadvantages.

Q.5. What is use of Comparators, explain Optical Comparator with diagram.

Q.6. Define various terminologies of Screw thread with suitable diagram.

Q.7. Explain:

(a) Interchangeability

(b) Flatness testing

PART-C [3x10=30]

(Descriptive/Analytical/Problem-Solving/Design questions)

Attempt any three questions

Q.1. What is CMM? Explain various types of CMM based on their construction and application.

Q.2. Explain Following Force Measuring instruments with diagram:

(a) Accelerometer

(b) Bourdon tube

Q.3. What are the limit gauges? Explain various types of limit gauges with diagram.

Q.4. Write short note on:

(a) Measurement of Power

(b) Gear Measurement

Q.5. Explain the construction, working principle and application of following:

(a) Sine bar

(b) Pyrometers.

----- × -----

289

6E7112

Total No. of Questions : 22 Total No. of Pages : 04

Roll No. : .....

6E7112

B.Tech. VI-Sem. (Main/Back) Exam. June- 2024

MECHANICAL ENGINEERING

6ME4-02, Computer Integrated Manufacturing Systems

Time : 3 Hours Maximum Marks : 70

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in Form No. 205)

The following coded (s) are required :

1. ..... 2. .....

PART-A [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. What are various works or functions of Human Workers in the most highly automated operations?

Q.2 What are the reasons why companies automate their operations? Name them.

Q.3. What are the various strategies for automation and process improvement. Identify ten of these strategies.

Q.4. What is the difference between a closed-loop control system and an open-loop control system?

Q.5. What is the difference between manual part programming and computer-assisted part programming?

Q.6. What is the unit load principle in material handling?

Q.7. What are the production conditions under which group technology and cellular manufacturing are most applicable?

Q.8. What are the four basic components of a flexible manufacturing system?

Q.9. What is concurrent engineering?

Q.10. What are the various wastes according to Toyota production system?

PART-B [5x4=20]

(Analytical/Problem solving questions)

(Up to 100 words)

Attempt any five questions

Q.1. What are the difference between direct numerical control (DNC) and distributed numerical control (DNC)?

Q.2. What is an optical encoder, and how does it work?

Q.3. Compare in detail the Fixed, Programmable and flexible automation with highlighting the various features of each.

Q.4. The XYZ Company is planning to introduce a new product line and will build a new factory to produce the parts and assembly the final products for the product line. The new product line will include 100 different models. Annual productio of each model is expected to be 1000 units. Each product will be assembled of 600 components. All processing of parts and assembly of products will be accomplished in one factory. There are an average of 10 processing steps required to produce each component, and each processing step takes 30 sec. (includes an allowance for setup time and part handling). Each final unit of product takes. 3.0 hours to assemble. All processing operations are performed at work cells that each includes a production machine and a human worker. Products are assembled on single workstations consisting of two workers each. If each work cell and each workstation require 200 ft^2, and the factory operates one shiflt (2000 hr/yr), determine :

(a) How many production operations

(b) How much floor space

(c) How many workers will be required in the plant.

Q.5. Name the ten features and capabilities of a modern CNC machine control unit.

Q.6. A two-axis NC system used to control a machine tool table uses a bit storage capacity of 16 bits in its control memory for each axis. The range of the x-axis is 600 mm and the range of the y-axis is 500 mm. The mechanical accuracy of the machine table can be represented by a Normal distribution with standard deviation = 0.002 mm for both axes. For each axis of the NC system, determine (a) the control resolution, (b) accuracy, and (c) repeatability.

Q.7. A planned fleet of forklift trucks has an average travel distance per delivery = 500 ft loaded and an average empty travel distance = 350 ft. The fleet must make a total of 60 deliveries per hour. Load and unload times are each 0.5 min and the speed of the vehicles = 300 ft/min. The traffic factor for the system = 0.85. Availability = 0.95, and worker efficiency = 90%. Determine (a) ideal cycle time per delivery, (b) the resulting average number of deliveries per hour that a forklift truck can make, and (c) how many trucks are required to accomplish the 60 deliveries per hour.

