6E7111

B.Tech. VI-Sem. (Main/Back) Exam. May - 2025

AUTOMOBILE ENGINEERING

6AE3-01 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 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. What are fundamental methods of measurement?

Q.2. Define sensitivity and repeatability.

Q.3. List different methods of angle measurement.

Q.4. Define thermo electric effect.

Q.5. What is Calibration?

Q.6. What is uncertainty?

Q.7. Give application of load cells.

Q.8. Define systematic and random error.

Q.9. Classify comparators.

Q.10. List different type of gear errors.

PART-B   [5×4=20]

(Analytical/Problem-solving Questions)
Attempt any five questions

Q.1. What is difference between gauging and measurement?

Q.2. Explain dial test indicator with neat sketch.

Q.3. Discuss screw thread terminology with sketch. Define all thread elements.

Q.4. Explain working principle of pitot tube with suitable diagram.

Q.5. Explain mechanical dynamometer with neat sketch.

Q.6. Discuss working principle of Thermocouple. State the advantages and disadvantages.

Q.7. Explain (i) Interchangeability (ii) Flatness Testing.

(Descriptive/Analytical/Problem-Solving/Design Questions)
Attempt any three questions

Q. 1. Explain Limit, Fits and Tolerances with neat sketch.

Q. 2. Explain : (a) Co-ordinate measuring Machine

(b) Rotameter and its working principle

Q. 3. Explain construction, working principle and application of following :

(a) Sine bar

(b) Pyrometers

Q. 4. Write short notes on the following :

(a) Measurement of Power

(b) Gear Measurement

Q. 5. What are the limit gauge? Explain various type of limit gauges with diagram.

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6E7112

6E7112

B.Tech. VI-Sem. (Main/Back) Exam. May, 2025

Automobile Engineering

6AE5-12/ CIMS (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. ....   2. ....

PART-A   [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. What are the advantages of Automation in production systems?

Q.2. Write features of CNC systems.

Q.3. Give name of at least 5 CAD/CAM Softwares.

Q.4. Define CAPP.

Q.5. What are the main elements of CIM Systems?

Q.6. What do you understand by "Group Technology"?

Q.7. What are components of Flexible Manufacturing System?

Q.8. Briefly explain concurrent engineering.

Q.9. Explain the various categories of Automation.

Q.10. What do you understand by Lean Manufacturing?

PART-B   [5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. Differentiate between Direct Numerical Control and Distributed Numerical Control.

Q.2. What are the major components of NC Machine? Explain in detail.

Q.3. What are the four types of Statement in APT Language?

Q.4. Explain Enterprise Resource Planning and Capacity Requirement Planning.

Q.5. Elaborate in detail, how automated inspection and control is carried out?

Q.6. Explain the part program segment given below. Draw the Trajectory of table motion that this program seeks to create :

N0010G90;

N0011G01X1Y2;

N0011G01X2Y2;

N0013G91;

N0014G01X1;

N0015G92X2Y2;

N0016G01X1Y1;

Q.7. 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 600mm and the range of 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.

PART-C [3×10=30]

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any three questions

Q.1. (a) Describe the Scheduling and Dispatching issues related to flexible manufacturing system (FMS).

(b) Differentiate between Agile and Lean Manufacturing System. How these two improve productivity and customer satisfaction?

Q.2. Differentiate between Contact and Non-contact inspection methods. List some of these methods. Explain in detail to any five of these inspection methods.

Q.3. What are the differences between Retrieval and Generative type of Computer Aided Process Planning? Which is better? Explain your choice.

Q.4. Write a manual part program to turn the component on a CNC Lathe from 75 mm bar.
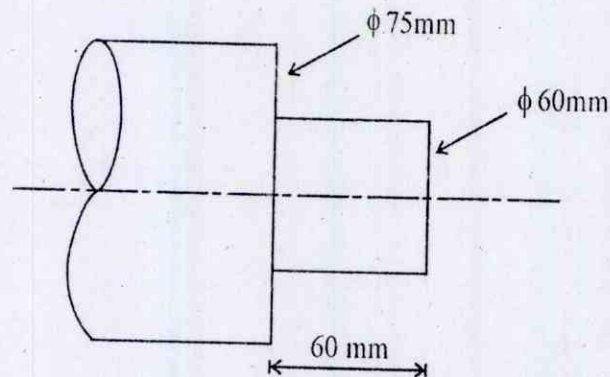
Q.5. Write short notes on **any three** of the following :

(a) Role of Machining Cells in CAPP

(b) Role of Computers in Material Handling

(c) Role of Computers in Quality Control

(d) Role of Computers in Process Planning

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6E7113

6E7113

B.Tech. VI-Sem. (Main/Back) Exam. May - 2025

AUTOMOBILE ENGINEERING

6AE4-03 / 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   [10x2=20]

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

Q.1. Define Sound power, Sound intensity and Sound pressure level.

