[Time: 3 hours]   [Total Marks: 80]

NB: 1)   Question No. 1 is compulsory
       2)   Attempt any three questions out of the remaining five questions.
       3)   The figures to the right indicate full marks.
       4)   Assume suitable data wherever required but justify the same.

Q1.   **Attempt any four**   (20)
   A.   Justify the use of Pneumatics and Hydraulics with suitable examples.
   B.   List four levels of automation with suitable examples.
   C.   Explain the components of a Robotic system with a neat sketch.
   D.   Explain the Architecture of PLC with a neat block diagram
   E.   State the meaning of an intelligent system and explain the components of an
            intelligent system

Q2   **A.**   Design an electro-pneumatic circuit for two-cylinder operation with the   (10)
               following sequence using 5/2 both side solenoid operated valve as DCV.
                        A+ B+ Delay A-B-
               With user selection option single cycle Multicycle operation.
         B.   Differentiate between hydraulic meter-in and meter-out circuits with suitable   (10)
               applications.

Q3   **A.**   State the types of intelligent agents. Explain the goal-based agent along with a   (10)
               neat sketch.
         B.   Illustrate with neat sketches the mechanical and vacuum type of end effectors   (10)
               used in robotic systems, stating their advantages and disadvantages.

Q4   **A.**   Compare Supervised, Unsupervised, and reinforcement learning with different   (10)
               parameters.
         B.   Design a hydraulic circuit for two-cylinder operation with the following sequence   (10)
               using 4/2 pilot-operated valve as DCV using cascade method, A+ , B+ , Delay B-
               , A-

Q5   **A.**   State the use of a decision tree. Explain the terminology of the decision tree with   (08)
               a suitable example.
         B.   Write note on different actuation methods for Direction control valves   (08)
         C.   State the steps of the K-mean algorithm for clustering analysis   (04)

Q6   **A.**   What is the activation function? Explain the log-sigmoid activation function   (08)
               with a neat sketch.
         B.   List any five applications of Natural Language Processing (NLP).   (06)
         C.   What is the activation function? Explain the log-sigmoid activation function   (06)
               with a neat sketch

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Time: 3 Hour   **Max. Marks: 80**

N. B.   **1)** Question no. **1** is **compulsory**.
   (2) Attempt any **three** questions out of remaining **five** questions.
   (3) Illustrate your answer with **necessary** sketch wherever **necessary**.

Q1. Attempt any four of the following   20
   (a) Sketch a 'push-through' and an 'inverted' draw die and label all parts.
   (b) Explain with the help of neat sketch design aspects of Press tool elements.
   (c) Explain different methods of mounting punches.
   (d) How is the size of a blank calculated for drawing a cup?
   (e) Five holes of diameter 10 mm each is to be punched in a sheet 3 mm thick at a pitch of 25 mm. What should be the minimum capacity of the press (in tons) if the yield point of the material is 50 MPa and one hole is punched per stroke?

Q2. (a) Determine the diameter of the hole that can be punched in a steel sheet of thickness 1.6   10
         mm, for which the ultimate shear stress is 310 N/mm^2, if Press Capacity is 250 KN.
         (b) What will be the punch size if punching is the needed operation?
         (c) If the blank is to be drawn into a cup, determine the diameter of the cup after the first draw.
   (b) Explain the basic construction & working of combination dies.   10

Q3. (a) A washer with 12.7 mm internal diameter and outside diameter of 25.4 mm needs to be   10
         made from 1.5 mm thick strip of 0.2 percent carbon steel. The ultimate strength of material
         is 280 N/mm^2. a) Find the total cutting force if both punches act at the same time and no
         shear is applied to either punch or the die. b) What will be the cutting force if the punches
         are staggered, so that only one punch acts at a time? c) Taking 60 % penetration and shear
         on punch as 1 mm, what will be the cutting force if both punches act together.
   (b) Explain a) Types of bending b) Classify press working operations.   10

Q4. (a) Explain the defects in drawn parts with suitable sketches.   10
   (b) Determine the capacity of the double bending die for the following data.   10
         sheet metal thickness =1 mm
         sheet metal width at bend = 50 mm
         die radius =3 mm
         punch radius = 1.5 mm
         die clearance = 1.25 mm
         tensile strength = 315 MPa
         setting pressure = 560 MPa
         beads on punch = 2
         projected width of each bead = 3 mm

Q5. (a) A steel cup of height 30mm and internal diameter 40 mm with a flange width of 10 mm is   10
         to be deep drawn from a sheet 1mm thick. Determine the diameter of blank and the drawing
         force. What is the draw ratio? Can the cup be drawn in a single operation?
   (b) Explain overloading of presses criteria while selecting the press.   10

Q6.   Attempt any four of the following: 20
   (a) Explain with sketch any four types of sensors used for hand protection.
   (b) Explain different defects in drawn parts.
   (c) Draw and label parts of shaving die and explain its working
   (d) Sketch the various methods of applying shear to the punch and die.
   (e) Describe Spring back effect and measures to control it.
                                         ****

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3 Hours   **Marks: 80**

NB: - 1) Draw neat sketches whenever necessary.
   2) **Q. No. 1** is compulsory.
   3) Solve any **three** questions from the remaining five questions.
   4) Assume suitable data wherever necessary.
   5) use of design data book is permitted.