PART-C **[3x10=30]**

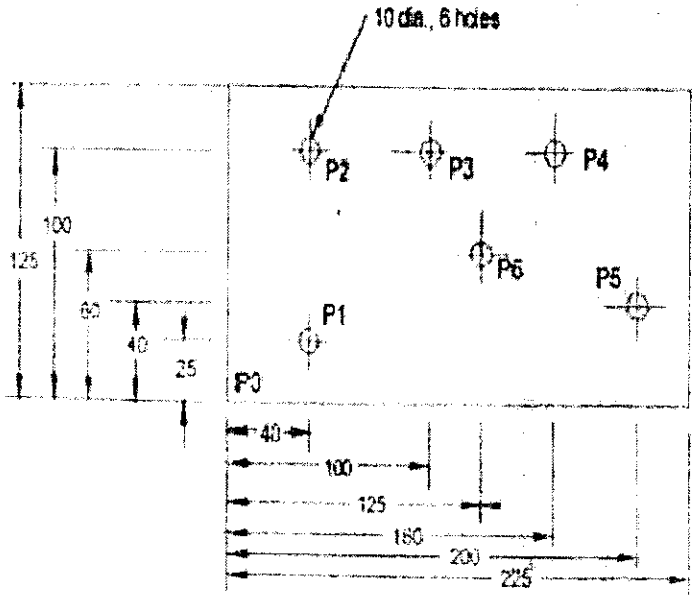
(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any three questions

Q.1. A dc servomotor is used to drive one of the table axes of an NC milling machine. The motor is coupled directly to the lead screw for the axis, and the lead screw pitch = 5 mm. The optical encoder attached to the lead screw emits 500 pulses per revolution of the lead screw. The motor rotates at a normal speed of 300 rev/min. Determine (a) control resolution of the system, expressed in linear travel distance of the table axis, (b) frequency of the pulse train emitted by the optical encoder when the servomotor operates at full speed, and (c) travel rate of the table at normal rpm of the motor.

Q.2 **Figure -1**

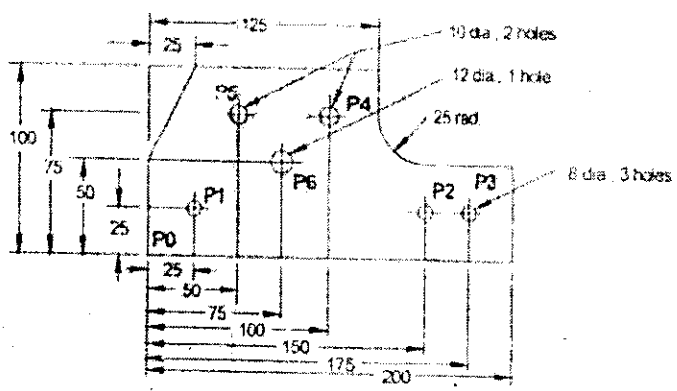
12



Write the part program to drill the holes in the part shown in Figure 1. The part is 12.0 mm thick. Cutting speed = 100 m/min and feed = 0.06 mm/rev. Use the lower left corner of the part as the origin in the x-y axis system. Write the part program in the word address format using absolute positioning.

Q.3.

Figure -2



Write the APT part program to perform the drilling operations for the part drawing in Figure 2. Use the TURRET command to call the different drills required. Cutting speed = 0.4 m/s, feed = 0.10 mm/rev., and table travel speed between holes = 500 mm/min. Postprocessor call statement is MACHIN / TURDRL, 02.

Q.4. What are the benefits that can be expected from a successful FMS installation?

Q.5. Describe the two basic approaches in computer-aided process planning (CAPP).

----- × -----

293

6E7113

Total No. of Questions : 22 Total No. of Pages : 04

Roll No. : .....

6E7113

B.Tech. VI-Sem. (Main) Exam. - 2024

MECHANICAL ENGG.

6ME4-03 MECHANICAL VIBRATIONS

ME, AE

Time : 3 Hours Maximum Marks : 70

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10×2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory.

Q.1. Define vibration.

Q.2. Vibration is desirable or undesirable. Comment on it.

Q.3. Define degree of freedom.

Q.4. State D' Alembert's principle.

Q.5. Write the importance of centre of percussion.

294

Q.6. Define magnification factor.

Q.7. Define transmissibility.

Q.8. What is the critical speed of shaft?

Q.9. State 'Maxwell Reciprocal' theorem.

Q.10. What is the need of approximate analysis?

PART-B

[5x4=20]

(Answer should be given up to 100 words only)

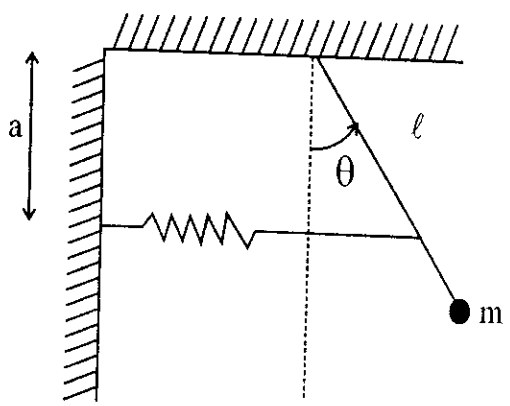
(Analytical/Problem-solving questions)

Attempt any five questions.