Q.2. What are the Auditory and Non-auditory effects of Noise ?

Q.3. List major Industrial Noise sources.

Q.4. State Newton's Second law of Motion.

Q.5. Define Damping and its types.

Q.6. What is a Compound Pendulum ?

Q.7. Define Forced Vibration with an example.

Q.8. What is Motion Transmissibility ?

Q.9. What is a Mode Shape ?

Q.10. State Dunkerley's Method.

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PART-B   [5×4=20]

Part B(Analytical/Problem solving questions)

Attempt any Five questions

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Q.1. Convert the following complex number into exponential and graphical form :

    (a) $3i-4j$

    (b) $i+5j$

Q.2. Determine the natural frequency of the following Spring-Mass System using D'Alembert's Principle, where the mass is placed on a smooth surface.
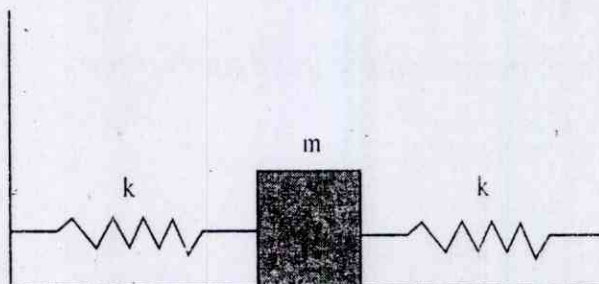
Given : Mass, m = 5 kg, spring stiffness, k = 100 N/m

Q.3. A mass-spring-damper system consists of a mass m = 10 kg, a damping coefficient c = 50 Ns/m, and a spring with stiffness k = 2000 N/m.

Determine the following :

    (a)   Type of the system (underdamped, critically damped, or overdamped).

    (b)   Logarithmic decrement δ.

Q.4. A 50 kg machine is mounted on a rubber pad (vibration isolator) with stiffness 2000 N/m and damping coefficient 100 Ns/m. The machine experiences a harmonic excitation at 15 Hz due to unbalanced forces.

   (a)   Determine the transmissibility ratio.

   (b)   Assess the effectiveness of vibration isolation and suggest improvements.

Q.5. Define critical speed of a shaft and explain its significance in rotating machinery. How does the presence of multiple discs and damping affect the critical speed of the shaft ?

Q.6. Determine the location of the Centre of Percussion (h) from the pivot point in terms of the following parameters. Draw the appropriate diagram

   m = Mass of the body, I_G = Moment of inertia about the pivot point

   R = Distance of the center of mass from the pivot

   g = Acceleration due to gravity

Q.7. Write short notes on **any two** of the following approximate methods used for analyzing many degrees of freedom systems :

   (a)   Rayleigh's method

   (b)   Stodola's method

   (c)   Holzer's method

   Explain their basic principles and applications.

<div align="center">PART-C   [3x10=30]</div>

<div align="center">Part C(Descriptive/Analytical/Problem Solving/Design question)</div>
<div align="center">Attempt any three questions</div>

Q.1. Explain the working principle of a vibration absorber with the help of a well-labeled diagram. What are the different types of vibration absorbers ? Briefly explain any two types with their applications.

Q.2. Write notes on the following :

   (a)   Auditory and Non-auditory effect of Noise

   (b)   Vibration of Continuous System

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Q.3. A machine of mass 50 kg is mounted on a Spring-Damper system. The stiffness of the spring is 20 KN/m, and the damping coefficient is 200 Ns/m. The system is subjected to a harmonic force of amplitude 500 N and frequency 10 Hz :

(a) Calculate the magnification factor (MF).

(b) Determine the amplitude of forced vibration.

(c) Sketch the characteristic curve of the magnification factor as a function of frequency ratio $(\omega/\omega n)$.

