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Roll No. _____   [Total No. of Pages : 2

6E7111

6E7111

B.Tech. VI Sem. (Main) Examination, July - 2023
Mechanical Engineering
6ME3-01 Measurement and Metrology
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 states clearly. Units of quantities used/calculated must be stated clearly.

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

PART - A

(Answer should be given up to 25 words only)

All question are compulsory.   (10×2=20)

1. Discuss the term consistency.
2. Define Comparators.
3. Differentiate accuracy and precision.
4. List the important mechanical comparator.
5. State the classification of measuring instruments.
6. Explain the principle of sine bar for measuring angles.
7. What are the differences in the vernier and micrometer as used for linear measurements?
8. What are the applications of limit gauges?
9. Define Sensitivity and repeatability.
10. Explain major diameter and minor diameter of screw thread.

PART - B

(Analytical/Problem solving questions)

Attempt any Five questions.   (5×4=20)

1. What are the difference between systematic error and random error?
2. Discuss the significance of calibration of instruments.

6E7111/2023   (1)   [Contd....

3. Write short note on slip gauges.

4. Define any six terms from screw thread terminology.

5. Explain working principle of rotameter.

6. Write short note on measurement of flow.

7. Explain any one method used for force measurement.

PART - C

(Descriptive/Analytical/Problem solving/Design Questions)

Attempt any Three questions. (3×10=30)

1. Enlist various types of comparators. Also explain electrical comparator with sketch.

2. Write short note on measurement of power.

3. Define errors in measurement. Explain various types of errors in measurements.

4. With neat sketch explains various types of CMM based on their constructions.

5. Write short note on measurement of temperature.

Roll No. _____ [Total No. of Pages : 2

6E1601

6E1601

B.Tech. VI-Sem. (Back) Examination, July - 2023
Automobile Engineering
6AE3-01 Measurement and Metrology
AE, ME

Time : 2 Hours

Maximum Marks : 80
Min. Passing Marks : 28

Instructions to Candidates:

Attempt all **Five** questions from **Part A**, **Four** questions out of **Six** questions from **Part B** and **Two** questions out of **Three** 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).

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory. (5×2=10)

1. What is measurement? Give its types.

2. Classify the comparator according to the principles used for obtaining magnification.

3. Differentiate between straightness and flatness.

4. What is CMM?

5. What are the load cells?

PART - B

(Analytical/Problem solving questions)

Attempt any Four questions. (4×10=40)

1. Classify standards. Tabulate the comparison between line standard and end standard on the basis of characteristics.

2. Explain Dial type Mechanical Comparator with neat sketch and its advantages.

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

4. a) Define various terminologies of screw thread with suitable diagram.

   b) Define various terminologies of Gear with suitalle diagram.

5. What is surface roughness? In the measurement of surface roughness heights of successive 10 peaks and troughs were measured from datum were 35,25,32,20,23,18,26,24,28,and 21 micron. If these measurements were obtained on 10 mm length, determine CLA and RMS values of surface roughness.

6. Explain the working principle of thermocouple. Name the materials used for thermocouple. State the advantages and disadvantages of thermocouple.

PART - C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any Two questions.   **(2×15=30)**

1. Explain in details the various types of errors and its sources in measurements. A thermometer is calibrated from 200 Deg.c to 300 Deg.c. The accuracy is specified within $\pm$ 0.25%. What is the maximum static error?

2. Explain the construction, working principle and application of sine bar. A 100 mm sine bar is used to measure the taper angle of the specimen and the gauge block is 5.055mm. What is taper angle?

3. With neat diagram explain the construction and working principle of the following:
   i) Pitot tube.
   ii) Bimetallic strip.

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B. Tech. VI-Sem. (Main) Exam July 2023
Mechanical Engg.
6ME4-02CIMS
ME,AE
6E7112

Time: 3 Hours

Maximum Marks: 70

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   Normal Table

2. NIL

Part A (Answer should be given up to 25 words only)
All questions are compulsory

Q. 1   Name six reasons why companies automate their operations?

Q.2   Human workers will be needed in factory operations, even in the most highly automated operations. Name four types of work for which humans will be needed in automated systems.

Q.3   Flow line production is associated with which one of the following layout types: (a) cellular layout, (b) fixed-position layout, (c) process layout, or (d) product layout? And Draw.

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

Q.5   Identify the four levels of automation in a production plant.

Q.6   What is concurrent engineering? How it is different from reverse engineering?

Q.7   What is the Japanese word for waste? And name different types of it.

Q.8   What are the production conditions under which group technology and cellular manufacturing are most applicable?

Q.9   What is the difference between FMS and CIMS

Q.10   Compare AGILE manufacturing with LEAN manufacturing

10 x 2 = 20

Part B(Analytical/Problem solving questions)
Attempt any Five questions

Q.1   What is the difference between a push system and a pull system in production control? Explain using an example from Automobile Industry?

Q.2 Lists ten strategies for automation and process improvement.

Q.3 Compare in detail the Fixed automation, Programmable automation 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 production 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 ft2, and the factory operates one shift (2000 hr/yr), determine: (a) how many production operations, (b) how much floorspace, and (c) how many workers will be required in the plant.

Q.5 Name the eight factors that influence the make-or-buy decision? And support your answer through an example.

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

Part C(Descriptive/Analytical/Problem Solving/Design question)
5x 4 = 20
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 What are some of the advantages of noncontact inspection? Briefly describe some of the non - contact inspection methods with neat diagrams.