Q.1. Convert the following complex number in exponential form :

(i) $-1-i$ (ii) $1-i$

Q.2. Determine the natural frequency of following system :



The spring is in natural length when $\theta = 0$.

Q.3. A vibrating system is defined by the following parameters :

$M = 3$ kg, $K = 100 \frac{N}{cm}$, $C = 3 \frac{N-sec}{m}$

Determine

(a) damping factor

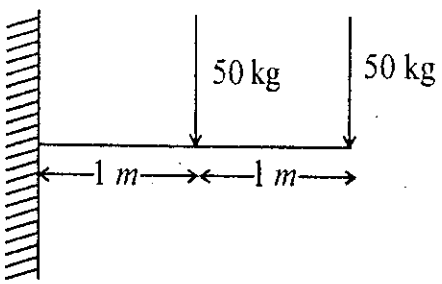
(b) damped natural frequency

Q.4. For force vibration problem, for maximum amplitude, derive $r)_{optimum} = \sqrt{1-2\zeta^2}$. Where r is the frequency ratio.

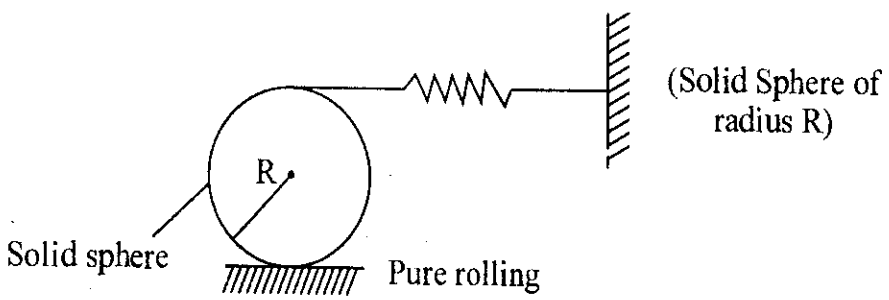
Q.5. Write a short note on principle mode of vibration and normal mode of vibration.

Q.6. A solid shaft of negligible weight, 6 cm diameter and 2 metres long is fixed at one end and other end is free. Find the frequency of vibration by Dunkerley's method.

$$E = 2\times10^4 \frac{N}{m^2}$$



Q.7. Derive the natural frequency of following system man = m :



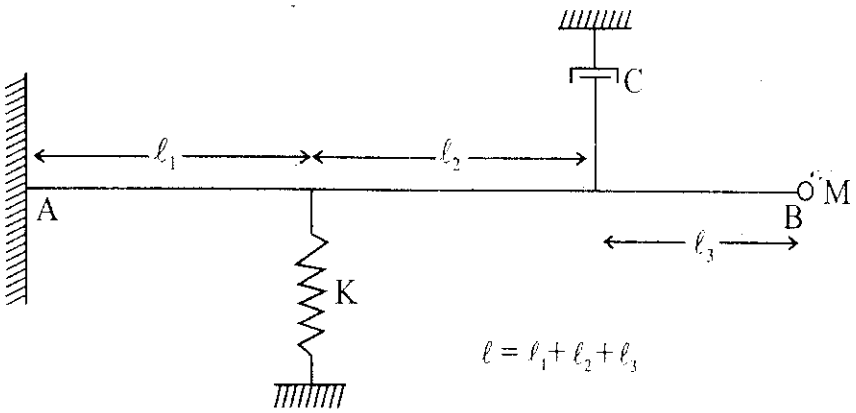
PART-C [3x10=30]

(Descriptive/Analytical/Problem-Solving/Design questions)

Attempt any three questions.

Q.1. Derive frequency equation for axial vibration of a straight bar.

Q.2. Derive an expression for critical damping coefficient and damped natural frequency for following system :

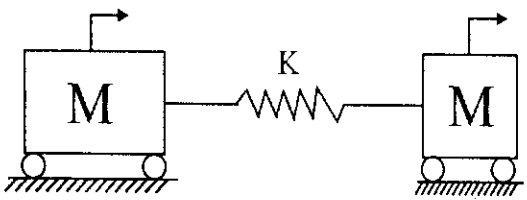


rod AB is massless.

A point mass 'm' is attached at free end of the rod as shown in figure. ℓ is the total length of the rod. K and C have their usual meanings.