Q.4. A two-degree-of-freedom system consists of two masses m_1 and m_2, connected by springs with stiffness values k_1 and k_2, as shown in the figure :
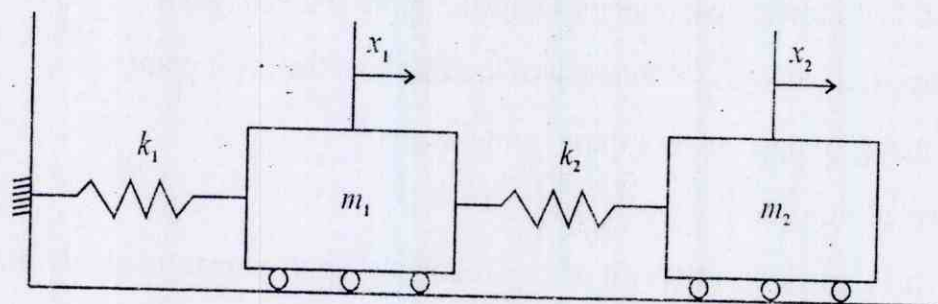
Given the values : $M_1 = 5$ kg, $M_2 = 3$ kg, $K_1 = 800$ N/m, $K_2 = 600$ N/m

(a) Formulate the equations of motion for the system.

(b) Determine the natural frequencies of the system.

(c) Compute the mode shapes associated with the natural frequencies.

Q.5. A block of mass 10 kg slides on a horizontal surface and is attached to a spring with stiffness 800 N/m. The system experiences Coulomb (dry friction) damping with a constant friction force of 20 N opposing the motion. The block is given an initial displacement of 0.1 m and released from rest.

(a) Derive the equation of motion considering Coulomb damping.

(b) Determine the time required for the block to come to rest.

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6E7114

6E7114

B. Tech. VI-Sem. (Main/Back) Exam., May-2025
Automobile Engineering
6AE4-05 Design of Machine Elements II
ME,AE
6E7114

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. Machine Design Databook   2. ....

PART-A   [10x2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1   What is endurance limit and its significance in fatigue design?

Q.2 What is stress concentration and notch sensitivity?

Q.3 What is the role of a crankshaft in an IC engine?

Q.4 What is the function of a flywheel in an IC engine?

Q.5 Discuss spring index and its significance.

Q.6 Discuss the term slip and creep in belt drives.

Q.7 Discuss the Lewis equation and its use in gear design.

Q.8 Discuss the term "dynamic load" in gear design.

Q.9 What is function of an anti-friction bearing?

Q.10 What is the purpose of preloading in antifriction bearings?

PART-B [5x4=20]

(Analytical/Problem solving Questions)

Attempt any five questions

Q.1 A transmission shaft of cold drawn steel 27Mn^2 (S$_{ut}$=500 N/mm^2 and S$_{yt}$=300 N/mm^2) is subjected to a fluctuating torque which varies from-100 N-m to + 400 N-m. The factor of safety is 2 and the expected reliability is 90%. Neglecting the effect of stress concentration, determine the diameter of the shaft. Assume the distortion energy theory of failure.

Q.2 Discuss the Goodman line and Soderberg line with neat sketch and equations?

Q.3 Discuss the functions of piston and the design requirements of piston?

Q.4 Derive the expression for the length of open belt drive.

Q.5   What is the law of gearing and derive its expression?

Q.6   Discuss the term "Lubrication" and methods of lubrication in brief.

Q.7   What is anti-friction bearing? Discuss the types of anti-friction bearing with their application?

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

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

Attempt any three questions

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Q.1   The work cycle of a mechanical component subjected to completely reversed bending stresses consists of the following three elements:

(i) ± 350 N/mm^2 for 85% of time

(ii) ± 400 N/mm^2 for 12% of time

(iii) ± 500 N/mm^2 for 3% of time

The material for the component is 50C4 ($S_{ut} = 660$ N/mm^2) and the corrected endurance limit of the component is 280 N/mm^2. Determine the life of the component.

Q.2   Determine the dimensions of cross-section of the connecting rod for a diesel engine with the following data:

Cylinder bore = 100 mm

Length of connecting rod = 350 mm

Maximum gas pressure = 4 MPa

Factor of safety = 6

Q.3 Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be 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.

Q.4 A bronze spur pinion rotation at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength.

Q.5 The load on the journal bearing is 150 kN due to turbine shaft of 300 mm diameter. running at 1800 r.p.m. Determine the following:

1. Length of the bearing if the allowable bearing pressure is 1.6 N/mm²,and

2. Amount of heat to be removed by the lubricant per minute if the bearing temperature is 60°C viscosity of the oil at 60°C is 0.02 kg/m-s and the bearing clearance is 0.25 mm.