Q.3 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.
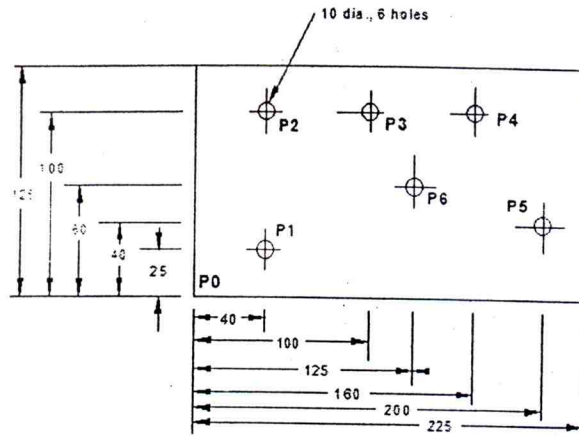

Figure 1

Q.4 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.
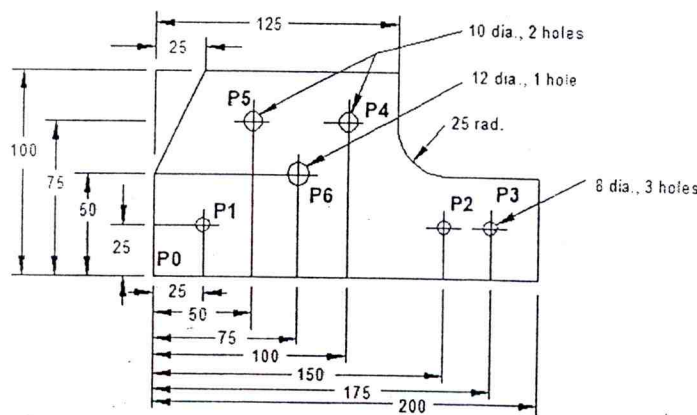

Figure 2

Q.5 Describe the two basic approaches in computer-aided process planning by comparing their characteristics, features, applications with suitable examples.

3 x 10= 30

Roll No. _____

[Total No. of Pages : 3

6E1602

6E1602

B.Tech. VI Sem. (Back) Examination, July- 2023
Automobile Engineering
6AE5-12 CIMS
AE,ME

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

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

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory.   (10×2=20)

1. What is the role of CIM in manufacturing?

2. How is CIM differs from CAM?

3. What do you understand by the term 'Canned Cycle' in manual part programming?

4. What are the different methods of listing coordinates of points in NC system?

5. What is a production system?

6. What is numerical control? Name the three basic components of NC system.

7. What is group technology?

8. What is production flow analysis?

9. What is lean manufacturing?

10. What is an automated guided vehicle?

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PART - B

(Analytical/Problem solving questions)

Attempt any Five questions. (5×8=40)

1. Briefly describe the computerized product cycle in manufacturing environment.

2. What is adaptive control optimisation? How is it used in CNC machines?

3. What is difference between retrieval and generative type process planning? Which is better? Explain you answer.

4. Explain the different levels of automation in their hierarchical order.

5. Differentiate between direct numerical control and distributed numerical control. Which is better? Explain your answer.

6. Discuss optical and non optical computer aided testing method. Discuss how computer is used in quality control.

7. Compare Agile and lean manufacturing. What are the seven wastes in manufacturing plants? Give a brief description.
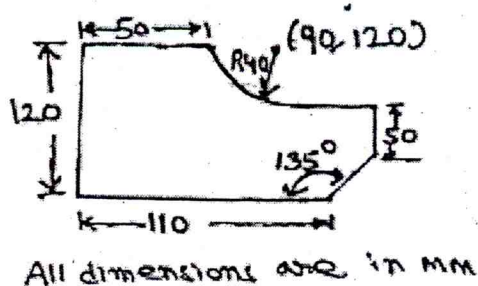
PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any Four questions. (4×15=60)

1. Draw the CIM wheel and explain its different segments in relation to CIM scope.

2. What is a flexible manufacturing system? What are the basic components of flexible manufacturing system? What are the functions of material handling and storage system in a flexible manufacturing system.

3. Write short notes on:

   i) Concurrent engineering

   ii) Collaborative Engineering

   iii) MRPII

   iv) MPS

4. a) Explain the function of preparatory functions. Give the functioning of any one G code used for this purpose.

b) The following component is to be made using a CNC turning center equipped with a FANUC controller. Prepare a part program using G and M codes to completely machine the part from rolled stock. The work material is AIS/1040 steel. Machining parameters are provided as simple speed =1200 rev per min, feed rate = 85 mm per min, depth of cut=1 mm, finishing allowance = 0.5mm, coolant (flood type). clearly show the set point and axes on the sketch of the part.

All dimensions are in MM
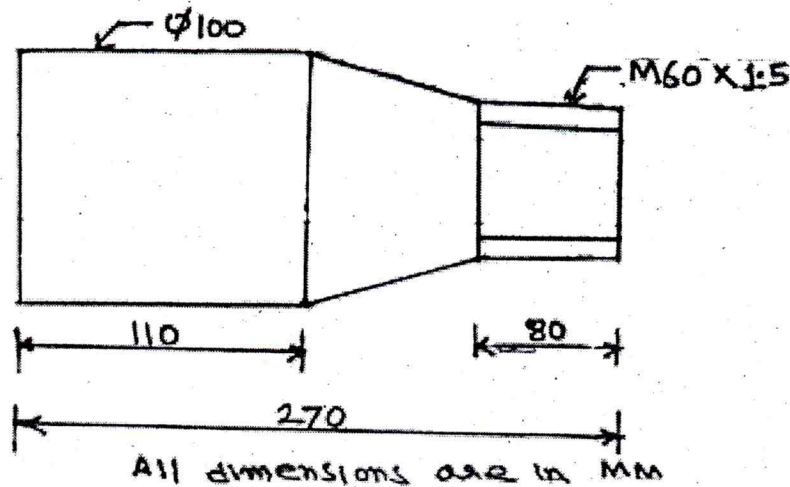
5. a) Explain the concept and need for a post processor as used in computer assisted part prgoamming such as APT. Describe the functions of a post processor.

b) Write a complete APT program for milling the following component using an end milling cutter of 20mm diameter. The bottom of cutter lies 15 mm below the top surface of the part. The thickness of part is 10mm. machining parameters are given as: speed of cutter=1000 RPM, feed=50mm/min. Clearly show axes system chosen with a sketch and direction of the cutter for the motion statements.

All dimensions are in MM

6E7113

B.Tech. VI-sem. (Main) Examination, July - 2023
Mechanical Engineering
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 diagram 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)

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory.