Q.3. How centrifugal absorber works? Explain in detail with neat sketch.

Q.4. Solve for principle modes and normal modes of vibration of following system :



Q.5. Write a short note on following (any two) :

(i) Industrial noise control strategies.

(ii) Vibration characteristics of coulomb and hysteretic damped system.

(iii) Logarithmic decrement with its physical significance.

----x----

297

6E7114

Total No. of Questions : 22 Total No. of Pages : 04

Roll No. : .....

6E7114

B.Tech. VI-Sem. (Main/Back) Exam. - 2024

Mechanical Engg.

6ME4-04 DESIGN OF MACHINE ELEMENTS-II

ME, AE

Time : 3 Hours Maximum Marks : 70

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10×2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

1. Write the scope of the subject "Design of Machine Elements-II".

2. Write the difference between static and dynamic load.

3. What do you mean by fatigue?

4. Write the type of stresses induced in shaft subjected to torsion.

5. Write the application of torsion spring.

6. What do you mean by gear ratio?

7. What do you mean by herringbone gears?

8. How the lubricant is designated?

9. What is the function of the journal bearing?

10. What do you mean by anti-friction bearings?

PART-B [5x4=20]

(Analytical/Problem-solving questions)

Attempt any five questions

1. Calculate factor of safety, if a machine component is subjected to following:

   mean stress = 570 N/mm^2; variable stress = 190 N/mm^2;

   correct endurance limit = 600 N/mm^2; ultimate strength = 1250 N/mm^2; yield strength = 500 N/mm^2

2. Write the design procedure (in brief) of IC engine cylinder.

3. Determine the size of piston rod subjected to a total load having cyclic fluctuations from -150kN to +50 kN. The endurance limit is 360MPa and yield strength is 400MPa. Use: factor of safety 1.5, surface finish factor 0.88, theoretical stress concentration factor K_t = 2.25, notch sensitivity = 0.2.

4. A helical tensile spring of wire with diameter d and length L is subjected to axial load P. Derive an expression for :

(i) direct shear stress

(ii) torsional shear stress

(iii) angle of twist

5. Obtain an expression for beam strength of spur gear tooth with suitable assumptions.

6. Calculate Sommerfeld number, if viscosity of oil = 3.312×10^{-9} N-sec/mm^2 ; speed of journal = 1350 rpm; pressure of oil = 0.9 N/mm^2; diametral clearance = 100 μm; journal diameter = 100 mm.

7. Write the difference between hydrostatic and hydrodynamic bearing with suitable diagram.

PART-C [3x10=30]

(Descriptive/Analytical/Problem-Solving/Design questions)

Attempt any three questions

1. Write the design procedure of connecting rod.

2. Discuss on :

(i) Method of lubrication

(ii) Goodman line

3. Design a compression helical spring to carry a load of 600N. The maximum compression of spring is 25mm. The spring index is 8. Assume shear stress for spring material as 325MPa, G=84000MPa.

4. A deep groove ball bearing is subjected to radial load of 10KN and thrust load of 4KN. The inner ring of the bearing rotates at 1000 rpm. For the average life of 5000 hours, determine the basic dynamic capacity of the bearing.

5. Discuss on :

(i) Stress concentration

(ii) Buckingham equation

----- × -----

300

6E7115

Total No. of Questions : 23 Total No. of Pages : 08

Roll No. : .....

6E7115

B.Tech. VI-Sem. (Main/Back) Exam. - 2024

AUTOMOBILE/MECH. ENGG.

6 AE5-13 Quality Management

AE,ME

Time : 3 Hours Maximum Marks : 70

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of eight questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10x2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. Define process capability.

Q.2. What is quality of design?

Q.3. Expand the terms : LTPD, AOQL, AOQ, IQL.

Q.4. What is producer's risk and consumer's risk in context of acceptance sampling?

Q.5. Write the key objectives of statistical quality control.

Q.6. Write the mathematical expressions for normal and poisson distribution mentioning the parameters involved.

Q.7. Explain the quality loss function as proposed by Taguchi.

Q.8. Bring out the differences between variable and attribute data with suitable examples.

Q.9. Write the purpose of using c-chart.

Q.10. What is an operating characteristic (OC) curve?

PART-B

[5x4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. What is the meaning of quality of conformance? Explain the factors affecting the quality of conformance.