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6E7115

B.Tech. VI-Sem. (Main/Back) Exam. - 2025

AUTOMOBILE ENGINEERING

6AE5-13 /Quality Management (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._____   2. _____

PART-A   [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1.   Explain the difference between quality control and quality assurance.

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

Q.3.   Distinguish between the usage of the mean, median and mode in quality control applications. When would you prefer to use the trimmed mean?

Q.4. Explain the difference between an null hypothesis and alternative hypothesis.

Q.5. Define and explain Type I error and Type II error in the context of control charts. Are they related?

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

Q.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.

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

Q.9. Define reliability. Exaplain its role in quality control and improvement.

Q.10. Compare and contrast Taguchi's loss functions for the situations; target is best, smaller is better, and larger is better.
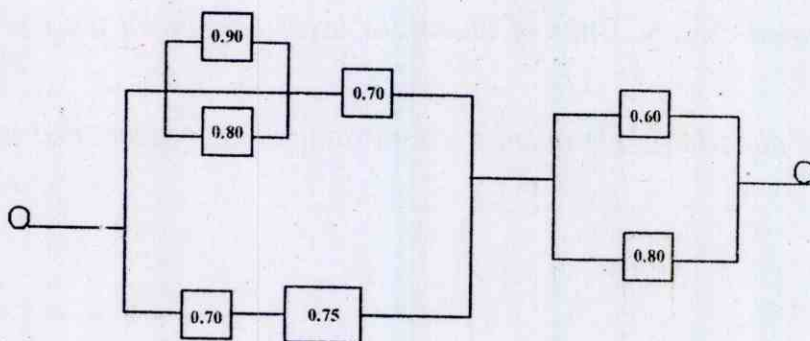
PART-B [5x4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. Calculate the reliability of the system shown below :

Q.2 Find the reliability, failure density function and mean time to failure (MTTF) when hazard increases linearly with time.

Q.3. It is estimated that the average number of surface defects in $20m^2$ of paper produced by a process is 3, What is the probability of finding no more than 2 defects in $40m^2$ of paper through random selection?

Q.4. The time to repair an equipment is known to be exponentially distributed with a mean of 45 min.

(a)   What is the probability of the machine being repaired within an hour?

(b)   If the machine breaks down at 3 PM and a repair man is available immediately, what is the probability of the machine being available for production by the start of the next day? Assume that the repairman is available until 5 PM.

(c)   What is the standard deviation of the repair time?

Q.5. 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 120kg and 8kg, 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?

Q.6. Discuss the signal-to-nosie ratio. How is it used in the Taguchi method? What is an adjustment parameter and how is it used?

Q.7. 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 components 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?

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PART-C   [3x10=30]

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any three questions

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Q.1. The length of a machined part is known to have a normal distribution with a mean of 100mm 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?

Q.2.   Control charts for X bar and R are kept on the tensile strenght (in kg/cm²) of steel beams. The sample size is 5. After 30 samples, the summary information is

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

The specifications are $250 \pm 10 \, \text{kg/cm}^2$.

(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?

Q.3.   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 ± 1.1mm. 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?

Q.4.   Discuss the relative advantages and disadvantages of single, double, and multiple sampling plans.

Q.5.   Suppose that medical science has a cancer-diagnostic test that is 98 percent accurate on both those who do and those who do not have cancer. If 0.005 of the population actually does have cancer, compute the probability that a particular individual has cancer, given that the test says he has cancer.

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

Roll No. : ....

6E7116

B.Tech. VI-Sem. (Main/Back) Exam. May - 2025

AUTOMOBILE ENGINEERING

6AE5-11 / 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. ....   2. ....

PART-A   [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. Define unit of Refrigeration.

Q.2 What are the Limitation of Carnot cycle of refrigeration?

Q.3. Define relative humidity and absolute humidity.

Q.4. Define infiltration load.

Q.5. Why is it necessary to refrigerate an aircraft.

Q.6. What do you understand by the term psychrometry?

Q.7. State the desirable properties of refrigerant.

Q.8. State the function of expansion value.

Q.9. Define sensible heat factor.

Q.10. State the difference between refrigerator and heat pump.

PART-B [5x4=20]
(Analytical/Problem solving questions)
Attempt any five questions

Q.1. With the help of neat sketch explain the working of vapour absorption refrigeration system.