(10×2=20)

1. Define resonance.

2. Write principle of conservation of energy.

3. What is damping factor?

4. Write the materials used for vibration isolation.

5. How many degrees of freedom for a solid body?

6. How many degrees of freedom for a particle?

7. Infinite degree of freedom. Comment on it.

8. Write the principle of tuned mass damper.

9. Define magnification factor.

10. How could you find the damping ratio of a steel scale.

PART - B
(Analytical/Problem solving questions)

Attempt any five questions.   (5×4=20)

1. Define logarithmic decrement and derive its expression for damped free vibration.
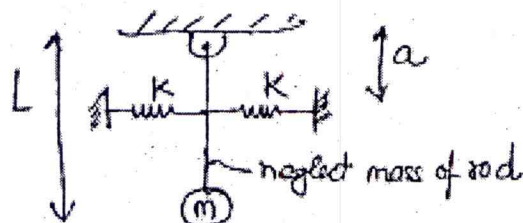
2. A spring mass damper system is defined as

    $m = 3kg$

    $k = 100 \, N/m$

    $c = 3 \, N-s/m$

    Calculate
    a) Critically damping constant
    b) Damped natural frequency
    c) Damping factor
    d) logarithmic decrement.

3. Determine the natural frequency of the following system.

4. For a forced vibration system, discuss curve between magnification factor v/s frequency ratio. The excitation force is represented as $F_0 \sin wt$. F_0 is a constant value.

5. Explain the working of an accelerometer with neat sketch.

6. Add the following harmonic motions analytically

    $x_1 = 4\sin\left(wt + \pi/6\right)$

    $x_2 = 6\cos\left(wt + \pi/3\right)$

7. Find the natural frequency of following system.
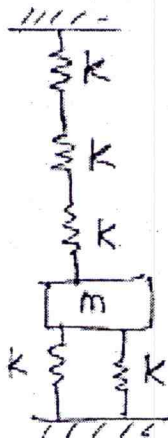
PART - C

(Descriptive/Analytical/Problem solving/Design questions))
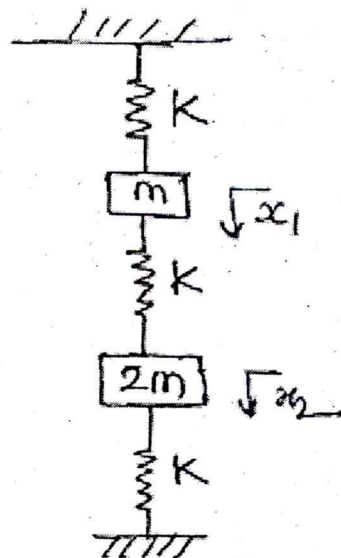
Attempt any three questions. (3×10=30)

1. Write short notes on followings
   i) Industrial noise control strategies
   ii) Auditory and non-auditory effects of noise.

2. Solve followings
   a) Convert into exponential form
      i) -1-i
      ii) 1-i
   b) Convert into rectangular form
      i) $2e^{(i\pi/3)}$
      ii) $3\overline{e}^{i(\pi/6)}$

3. Derive an expression for natural frequency.
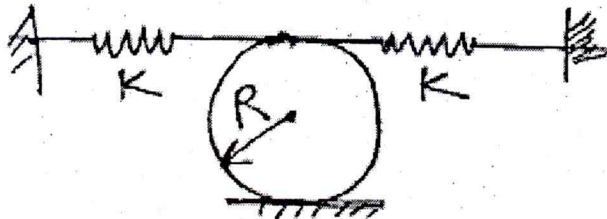
   Mass of cylinder is m and moment of inertia is I. Consider pure rolling case.

4. Derive an expression for torsional vibration of a shaft.

5. Derive an expression for principle modes of vibration for following.

Roll No. _____ [Total No. of Pages : 3]

6E1603

6E1603

B.Tech. VI Sem. (Back) Examination, July - 2023
Automobile Engineering
6AE4-03 : Mechanical Vibrations
AE, ME

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

*Attempt all **Ten** questions from **Part A**, **Five** questions out of **Seven** from **Part B** and **Four** questions out of **Five** 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).

PART - A

(Answer should be given up to 25 words only.)

All questions are compulsory. (10×2=20)

1. What are the usual audible frequency range and frequency range of human voice?

2. Differentiate between auditory and non-auditory effects of noise.

3. How can the two harmonic motions be added having different frequencies?

4. What is critical damping, and what is its importance?

5. In what ways is the response of a system with coulomb damping different from that of systems with other types of damping?

6. How does the force transmitted to the base change as damping is added to it?

7. What is the difference between generalised coordinates and cartesian coordinates?

8. How many distinct natural frequencies can exist for an n-degree-of-freedom system?

9. What is Rayleigh's principle and Rayleigh's quotient?.

10. What is the main difference in the nature of the frequency equations of a discrete system and a continuous system?

PART - B

(Analytical/Problem solving questions.)

Attempt any Five questions. (5×8=40)

1. Explain Rayleigh's Energy Method for a spring-mass system.

2. A spring-mass system is subjected to a harmonic force whose frequency is close to the natural frequency of the system. If the forcing frequency is 39.8 Hz and the natural frequency is 40 Hz, determine the period of beating.

3. Describe the relationship between frequencies of higher harmonics and frequency of the first harmonic for a periodic excitation.

4. Differentiate between methods used to solve two-degree-of freedom free-and forced-vibration problems.

5. Express the potential and kinetic energies of an n-degree-of-freedom system, using matrix notation.

6. Find the approximate natural frequencies of vibration and the modal vectors by using Holzer's method.

7. A chord of length ℓ is made to vibrate in a viscous medium. Derive the equation of motion considering viscous damping force.