Q.2. Control charts for $\overline{X}$ chart and R are maintained on certain dimensions of a manufactured part, measured in mm. The subgroup size is 4. The values of $\overline{X}$ chart X and R are computed for each subgroup. After 20 subgroups $\sum \overline{X} = 412.83$ and

$\sum R = 3.39$. Compute the values of upper and lower control limits for the $\overline{X}$ and R charts and estimate the value of σ' on the assumption that the process is in statistical control.

Q.3. Explain the term quality assurance. Mention in detail the activities accomplished under quality assurance function in an organization.

Q.4.

was checked after machining data and recorded as follows :

Width in mm	Frequency	Width in mm	Frequency
9.50-9.51	6	9.58-9.59	22
9.52-9.53	2	9.60-9.61	8
9.54-9.55	20	9.62-9.63	6
9.56-9.57	32	9.64-9.65	4

(a) Find the arithmetic mean, standard deviation and variance from the data.

(b) What percentage of the panels manufactured has width of 9.52 to 9.63?

Q.5. In a factory producing spark plug the number of defectives found in inspection of 20 lots of 100 each, is given below :

Lot No.	**No. of defectives**	**Lot No.**	**No. of defectives**
1.	5	11.	4
2.	10	12.	7
3.	12	13.	8
4.	8	14.	3
5.	6	15.	3
6.	4	16.	4
7.	6	17.	5
8.	3	18.	8
9.	3	19.	6
10.	5	20.	10

30

(a) Construct appropriate control chart and state whether the process is in statistical control.

(b) Determine the sample size when a quality limit not worse than 9% is desirable and a 10% bad product will not be permitted more than three times in thousand.

Q.6. In a double sampling plan, $N = 5000$, $n_1 = 100$, $c_1 = 0$, $n_2 = 100$, $c_2 = 1$. Use Poisson's table to compute the probability of acceptance of a 1% defective lot.

Q.7. Define reliability. Also explain the terms MTTR, MTBF.

Q.8. Explain briefly the Taguchi's design of experiment philosophy based on orthogonal arrays.

PART-C **[3x10=30]**

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any three questions

Q.1. State the scope of quality control function in an automobile industry. Give details of various aspects and necessary steps to achieve quality control. State the role of inspection in quality control.

Q.2. Explain the procedure for constructing the operating characteristic (OC) curve for a single sampling plan with $n = 300$ and $c = 5$.

Q.3. Explain in detail theory underlying control charts for fraction defective. State and explain the conditions favourable for economic use of control charts for defects per unit.

Q.4. Describe the various steps necessary for obtaining ISO : 9000 standard registration.

Q.5. The following table shows the averages and ranges of the spindle diameters in millimetres for 30 subgroups of 5 items each. For the first 20 samples set up an $\bar{X}$ and R chart. Plot the next 10 samples on these charts to see if the process continues 'under control' both to average and range. Also find the process capability.

$\bar{X}$	R	$\bar{X}$	R	$\bar{X}$	R
45.020	0.375	45.600	0.275	45.26	0.150
44.950	0.450	45.020	0.175	45.650	0.200
45.480	0.450	45.320	0.200	45.620	0.400
45.320	0.150	45.560	0.425	45.480	0.225
45.280	0.200	45.140	0.250	45.380	0.125
45.820	0.250	45.620	0.375	45.660	0.350
45.580	0.275	45.800	0.475	45.460	0.225
45.400	0.475	45.500	0.275	45.640	0.375
45.680	0.475	45.780	0.275	45.390	0.650
45.680	0.275	45.640	0.225	45.290	0.350

----- x -----

302

6E7116

Total No. of Questions : 22 Total No. of Pages : 04

Roll No. : .....

6E7116

B.Tech. VI-Sem. (Main/Back) Exam. - 2024

Mechanical Engineering

6ME5-11 Refrigeration and Air Conditioning (El.-II)

ME, AE

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in Form No. 205)

1. Refrigeration Table 2. Psychrometry Chart

PART-A **[10x2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. What is Ton of Refrigeration?

Q.2. Define coefficient of Performance.

Q.3. What are the limitations of Carnot cycle of Refrigeration?

Q.4. State the functions of expansion device.

Q.5. Enumerate the different methods used for refrigeration.

Q.6. Name any four refrigerants used in Household appliances.

Q.7. List factors affecting Human comfort.

Q.8. What do you understand by the term Psychrometry?

Q.9. Define 'Dry Bulb temperature'.

Q.10. Explain year round air conditioning system.

PART-B [5x4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. Explain the working of a Reversed Carnot cycle of refrigeration with P-V and T-S Diagrams.

Q.2. Explain, with a neat sketch, the working principle of Regenerative Air refrigeration system.

Q.3. Discuss the advantages of vapour absorption refrigeration system over vapour compression refrigeration system.