Q.1   Answer **any four** of the following :   **20**

        a) Write Design considerations for piston.
        b) Differentiate between flywheel and torque converter.
        c) Draw the diagram for Torque tube drive
        d) Explain construction of Radial Ply tyre
        e) Explain working of Universal joint with sketch.
        f) Write advantages of front engine Rear wheel drive

Q.2 a) A multi-disc clutch is constituted of 5 discs providing four pairs. The outer   **10**
diameter of the contact surface is 25 cm and inner diameter is 15 cm.
Determine the total load on springs with which the discs will be held
together if 18.75 KW. is to be transmitted at 500 r.p.m., assuming a
coefficient of friction is equal to 0.3. Then determine the maximum axial
intensity of pressure between the discs

    b) Explain Hydraulic type power assisted steering with neat sketch with   **10**
advantages.

Q.3 a) A four stroke internal combustion engine has the following specifications :   **10**
Brake power = 7 KW, speed = 1000 rpm, indicated mean pressure = 0.35 N
/mm ^{2} , maximum gas pressure = 3.9 N / mm ^{2} , mechanical efficiency = 85
%. Determine i) the dimensions of the cylinder, if the length of the stroke is
1.4 times the bore of the cylinder.

    b) Explain synchromesh gearbox with construction and working with   **10**
advantages.

Q.4 a) The propeller shaft has to transmit 171.5 Nm torque and the bottom gear   **10**
ratio is 3 Find the diameter of the shaft. Assume a safe shear stress of 3300
Kg/cm^2.

    b) Explain with diagram two types of wheels.   **10**

Q.5 a) A four speed gear box is to be constructed for providing the rations of 1.0 ,1.46, 2.28 and 3.93 to 1 as nearly as possible. The diametral pitch of each gear is 3.25 mm and the smallest pinion is to have at least 15 teeth. Determine the suitable number of teeth of the different gears.   **10**

b) Enlist types of springs and explain leaf spring with diagram.   **10**

Q.6 Write short note on **(Any Four)**   **20**

    a) Continuously Varying Transmission
    b) Centrifugal Clutch
    c) Swing axle type suspension system
    d) Any one type of steering gear box
    e) Reversibility and irreversibility in steering system
    f) Disc brakes

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Duration: 3 Hours [Total Marks: 80]

Instructions :
[1] Question No.**1 is compulsory**.
[2] Answer **any three** from the remaining five questions.
[3] Assume suitable data whenever required with proper justification.
[4] Answers to questions should be grouped and written together.
[5] Figures to the right indicate full marks.

**Q.1** **Attempt any four of the following. All sub-questions carry equal marks** **20**
  (a) Briefly explain causes and effects of vibration
  (b) Draw frequency response curve for vibrometer
  (c) Write short note on Ralyleigh's method.
  (d) Draw spring, mass and damper system for free vibration and write equation of motion.
  (e) Describe direct and reverse crank method in balancing of reciprocating masses.
  (f) Compare Coulomb's damping and viscous damping.

Q.2 **(a)** What is the equivalent stiffness of the system as shown in fig. 1 **10**
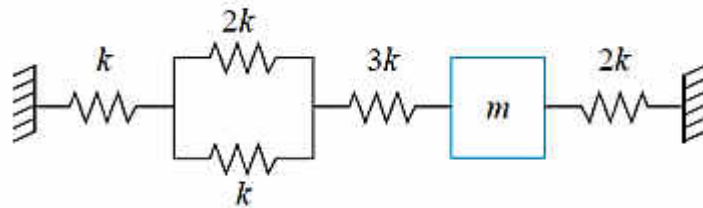
Fig : 1

  (b) Determine the parameters in an equivalent system model of the system of figure 2 when **10**
  Θ, the clockwise angular displacement of the bar form the system's equilibrium
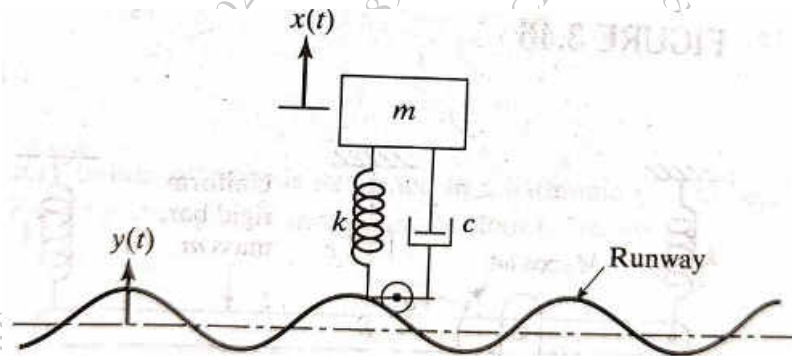 position, is used as the generalized co-ordinate assume small Θ.
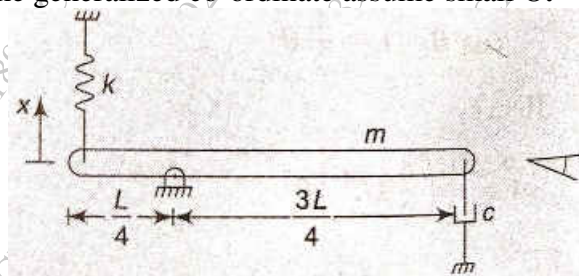
Fig. 2