PART - C

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

Attempt any Four questions. (4×15=60)

1. The maximum velocity attained by the mass of a simple harmonic oscillator is 10 cm/s, and the period of oscillation is 2 S. If the mass is released with an initial displacement of 2 cm, find

   a) The amplitude

   b) The initial Velocity

   c) The maximum acceleration and

   d) The phase angle

2. For a vibrating system, m = 10 kg, k = 2500 N/m and C = 45 N-s/m. A harmonic force of amplitude 180 N and frequency 3.5 Hz acts on the mass. If the initial displacement and velocity of the mass are 15 mm and 5 m/s, find the complete solution representing the motion of mass.
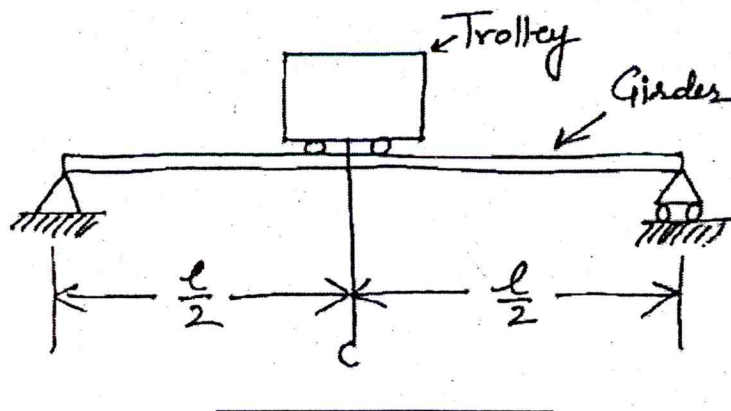
3. The base of a spring-mass system, with coulomb damping, is connected to the slider-crank mechanism shown below. Determine the response of system for coefficient of friction μ between mass and surface by approximating motion $y(t)$ as a series of harmonic functions for $m = 1$ kg, $k = 100$ N/m, $r = 10$ cm, $\ell = 1$m, $\mu = 0.1$ and $w = 100$ rad/s.
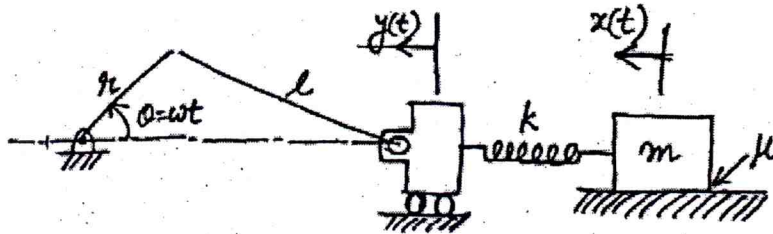
4. Find the natural frequencies of the system shown in figure, with $m_1 = m$, $m_2 = 2m$, $k_1 = k$, and $k_2 = 2k$. Determine the response of system when $k = 1000$ N/m, $m = 20$ kg and the initial values of displacements of mass m_1 and m_2 are 1 and -1, respectively.
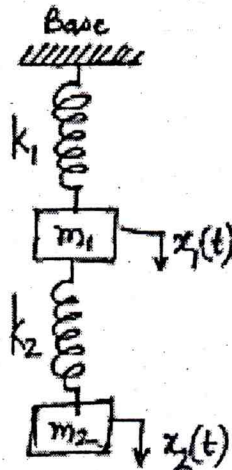
5. In an overhead crane shown below, the trolley weighs ten times the weight of the girder. Using Dunkerley's formula, estimate the fundamental frequency of the system.

6E1603   (3)

6E7114

| 6E7114 |

B.Tech. VI sem. (Main) Examination, July - 2023
Mechanical Engg.
6ME4-04 Design of Machine Elements-II
AE, ME

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

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

Part - A
(Answer should be given up to 25 words only)
All questions are compulsory.   (10×2=20)

1. What do you mean by blow-by operation in case of IC Engine?
2. Explain
    i)   Zero film,
    ii) Thin film
    iii) Thick film lubrication.
3. State the importance of Wahl's factor in Spring Design.
4. List out the assumptions made in Lewis equation for gear Design.
5. What is the significance of notch sensitivity?
6. Draw stress-time curve for fluctuating stress.
7. List out the factors that affect endurance limit of machine part?
8. Why is the cross-section of the pulley an elliptical arm?
9. Why is the pinion weaker than the gear made of same material?
10. Mention advantage of rolling contact bearings.

Part - B
(Analytical/Problem solving questions)
Attempt any five questions.   (5×4=20)

1. What types of shear stresses are induced in the wire of helical spring? Sketch the distribution of shear stresses.

2. A bar of rectangular section is subjected to an axial pull of 500 kN as shown in Fig. Calculate its thickness at **Section A-A** if the allowable tensile stress in the bar is 200 MPa.
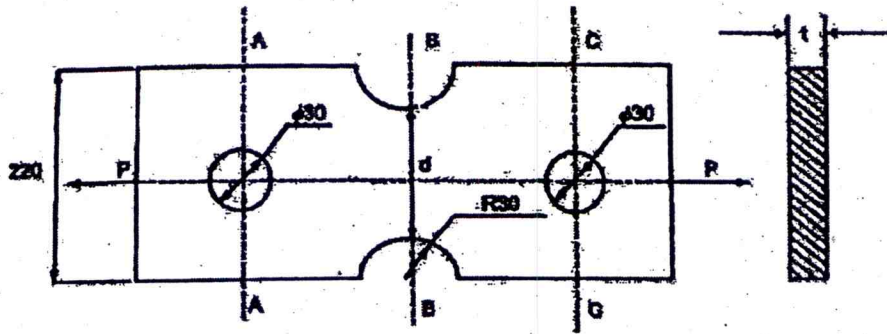
3. What do you mean by bearing? Why ball bearing are called "antifriction" Bearing?

4. Design a spring for balance to measure 0 to 1000 N over a scale of length 80 mm. the spring is to enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm². Also calculate the maximum shear stress induced.

5. What do you mean by stress concentration? How do you take it into consideration in case of components subjected to dynamic loads?

6. Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete stress reversal), $\sigma_e = 265$ Mpa and tensile yield strength of 350 MPa. The member is subjected to varying axial load from $W_{min} = -300 \times 103 N$ to $W_{max} = 700 \times 103$ N and has a stress concentration factor $= 1.8$. Use factor of safety as 2.0.

7. A single row angular contact ball bearing number 310 is used for an axial flow compressor. The bearing is to carry a radial load of 2500 N and an axial or thrust load or 1500 N. Assuming light shock load, determine the rating life of the bearing.

Part - C

(Descriptive/Analytical/Problem solving/Design Questions)

Attempt any three questions. (3×10=30)

1. Discuss the Lewis equation for Beam Strength for Gears.

2. A pulley of 0.9 m diameter revolving at 200 r.p.m. is to transmit 7.5 kW. Find the width of a leather belt if the maximum tension is not to exceed 145 N in 10 mm width. The tension in the tight side is twice that in the slack side. Determine the diameter of the shaft and the dimensions of the various parts of the pulley, assuming it to have six arms. Maximum shear stress is not to exceed 63 Mpa.