Q.4. How the refrigerants are classified? What are the essential properties of a good refrigerant?

Q.5. With the help of psychrometric chart, explain the Heating process and dehumidification process.

Q.6. Explain the procedure to draw a grand sensible heat factor line on a psychrometric chart.

Q.7. A 25 tonnes air-refrigeration plant is used for food storage. The temperature of air at entry of the compressor and exit of cooler are 7°C and 27°C, respectively. Find:

(a) COP of the cycle and

(b) Power per tonne of refrigeration required by the compressor.

The quantity of air circulated in the system is 3000 kg/h. The compression and expansion both follows the law $PV^{1.3}$ = constant and take $\gamma = 1.4$; and C_p = 1 kJ /kg K for air.

PART-C [3x10=30]

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any three questions

Q.1. Explain the effects of the following on the performance of vapour compression refrigeration system with the help of T-S and P-h charts.

(i) Decrease in evaporator pressure

(ii) Increase in condenser pressure

(iii) Suction vapour superheat

(iv) Subcooling of saturated liquid

Q.2. Draw a neat diagram of Electrolux refrigeration and explain its working principle. What is the important role of hydrogen in refrigeration system?

Q.3. Atmospheric air at 760 mm of Hg pressure and dry bulb and wet bulb temperatures of 16°C and 10°C, respectively enters the heating coil whose temperature is 42°C. The bypass factor of heating coil is 0.4. Calculate the dry bulb and wet bulb temperatures, relative humidity of air leaving the heating coil and the sensible heat added per kg of dry air.

Q.4. A shop in a mall is to be air conditioned for sensible load of 58.15 kW and latent heat load of 14.55 kW. The inside design conditions are 25°C dbt and 50% RH. The outside design conditions are 40°C dbt and 27°C wbt. If the quantity of fresh air supplied is 70 m^3 /min, find :

(i) The ventilation load

(ii) Total load to be taken by plant

(iii) Effective sensible heat factor

(iv) Apparatus dew point

(v) Dehumidified air quantity

Q.5. Define the following terms :

(i) Wet Bulb Temperature

(ii) Dew Point Temperature

(iii) Specific humidity

(iv) Degree of saturation

(v) Relative Humidity

(vi) Bypass factor of coil

----- × -----

6E1603

Total No. of Questions : 22 Total No. of Pages : 08

Roll No. : .....

6E1603

B.Tech. VI-Sem. (Back) Exam. 2024

PCC/PEC AUTOMOBILE ENGINEERING

6AE4-03 Mechanical Vibrations

AE, ME

Time : 3 Hours Maximum Marks : 120

Instruction to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and four questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10×2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

308

1. What are the main causes of Vibration ?

2. Represent the following complex numbers in exponential form :

   (i) $3+j_4$

   (ii) $3-j_4$

   (iii) $-3+j_4$

   (iv) $-3-j_4$

3. Add the following vectors analytically :

   $X_1 = 8\sin(\omega t + 30^\circ)$

   $X_2 = 10\sin(\omega t - 60^\circ)$

4. What is Viscous Damping ?

5. Differentiate between Damped and Undamped Vibration.

6. If a system has both viscous and coulomb damping in it, how do you expect its free vibration response ?

7. What do you understand by Degree of Freedom ?

8. Find the amplitude of the sum of the two harmonic motions :

   $X_1 = 3\cos(2t+1)$

   $X_2 = 4\cos(2t+1.5)$

9. Is the motion of a piston in a reciprocating engine a simple harmonic motion ? Explain clearly.

10. What do you understand by Logarithmic Decrement ?

PART-B [5x8=40]

(Analytical/Problem solving questions)

Answer should be given up 100 words only.

Attempt any five questions

1. Add the following motions analytically :

$X_1 = 2\cos(\omega t + 0.5)$

$X_2 = 5\sin(\omega t + 1.0)$

check the solution graphically.

2. A light cantilever of length l has a mass M fixed at its free end. Find the frequency of lateral vibrations in the vertical plane.

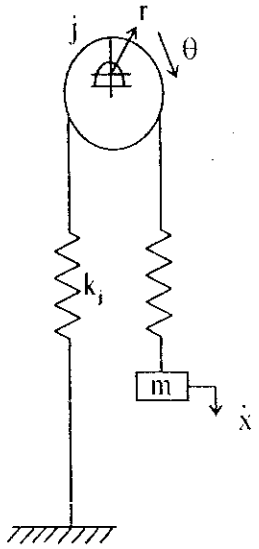
3. A cylinder of mass M and radius r rolls without slipping on a cylinderical surface of radius R. Find the natural frequency for small oscillations about the lowest point.