Q.2 What is heat load? Show the various steps of heat load calculation by taking a suitable example.

Q.3. Describe cascade system with the help of a neat sketch.

Q.4. A cold storage is to be maintained at -5°C while the surroundings are at 35°C. The heat Leakage from the surroundings into the cold storage is estimated to be 29KW. The actual C.O.P. of the refrigeration plant is one-third of an ideal plant working between the same temperatures. Find the power required to drive the plant.

Q.5. With the help of psychrometric chart explain the heating and dehumidification processes.

Q.6. Discuss, briefly, the factors which governs the optimum effective temperature for comfort.

Q.7. Describe with a sketch a Regenerative air cooling system.

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any three questions

Q.1.   Describe Brayton Cycle with regenerative heat exchanger.

Q.2   A gas refrigeration system working on reversed brayton cycle at a temperature of 250 k at the inlet of the compressor. If the temperature at the end of constant pressure cooling is 300k and raising the temperature of air in refrigerator is 50k then find network output. (Take CP= 1KJ/Kg-K).

Q.3.   With the help of neat sketch explain the year round air conditioning system.

Q.4.   The humidity ratio of atmospheric air at 30°C DBT and 740mm of 1 Hg is 0.016KJ/ kg of dry air. Determine :

   (i)   Partial Pressure of water vapour

   (ii)   Specific enthalpy

   (iii)   Dew point temperature

   (iv)   Relative humidity

Q.5.   A vapour compression refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry air at the end of compression and there is no under cooling of the liquid before the expansion value. Determine :

   (i)   C.O.P. of the cycle

   (ii)   Capacity of the refrigerator if the fluid flow is at the rate of 5kg/min.

           Data :

Pressure bar	Saturation Temperature (K)	Enthalpy (KJ/kg)		Entropy (KJ/kg.k)	
		Liquid	Vapour	Liquid	Vapour
60	295	151.96	293.29	0.554	1.0332
25	261	56.32	322.58	0.226	1.2464

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6E1603

6E1603

B.Tech. VI-Sem. (Back) Exam. - 2025

AUTOMOBILE ENGG.

6AE4-03 / Mechanical Vibrations

AE, ME

Time : 3 Hours   Maximum Marks : 120

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)

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

PART-A   [10x2=20]

(Answer should be given up to 25 words only)

(All questions are compulsory)

Q.1.   Define sound intensity and sound power.

Q.2.   What are types of vibrations?

Q.3.   Describe causes of vibrations.

Q.4. With the help of figure explain multi-degree freedom system.

Q.5. What do you understand by natural frequency?

Q.6. What do you understand by degree of freedom?

Q.7. Why soldiers are asked to break their marching steps while crossing a bridge? Explain.

Q.8. What is principle of vibration absorber?

Q.9. What do you understand by resonance?

Q.10. State D' Alembert's principle.

PART-B   [5x8=40]

(Analytical/Problem Solving Questions)

(Attempt any Five questions)

Q.1. Describe and differentiate coulomb and viscous damping in detail.

Q.2. Add two harmonic motions analytically which are represented by the equations :

$$x(1) = 4\sin(7t + \pi/6)$$

$$x(1) = 4\sin(7t + \pi/6)$$

Compare the results with graphical representation.

Q.3. Torque T is applied at the midpoint of a uniform cross-section circular shaft of length 'ℓ', which twists the shaft by angle "α" radians. If the torque is released suddenly, derive equation for resulting motion.

Q.4. Write in detail about auditory and non-auditory effects of noise.

Q.5. Differentiate between free vibration and force vibration ? Also give classification of mechanical vibrations.

Q.6. Explain the following :

(a) Vibration isolation and transmissibility

(b) Torsional Vibration of circular shafts

Q.7. What do you understand by Eigenvectors and Eigen values? Explain these with suitable examples related to many degree of freedom systems.

PART-C [4x15=60]

(Descriptive/Analytical/Problem Solving/Design Questions)

(Attempt any four questions)

Q.1. A beam having length of 0.42m, moment of inertia 10000 m^4 and modulus of elasticity 196000 N/m^2 is supporting two masses 40 kg and 20 kg at a distance of 0.16 and 0.24 m from one end. Determine lowest natural frequency by Rayleigh's method.