3. It is required to design a pair of spur gear with 20° full - depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3mm while face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of 600 Mpa. The gears material surface hardness is measured as 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for the dynamic load and the factor of safety is 1.5. Determine the rated power that the gears can transmit.

4. The cylinder of four stroke diesel engine has following specifications: Brake power = 7.5 KW, speed = 1400 RPM; Indicated mean effective pressure= 0.35 MPa, Mechanical efficiency = 80% and Maximum gas pressure = 3.5 MPa. If the cylinder liner and Head are made of grey cast iron FG 260$\left(\sigma_{ut} = 260 \text{ Mp}_a \text{ and } \mu = 0.25\right)$ and studs are made of plan carbon steel 40C8$\left(\sigma_{yt} = 380 Mp_a\right)$.

Calculate :-

a) bore and length of the cylinder

b) Thickness of the cylinder

c) Thickness of cylinder head.

5. A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of 250 N/mm². The bar is made of steel 40C8$\left(S_{ut} = 600 N / mm^2\right)$. Calculate the life of the bar for a reliability of 90%.

Roll No. _____ [Total No. of Pages : 3]

6E1604

6E1604

B.Tech. VI Sem. (Back) Examination, July- 2023
Automobile Engineering
6AE4-05 Design of Machine Elements - II
AE, ME

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

*Attempt all **Ten** questions from **Part A**, **Five** questions out of **Seven** from **Part B** and **Four** questions out of **Five** 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).

PART - A

(Answer should be given up to 25 words only.)

All questions are compulsory.   (10×2=20)

1. Define endurance limit.

2. Define notch sensitivity.

3. What type of stresses induced in cylinder (component of I.C. engine)?

4. Write type of stresses induced in helical tension spring.

5. Write the purpose of initial tension in belt drive.

6. Define virtual number of teeth used in design of helical gears.

7. What do you mean by hydrostatic lubrication?

8. Define L_{10} life.

9. What is 'Sommerfeld number'?

10. Explain the term 'number of stress cycle'.

PART - B

(Analytical/Problem solving questions.)

Attempt any Five questions.   (5×8=40)

1. A transmission shaft of cold drawn steel (S_{ut} = 500 N/mm² and S_{yt} = 300 N/mm²) is subjected to a fluctuating torque which varies from - 100 Nm to 400 Nm.

   The factor of safety is 2. Neglect the effect of stress concentration, determine the diameter of the shaft. Assume the distortion energy theory of failure.

   Table

   Size factor = 0.79
   Surface finish factor = 0.85
   Reliability factor = 0.897

2. The assembly of two circular plates clamped together by means of a bolt is subjected to a variable force. P varying from 0 to 10kN. The bolt is made of plain carbon steel (S_{ut} = 630 N/mm², S_{yt} = 380 N/mm², E = 207000 N/mm²). The circular plates are made of aluminium (E = 71000 N/mm²).

   Complete endurance limit = 128.4 N/mm² initial preload in the bolt = 5kN F.S. = 2

   Determine the size of bolt.
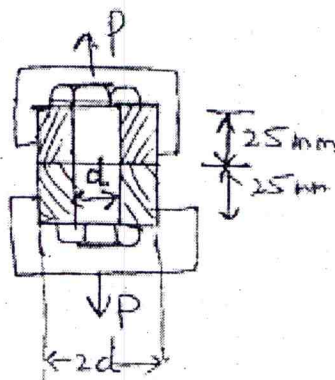
3. Write the design procedure of 'Piston'.

4. Calculate stiffness (k) of helical tension spring (a) Theoretical (b) Actual using following data

Static deflection	=	100 mm
Spring index	=	6
Sut of wire material	=	$1360\dfrac{N}{mm^2}$
Modules of rigidity	=	$81370\dfrac{N}{mm^2}$
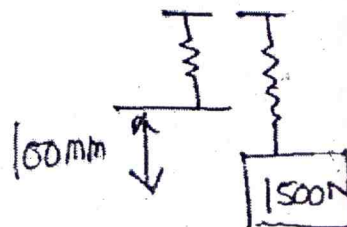
   The permissible shear stress in the spring wire should be taken as 50% of ultimate tensile strength

   K_{Actual} = ? $K_{Theoretical}$ = ?

6E1604   (2)

5. The pitch circles of a train of spur gears are shown in fig. Gear A receives 3.5 kw power at 700 rpm through its shaft and rotates in the clockwise direction.
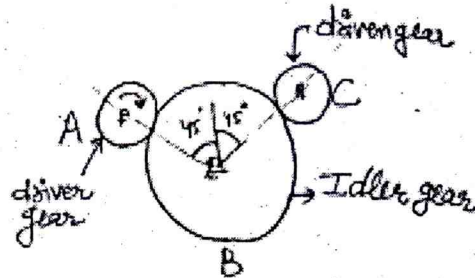
No. of teeth on gear A, B and C are 30, 60 and 40 respectively.

Take m = 5 mm Calculate

(i) Tangential component (force) between gear B and C.

6. Discuss methods of lubrication in Journal bearing (brief).

7. Write the design procedure of anti-friction bearings.

PART - C

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

Attempt any Three questions. (4×15=60)

1. A machine component is subjected to two dimensional stresses. The tensile stress in the X direction varies from 50 to 100 N/mm² while the tensile stress in the Y direction varies from 20 to 80 N/mm². The frequency of variation of these stresses are equal.

   Correct Endurance limit = 270 N/mm²

   Sut = 660 N/mm²

   Determine the factor of safety used by the designer.

2. Write the design procedure of crankshaft in detail.

3. It is required to select a flat belt drive for a compressor running at 720 rpm, which is driven by a 25 kW, 1440 rpm motor space is available for a centre distance of 3m. The belt is open type.

4. It is required to design a pair of spur gears with 20° full depth involute teeth based on Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 kW, 1440 rpm motor. The motor is to be designed for 50% overload condition. The speed reduction is 4:1. The pinion as well as the gear is made of plain carbon steel 40C8 (Sut = 600 N/mm²). The factor of safety can be taken as 1.5. Design the gears.