4. Write down the derivation of critically-damped system.

5. A system of beams supports a motor of mass 1200 kg. The motor has an unbalanced mass of 1 kg located at 6.0 cm radius. It is known that the resonance occurs at 2210 rpm. What amplitude of vibration can be expected at the motor's operating speed of 1440 rpm if damping factor is assumed to be less than 0.1 ?

6. Write a short note on Frahm vibration absorber.

7. For the combined rectilinear and rotary two degree of freedom system, shown in figure, write down the two differential equation of motion. Put these equations in matrix form :



310

PART-C [4x15=60]

(Descriptive/Analytical/Problem Solving/Design questions)

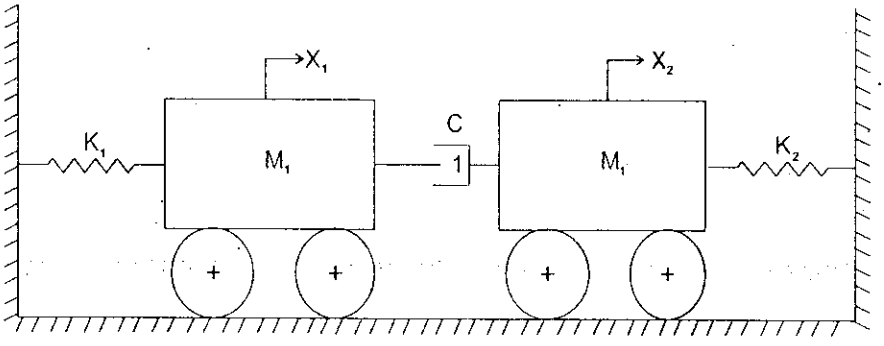
Attempt any four questions

1. A 75 kg. machine is mounted on springs of stiffness $k = 11.76 \times 10^5 N/m$ with an assumed damping factor of $\zeta = 0.20$. A 2 kg. piston within the machine has a reciprocating motion with a stroke of 0.08 m and a speed of 3000 cpm. Assuming the motion of the piston to be harmonic, determine the amplitude of vibration of the machine and the vibratory force transmitted to the foundation.

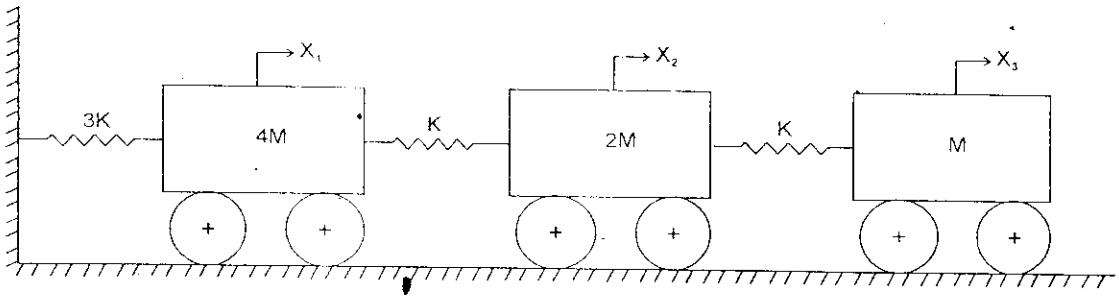
2. For the system whose schematic diagram is shown in figure, find the mode shape and the general equations of motions for the two masses for the case when