Q.2. (a) A vertical shaft 15 mm diameter is held in long bearings 1 m apart and carries a disc of mass 15 kg at its center. The eccentricity of disc mass is 0.30 mm. The modulus of elasticity of the disc material is 200 GPa and permissible stress is 70 MPa. Neglect the mass of the shaft and ditermine the critical speed of the shoft. Also find the unsafe range of speed of shoft.

(b) Write a short note on centrifugal pendulum absorber.

Q.3. A machine weighs 15 kg and is supported on springs and dashpot. The total stiffness of the spring is 10 N/mm and damping coefficient is 0.2 N-S/mm. The system is initially at rest, a velocity of 100 mm/s is imparted to the mass determine :

(a) The displacement and velocity of mass as a function of time.

(b) The displacement and velocity of the mass after 0.5 sec.

(c) Now if an excitation force of 24 sin 1st is applied to the mass find the steady state response of the system.

Q.4. Derive expressions of under damped, critically damped and over damped system for single degree of freedom systems. Give suitable sketches.

Q.5. Write short notes on **any three** of the following :

    (a)   Logarithmic decrement

    (b)   Magnification factor

    (c)   Simple harmonic motion

    (d)   Discrete systems Vs. Continuous systems

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6E1606

B.Tech. VI-Sem. (Back) Exam. - 2025
AUTOMOBILE ENGINEERING
6AE5-11 Refrigeration and Air Conditioning
AE,ME

Time : 3 Hours   Maximum Marks : 120

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)

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

PART-A   [10x2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. Differentiate between refrigerator and heat Pump.

Q.2. Define Tons of Refrigeration.

Q.3. Draw P-h and T-S diagram for VCRS.

Q.4. Differentiate VCRS and VARS.

Q.5. Give the designation of "Di-Chloro Di-fluoro methane' refrigerant.

Q.6. State the function of analyzer and absorber in VARS.

Q.7. Show the process of adiabatic cooling on pschromatric chart.

Q.8. Classify Refrigerants.

Q.9. List different Psychrometric properties.

Q.10. Discuss concept of human comfort.

PART-B   [5x8=40]

(Analytical/Problem Solving Questions)

Attempt any five questions

Q.1. Explain working of VCRS with neat diagram. Draw P-h and T-S diagram.

Q.2. A refrigerating plant works between temperature limits of $-5°$ C and $25°$ C. The working fluid ammonia has a dryness fraction of 0.62 at entry to compressor. If the machine has a relative efficiency of 55%, calculate the amount of ice formed during a period of 24 hrs. The ice is to be formed at $0°$ C from water at $15°$ C and 6.4 Kg. of ammonia is circulated per minute. Specific heat of water is 4.187 KJ/Kg °C Properties of NH_3 (Datum = $40°$ C)

Temp °C	h_f (KJ/Kg)	h_{fg} (KJ/Kg)	Entropy (S_f) KJ/Kg K
25	298.9	1167.1	1.124
−5	158.2	1280.8	0.630

Latent heat of Ice = 335 KJ/Kg

Q.3. Explain Bootstrap air refrigeration cycle with diagram.

Q.4. Discuss working of electrolux refrigerator.

Q.5. Explain the working of Automatic expansion value.

Q.6. What do you understand by term cooling load?

Q.7. Discuss different Pschrometric processes on chart.

PART-C [4x15=60]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any four questions

Q.1. 250 m³/min of air at atmospheric conditions 32 °C DBT and 50% RH is supplied to an air conditioned Hall. The required conditions are 18° C DBT and 60% RH Determine.

    (a) Sensible heat and latent heat removed from the air per min.

    (b) Sensible heat factor of the system.

Q.2. 400 m³/min of recirculated air at 20° C DBT and 10° C DPT is to be mixed 150 m³/min of fresh air at 35° C DBT at 45% RH. Determine the enthalpy specific volume, humidity ratio and dew point temperature of mixture.

Q.3. Discuss properties of an Ideal Refrigerant. Explain Nomenclature process of refrigerants.

Q.4. A freon 12 Vapor compression system operating at a condenser temperature of 40° C and an evaporator temperature of –5° C develops 15 Ton of refrigeration. Using P-h chart for freon 12, Determine :

    (i) Mass flow rate of refrigerant

    (ii) Theoretical piston displacement of compressor and piston displacement per ton of refrigeration.

(iii)   Heat refected in condenser

(iv)   The Carnot C.O.P. and actual C.O.P.

(v)   Theoretical HP of compressor and HP per ton of refrigeration.

Q.5.   Explain vortex tube refrigeration with neat diagram.

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