5. Write short notes on following:

   i) Goodman line

   ii) Buckingham equation

   iii) Mountings of the bearings.

6E1604 (3)

6E7115

6E7115

B.Tech. VI-Sem. (Main) Examination, July - 2023
Mechanical Engineering
6ME4 - 05 Quality Management
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 diagram 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)

PART - A

(Answer should be given up to 25 words only).

All questions are compulsory. (10×2=20)

1. Explain the difference between quality control and quality improvement.

2. What are the major categories of quality costs? Explain each of them, and give examples.

3. State and explain the central limit theorem. Explain its role in quality control.

4. Explain the difference between a null hypothesis and alternative hypothesis.

5. Discuss a type I error and Type II error in hypothesis testing. Explain these in the context of a quality control setting.

6. Explain the difference between common causes and special causes. Give examples of each.

7. A new operator is introduced in a machining operation. Discuss what the patterns on an X-bar chart and R-chart might look like as learning on the job takes place.

8. Distinguish between failure, time-terminated, and sequential tests for reliability and life testing.

9. Define reliability. Explain its role in quality control and improvement.

10. Compare and contrast Taguchi's loss functions for the situations; target is best, smaller is better, and larger is better.
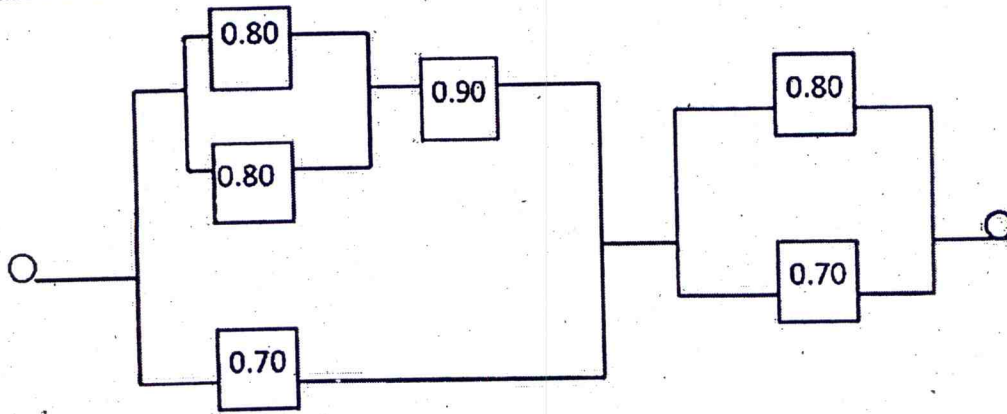
PART - B

(Analytical/Problem solving questions).

Attempt any five questions.   (5×4=20)

11. Calculate the reliability of the system shown below

12. It is estimated that the average number of surface defects in 20 m² of paper produced by a process is 3 , what is the probability of finding no more than 2 defects in 40 m² of paper through random selection?

13. A lot of 20 transistors contain 5 nonconforming ones. If an inspector randomly samples 4 items, find the probability of 3 nonconforming transistors.

14. A control chart is to be constructed for the average breaking strength of nylon fibers. Sample of size 5 are randomly chosen from the process. The process mean and standard deviation are estimated to be 120 kg and 8 kg, respectively.

    a)   If the control limits are placed 3 standard deviations from the process mean, what is the probability of a type I error?

    b)   If the process mean shifts to 125 kg, what is the probability of concluding that the process is in control and hence making a Type II error on the first sample plotted after the shift?

15. The emergency service unit in a hospital has a goal of 3.5 min for the waiting time of patients before being treated. A random sample of 20 patients is chosen and the sample average waiting time is found to be 2.3 min with a sample standard deviation of 0.5 min. Find an appropriate process capability index? Comment on the ability of the emergency service unit to meet the desirable goal.

16. The automatic focus unit of a television camera has 10 components in series. Each component has an exponential time-to-failure distribution with a constant failure rate of 0.05 per 4000 h. What is the reliability of each component after 2000 h of operation? Find the reliability of the automatic focus unit for 2000 h of operation. What is its mean time-to-failure?

17. What is the highest failure rate for a product if it is to have a probability of survival (that is, successful operation) of 95% at 4000 h? Assume that the time to failure follows an exponential distribution.

PART - C

(Descriptive/Analytical/Problem solving/Design questions).

Attempt any Three questions.   (3×10=30)

18. The length of a machined part is known to have a normal distribution with a mean of 100 mm and a standard deviation of 2 mm.

a) What proportion of the parts will be above 103.3 mm?

b) What proportion of the output will be between 98.5 to 102.0 mm?

c) What proportion of the parts will be shorter than 96.5 mm?

d) It is important that many of the parts exceed the desired length. If a manager stipulates that no more than 5% of the parts should be oversized, what specification limit should be recommended?

19. It is known that a battery for a video game has an average life of 500 hours (h). The failures of batteries are known to be random and independent and may be described by an exponential distribution.

a) Find the probability that a battery will last at least 600 h.

b) Find the probability of a battery failing within 200 h.

c) Find the probability of a battery lasting between 300 and 600 h.

d) Find the standard deviation of the life of a battery.

e) If it is known that a battery has lasted 300 h, what is the probability that it will last at least 500 h?

20. Control charts for X bar and R are kept on the tensile strength (in kg/cm²) of steel beams. The sample size is 5. After 30 samples, the summary information is

$$\sum_{i=1}^{30} \overline{X}_i = 7518; \quad \sum_{i=1}^{30} R_i = 375$$

The specifications are $250 \pm 10 \; kg / cm^2$.

a) Find the X bar and R chart control limits.

b) Assuming the process to be in control, estimate the process standard deviation.

c) What proportion of the output is now unacceptable?

d) If the company wants to make sure that the output tensile strength of the product is not less than 265 kg/cm², what proportion of the output will not meet this criterion?

21. A building contractor subcontracts a job involving hanging wallpaper to a local merchant. To have an idea of the quality level of the merchant's work, the contractor randomly selects 300 ft² and counts the number of blemishes. The total number of blemishes for 30 samples is 80. Construct the center line and control limits for an appropriate chart. Is it reasonable for the contractor to set a goal of an average of 0.5 blemish per 100 ft²?