$m_1 = m_2 = m$

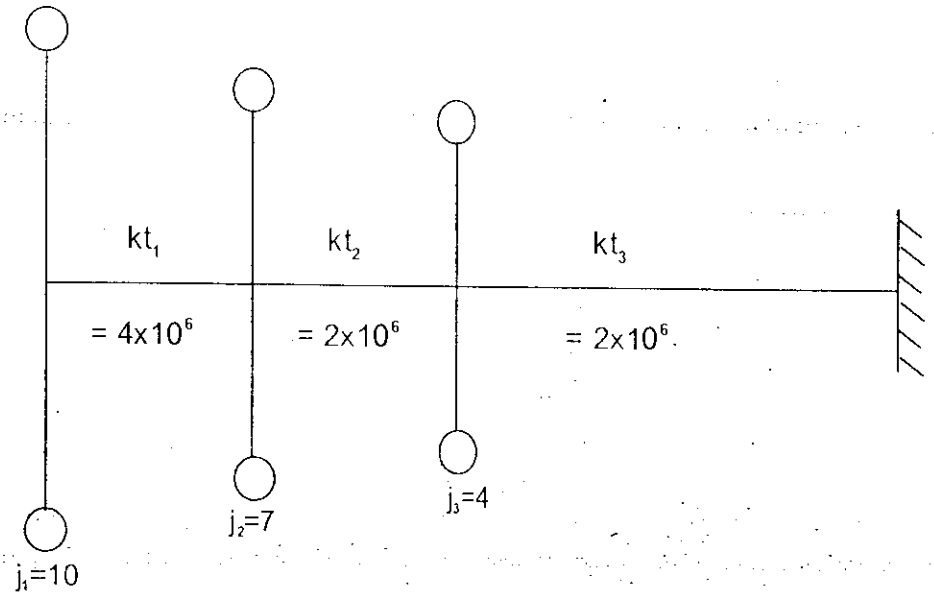
$k_1 = k_2 = k$



3. A three degree at freedom system is schematically shown in figure write down its three differential equations of motion by Newton second law. Put these equations in matrix form :



4. Find by Holzer's method the natural frequency of the torsional system shown in figure when the right end is fixed :



5. Write short notes on the following :

(i) Auditory and Non-auditory effect of noise

(ii) Over damping system

(iii) Vibration absorber

XXX

312

6E1606

Total No. of Questions : 22 Total No. of Pages : 04

Roll No. : .....:.....

6E1606

B. Tech. VI-Sem. (Back) Exam, June - 2024

AUTOMOBILE ENGG.

6AE5-11 Refrigeration and Air Conditioning

AE,ME

Time : 3 Hours **Maximum Marks : 120**

Instruction to Candidates :

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. Refrigeration Table and psychrometric chart 2. .....

PART-A **[10×2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. Explain the term "Tonne of refrigeration".

Q.2. Define C.O.P.

Q.3. Define the following

(i) Specific Humidity

(ii) Absolute Humidity

Q.4. What do you understand by comfort air conditioning ?

Q.5. Draw heating with dehumidification process on psychometric chart.

Q.6. Draw Bell Coleman cycle on P-V and T-S diagrams.

Q.7. What are secondary refrigerants ? Name any two secondary refrigerant.

Q.8. Define wet bulb temperature.

Q.9. Differentiate between the refrigerator and heat pump.

Q.10. Write the advantages of Cascade refrigeration system.

PART-B **[5×8=40]**

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. Draw the schematic of a boot-strap cycle of air refrigeration system, and explain it and show the cycle on T-s diagram.

Q.2. With the help of psychrometric chart, explain any two following processes :

(a) Sensible heating and sensible cooling process

(b) Heating and dehumidification process

(c) Cooling and humidification process

(d) Cooling and dehumidification process

Q.3. Find dew point temperature, relative humidity and specific humidity of moist air at dry buld temperature of 30 °C and wet bulb temperature of 20 °C.

Q.4. The temperature limits of an. ammonia refrigerating system are 25 °C and -10 °C. If the gas is dry at the end of compression, calculate the coefficient of performance of the cycle assuming no under cooling of the liquid ammonia. Use the following table for properties of ammonia :

Temperature (°C)	Liquid heat (KJ/Kg)	Latent heat (KJ/Kg)	Liquid entropy (KJ/Kg K)
25	298.9	1166.94	1.1242
-10	135.37	1297.68	0.5443

Q.5. Which factors influence human comfort ? Explain these factors.

Q.6. What are the desirable properties of an ideal refrigerant ? Classified the refrigerants also and name the different refrigerants generally used in domestic and industrial purpose.

Q.7. In a vapour absorption refrigeration system, heating, cooling and refrigeration take place at the temperatures of aoo° C, 20° C and -5° C respectively. Find the maximum C.O.P. of the system.

PART-C **[4×15=60]**

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any four questions

Q.1. Explain the working principle of lithium bromide vapourabsorption refrigeration system with neat sketch.

3'5

Q.2. Explain the effect of the following factors on COP of vapourcompression refrigeration system with the help of T-s diagram and h-s diagram :

(a) Sub cooling

(b) Super heating

(c) Condenser pressure

(d) Evaporator pressure

Q.3. Explain with a neat sketch, the working principle of summer air conditioning when Climate is Hot and Dry outdoor conditions.

Q.4. Write short notes on the following :

(a) Necessity of cooling of air craft

(b) Expansion device in refrigeration

(c) Cascade refrigeration system

Q.5. Derive the expression for C.O.P. of a refrigerating system consisting of three evaporators at the same temperature with single compressor and expansion value.

------x------