Q.3 **(a)** A spring mass damper system, having an undamped natural frequency of 100 Hz and a **10**
  damping constant of 25 Ns/m, is used as an accelerometer to measure the vibration of a
  machine operating at a speed of 3000 rpm. If the actual acceleration is 10 m/s^2 and the
  recorded acceleration is 9 m/s^2, find the mass and the spring constant of an
 accelerometer.

  (b) Draw free body diagram for multi degree of freedom system for torsioanl vibration. **10**
  Consider free free system. Write all the equations of motion. Assume 4 rotors.

Q.4 **(a)** A simplified model of a vehicle suspension system is shown in figure -3. Find the acceleration amplitude of vehicle, if it travels with a constant speed of 52m/s. The vehicle suspension system has mass m=500 Kg, stiffens K=4x10^5 N/m, damping constant C=3000 NS/m, runway wave length, λ = 2.5 m and Ymax. =0.01m. **10**

Fig. 3

(b) Use Lagrange's equation to derive the differential equations governing the motion of the system of fig. 4 using x_1, x_2 and x_3 as the generalized coordinates. Also write the equations in matrix form. **10**
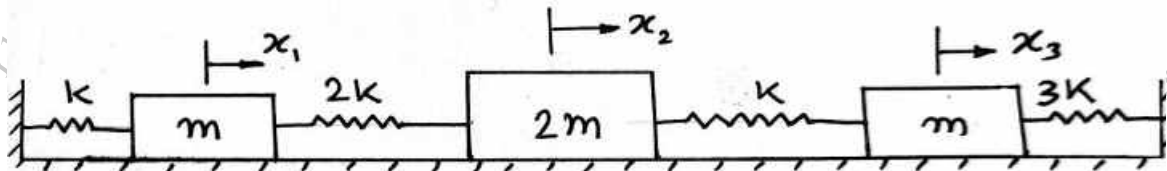
Fig.4

Q.5 **(a)** 3W, 2W, W, 2W and 3W are 5 sequentially equally spaced loads on 1200 mm simply supported beam. Deflection under 2W is 5 mm. Find the natural frequency of vibration for simply supported beam using Dunkerly's method only. Deflection at section "i" at xi from one support and zj from another support under unit load at "j" is given as, **15**

$$U_{ij} = \frac{x_i^{\square} z_j^{\square}(L_{\square}^2 - x_i^2 - z_j^2)}{6EIL} \qquad \& U_{ij} = U_{ji}$$

(b) Define whirling speed. Derive the equation for the critical speed of a light shaft with a single disc without damping. **05**

Q.6 **(a)** A shaft carries four masses A,B,C and D of magnitude 200 Kg, 300 Kg, 400 Kg and 200 Kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45^0, B to C 70^0 and C to D 120^0. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. **10**

(b) A machine of mass 60 Kg operates at 1200 rpm. Find the maximum stiffness of an isolator that provides 82 percent isolation. Assume that damping ratio of the isolator is 6.6 percent. **10**

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	(3 hours)	**Total Marks: 80**

NB   1) Question No. 1 is compulsory
      2) Attempt any three questions out of the remaining five questions.
      3) Assume suitable data wherever required
      4) Figures to the right indicate full marks.

Q1.   **Attempt any four**
    A. Write short note on Ultra light Steel Auto body(ULSAB)   **(5)**
    B. Write short notes on Pedestrian Protection   **(5)**
    C. What are requirements of driver seats   **(5)**
    D. Explain the term Universal Design   **(5)**
    E. Explain briefly various body optimization techniques for minimum drag.   **(5)**

Q2 **A.** Differentiate between active and passive systems.   **(10)**
    B. Explain methods of Improving visibility and space in car   **(10)**

Q3 **A.** What are design requirements of Child seat?   **(5)**
    B Write Short note on Vehicle Scrapping policy   **(5)**
    C. Explain any two technique used for vehicle body repairs.   **(10)**

Q4 **A.** What are different loads on vehicle body and explain it neat diagram   **(10)**
    B. Explain the role of seat in rear crash Safety   **(10)**

Q5 **A.** Write a short note on vehicle crash testing techniques   **(10)**
    B. What are different types of chassis frames? Explain any one in details   **(10)**

Q6 **A.** Explain the design consideration for vehicle body design for safety.   **(10)**
    B. Write note on Automotive Industry standards   **(5)**
    C. Explain fail safe design   **(5)**

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