22. The Control limits of a $\bar{x}$ chart for gun shells with n = 5 are 17.28 and 18.42. The Specs are 17.1±1.1 mm. If a shell falls below 16.0, it must be scrapped and then the loss is very high. If it falls above 18.2, it may be further machined. Where do you suggest the target process mean be set? And why?

6E1605

6E1605

B.Tech. VI-Sem. (Back) Examination, July - 2023
Automobile Engineering
6AE5-13 Quality Management
AE,ME

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions to Candidates:

Attempt all ten questions from **Part A**, five questions out of **Seven** from **Part B** and **Four** questions out of **Five** 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).

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory.   (10×2=20)

1. What are the benefits of quality control?

2. Explain how quality affects productivity. Discuss the implications on cost.

3. What are the benefits of using control charts?

4. What are warning limits, and what purpose do they serve?

5. Discuss a Type I error and Type II error in hypothesis testing. Explain these in the context of a quality control setting.

6. Explain the difference between common causes and special causes. Give examples of each.

7. Explain the concept of process capability.

8. Distinguish between failure, time-terminated, and sequential tests for reliability and life testing.

9. Define reliability. Explain its role in quality control and improvement.

10. Compare and contrast Taguchi's loss functions for the situations; target is best, smaller is better, and larger is better.
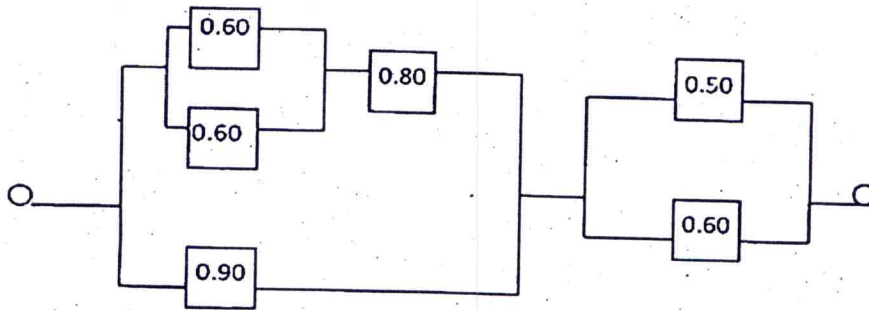
PART - B
(Analytical/Problem solving questions)
Attempt any Five questions.   (5×8=40)

11. Calculate the reliability of the system shown below

12. What are the advantages and disadvantages of control charts for attribute over those for variables?

13. Compare and contrast the process capability indices, C_p, CPU, CPL, and C_{pk}.

14. A semiautomatic turret lathe machines the thickness of a part that is subsequently used in an assembly. The process mean is known to be 30 mm with a standard deviation of 1.5 mm. Construct a control chart for the average thickness using 3σ limits if samples of size 5 are randomly selected from the process. Table below shows the average thickness of 15 samples selected from the process. Plot these on a control chart and make inferences.

Sample	Average Part Thickness	Sample	Average Part Thickness	Sample	Average Part Thickness
1	31.56	6	31.45	11	30.20
2	29.50	7	29.70	12	29.10
3	30.50	8	31.48	13	30.85
4	30.72	9	29.52	14	31.55
5	28.92	10	28.30	15	29.43

15. Discuss the relative advantages and disadvantages of Single, double and multiple sampling plans.

16. The automatic focus unit of a satellite camera has 20 components in series. Each component has an exponential time - to-failure distribution with a constant failure rate of 0.1 per 10000 h. What is the reliability of each component after 4000 h of operation? Find the reliability of the automatic focus unit for 4000 h of operation. What is, its mean time-to-failure?

17. What is the highest failure rate for a product if it is to have a probability of survival (that is, successful operation) of 99% at 6000 h? Assume that the time to failure follows an exponential distribution.

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

Attempt any Four questions. (4×15=60)

18. Consider a process by which coils are manufactured. Samples of size 5 are randomly selected from the process, and the resistance values (in Ohms) of the coils are measured. The data values are given in table below. Construct X bar and R control charts.

Sample	Observations	Sample	Observations
1	20,21,22,23,22	14	20,21,22,21,22
2	19,18,22,20,20	15	20,24,24,23,23
3	25,18,20,17,22	16	21,20,24,20,21
4	20,21,22,21,21	17	20,18,18,20,20
5	19,24,23,22,20	18	20,24,22,23,23
6	22,20,18,18,19	19	20,19,23,20,19
7	18,20,19,18,20	20	22,21,21,24,22
8	20,18,23,20,21	21	23,22,22,20,22
9	21,20,24,23,22	22	21,18,18,17,19
10	21,19,20,20,20	23	21,24,24,23,23
11	20,20,23,22,20	24	20,22,21,21,30
12	22,21,20,22,23	25	9,20,21,21,22
13	19,22,19,18,19		

19. Samples of fabric from a textile mill, each 100 m² are selected and the number of occurrences of foreign matter are recorded. Data for 25 samples are shown in table below. Construct a c-Chart for the number of nonconformities.

Sample	Nonconformities	Sample	Nonconformities
1	5	14	11
2	4	15	9
3	7	16	5
4	6	17	7
5	8	18	6
6	5	19	10
7	6	20	8
8	5	21	9
9	16	22	9
10	10	23	7
11	9	24	5
12	7	25	7
13	8		

20. Control charts for X bar and s are kept on the tensile strength (in kg/cm²) of steel beams. The sample size is 5. After 30 samples, the summary information is

$$\sum_{i=1}^{30} \overline{X}_i = 2550; \quad \sum_{i=1}^{30} S_i = 195.$$

The specifications are $900 \pm 15 \, kg/cm^2$.

a) Find the X bar and s chart control limits.

b) Assuming the process to be in control, estimate the process mean and process standard deviation.

21. What is the highest failure rate for a product if it is to have a probability of survival (that is successful operation) of 95% at 4000h? Assume that time to failure follows an exponential distribution.

22. The control limits of a $\overline{X}$ chart for gun shells with $n = 5$ are 17.28 and 18.42. The Specs are 17.1 ± 1.1 m.m. If a shell falls below 16.0, it must be scrapped and then the loss is very high. If it falls above 18.2, it may be further machined. Where do you suggest the target process mean be set? And why?

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6E7116

6E7116

B.Tech. VI-Sem. (Main) Examination, July - 2023
Mechanical Engg.
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.(Mention in form no. 205)

1.   Refrigeration Table & P-h chart

Part - A

(Answer should be given up to 25 words only)

All questions are compulsory.   (10×2=20)

1.   Define ton of refrigeration.

2.   Draw Schematic, P-h and T-s diagrams of simple vapour compression refrigeration system.

3.   Write the limitations of reversed Carnot cycle with the gas as a refrigerant.

4.   Why air cycle refrigeration is preferred in air crafts?

5.   What is the role of hydrogen in an Electrolux refrigeration system?

6.   Give the chemical formula and name of the refrigerant for R-22 and R-134a.

7.   Explain the following terms related to psychrometry:

a)   Relative humidity

b)   Dew point temperature.

8. What is human comfort?

9. What is heat load?

10. Define bypass factor.

Part - B

(Analytical/Problem solving questions)

Attempt any five questions. (5×4=20)

1. A refrigerating plant produced 30 tons of ice from and at 0°C per day in an ammonia refrigerator. The temperature range in compressor is from 25°C to -15°C. The vapour is dry and saturated at the end of compression. There is no liquid sub-cooling. Assuming actual COP of 62% of the theoretical, calculate the power required to drive the compressor. Take latent heat of ice = 335 kJ/kg.

2. Describe the working of a two stage vapour compression refrigeration system with water intercooler, liquid intercooler and a liquid flash chamber with the help of schematic and p-h diagram.

3. Describe with schematic and T-s diagram a Boot-strap cycle for air refrigeration system.

4. Draw and explain aqua-ammonia vapour absorption refrigeration system. Indicate the phases of fluids at various points on diagram.

5. What is the mechanism of maintaining constant temperature of human body? How it controls and adjusts to various weather conditions?

6. Define the following:

   a) Grand sensible heat factor.

   b) Effective room sensible heat factor.

7. What do you understand by the term cooling load? What are the different factors considered in load estimation sheet for comfort applications?

Part - C

(Descriptive/Analytical/Problem solving/Design Questions)

Attempt any three questions. (3×10=30)

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

   a) Decrease in evaporator pressure.

   b) Increase in condenser pressure.

   c) Subcooling of saturated liquid.

6E7116 (2)

2. The refrigeration plant of Boieng 747 aircraft has to handle a cabin load of 40 tonnes. The atmospheric air having the temperature 17°C is compressed to a pressure of 0.95 bar and temperature of 30°C due to ram action. This air is then further compressed in a compressor to 4.75 bar, cooled in heat exchanger to 67°C, expanded in a turbine to 1 bar pressure and supplied to the cabin. The air leaves the cabin at a temperature of 27°C. The isentropic efficiency of both compressor and turbine are 0.9. Calculate the mass of air circulated per minute and the COP.

3. Explain the construction and working of thermostatic expansion valve with neat sketch.

4. A restaurant with a capacity of 100 persons is to be air-conditioned with the following conditions:

   a) Outside conditions: 30°C DBT and 70% RH

   b) Desired inside condition: 23°C DBT and 55% RH

   c) Quantity of air supplied per person: 0.5 m³/min

   The desired conditions are achieved by cooling, dehumidifying and then heating. Determine:

   1) Capacity of cooling coil;

   2) Capacity of heating coil; and

   3) Amount of water removed by dehumidifier.

5. Describe Central, District and Unitary air conditioning systems with a neat sketch.

6E1606

6E1606

B.Tech. VI - Sem. (Back) Examination, July - 2023
Automobile Engineering
6AE5-11 Refrigeration and Air Conditioning
AE, ME

Time : 3 Hours

Maximum Marks : 120
Min. Passing Marks : 42

Instructions 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).

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory.   (10×2=20)

1. Define COP of refrigeration.

2. What is Refrigeration effect?

3. Write the advantages of reversed Brayton cycle for air refrigeration system.

4. Explain in brief the ramming action in an aircraft.

5. Write the limitation of Electrolux refrigeration system.

6. Classify the various types of refrigerants.

7. Define saturated air and relative humidity in terms of psychrometry.

8. Write the factors affecting human comfort.

9. Define bypass factor.

10. Write the components of a cooling load.

PART - B
(Analytical/Problem solving questions)

Attempt any Five questions. (5×8=40)

1. Describe the essential parts of the simple vapour compression cycle with the help of schematic diagram. Draw T-s and P-h diagram for the same.

2. Explain two stage compression with liquid intercooler with neat sketch and P-h diagrams.

3. State merits and demerits of an air refrigeration system.

4. Explain the thermodynamic expansion valve with neat sketch.

5. Write the properties for the good refrigerant for vapour compression cycle.

6. Define the following terms :
   a) Specific Humidity or Humidity ratio
   b) Relative Humidity
   c) Degree of Saturation
   d) Wet Bulb Temperature

7. Define the following terms :
   a) Room sensible heat factor
   b) Effective room sensible heat factor

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

Attempt any Four questions. (4×15=60)

1. A cold storage plant is required to store 20 tons of fish. The fish is supplied at a temperature of 30°C. The specific heat of fish above freezing point is 2.93kJ/kg K. The specific heat of fish below freezing point is 1.26kJ/kg K. The fish is stored in cold storage which is maintained at -8°C. The freezing point of fish is -4°C. The latent heat of fish is 235 kJ/kg. If the plant requires 75kW to drive it, find :
   a) The capacity of the plant, and
   b) Time taken to achieve cooling. Assume actual C.O.P. of the plant as 0.3 of the Carnot C.O.P.

2. Explain and draw Boot - strap air cooling system. Indicate actual and ideal points of cycle on temperature-entropy diagram.

3. Describe the working of Electrolux Refrigerator (Ammonia Hydrogen) with suitable diagram. Indicate the phases of fluids at various points on diagram.

4. Describe the working of automatic (constant pressure) expansion valve with neat sketch.

5. Explain with neat sketch the working of summer and winter air conditioning system.