Time: 3 Hours   **Total Marks: 80**

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

Q1   **Attempt any four**   **(20)**
   A. Explain the impact of automation on productivity and cost in manufacturing systems.
   B. What is the difference between uninformed and informed search algorithms? Explain with examples.
   C. What are the basic components of an Artificial Neural Network? List and explain briefly.
   D. Define a point-to-point control system used in the robotic system with suitable applications.
   E. What is latching in PLC programming? Draw a ladder diagram to demonstrate latching using a push button.

Q2 A Design simple pneumatic circuit for two-cylinder operation with the following sequence using 4/2 pilot-operated valve as DCV using cascade method **(10)**
Delay B+ A+ A- B-, With user option of single cycle – multi cycle. Also draw displacement diagram.

   B Compare supervised learning with unsupervised learning. Discuss their major differences in data labelling, model training, and algorithm use. **(10)**

Q3 A What is meant by agent and explain its types with reference to Artificial Intelligence. (include sketches) **(10)**

   B Illustrate with neat sketches mechanical and magnetic type of end effectors used in robotic system, stating its advantages and disadvantages. **(10)**

Q4 A Compare BFS and DFS based on the following parameters: **(10)**
i) Approach (Strategy), ii) Data structure used, iii) Time complexity, iv) Space complexity,
 v) Completeness and optimality

   B Illustrate with neat sketch hydraulic intensifier circuits. **(10)**

Q5 A Design electro-pneumatic circuit for two-cylinder operation with the following sequence using 5/2 both side solenoid-operated valve as DCV. **(10)**
A+B+Delay B- A- , With user selection option single cycle Multicycle operation.

   B How do pitch, yaw, and roll relate to the degrees of freedom in a robot? Explain with examples. **(05)**

   C Illustrate with neat sketches, the logic of AND and OR gates, used in operation of pneumatic circuits. **(05)**

Q6 A Define Natural Language Processing (NLP). Explain its role and applications in industrial automation. **(10)**

   B Differentiate between PLC and Relays. **(05)**

   C Illustrate K nearest neighbours algorithm used in machine learning. **(05)**

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3 Hours (80 Marks)

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N.**B**.: **(1) All questions carry equal marks.**
(2) Question No.1 Compulsory.
(3) Attempt any three from remaining five questions.
(3) Figures to the right indicate full marks.
(4) Draw neat sketches wherever necessary.
(5) Assume suitable data wherever necessary.

Q.1 Attempt any four. (20)
a) Write design considerations for piston.
b) Explain torque converter with neat sketch.
c) Write advantages and disadvantages of front engine front wheel drive with neat layout.
d) Explain the role of Constant velocity joint in Automobile.
e) Differentiate between Drum brake and Disc brake.
f) Identify the following code marked on tire **P195/75 R14 92S**.

Q.2 a) The cylinder of four stroke diesel engine has the following specifications:
Brake Power = 3.75 kW; Speed = 1000 rpm; Indicated mean effective pressure = 0.35
MPa; Mechanical Efficiency = 80%. Determine bore and length of the cylinder liner. **(10)**

b) Explain Hotchkiss drive and Torque tube drive with neat sketch. **(10)**

Q.3 a) A sliding mesh type of a gear box with forward speeds only is to be designed:
The gear box should have the following gear ratios available approximately: 1.0, 1.5, 2.5
and 3.9.The centre disatnce between layshaft and the mainshaft is 78 mm and the smallest
gear is to have at least 16 teeth with a diametral pitch of 3.25 mm.Calculate the number of
teeth of the various gears and exact gear ratios available. **(10)**

b) Explain hydraulic brake system and air brake system with neat sketch **(10)**

Q.4 a) A multidisc clutch consists of five steel plates and four bronze plates and transmits 10kW
power at 750 rpm. The ratio of outer diameter to inner diameter of friction disks is 2. The
coefficient of friction is 0.1 and the intensity of pressure on friction lining is limited to
0.3 N/mm^2 Assuming uniform wear theory, calculate the inner and outer diameters
of friction disks. **(10)**

b) Explain the following front wheel geometry. **(10)**

a) Camber
b) Castor
c) King Pin Inclination
d) Combined angle
e) Scrub Radius

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Q.5 a) A car moving on a level road at a speed 50 km/h has a wheel base 2.8 m, distance of C.G. from ground level 600 mm, and the distance of C.G. from rear wheels 1.2 m. The coefficient of friction between the tyres and the road may be taken as 0.6, Find the distance travelled by the car before coming to rest when brakes are applied.

      1) to the rear wheels.

      2) to all the four wheels. **(10)**

b) Explain Construction and Working of synchromesh gear box with neat sketch. **(10)**

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

    a) Electric Power Steering

    b) Types of wheels

    c) CVT

    d) Differential

    e) Tyre construction

    f) Centrifugal Clutch

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[Total Marks: 80]   **Duration: 3 Hours**

Instructions:
(i) Question No.1 is compulsory.
(ii) Answer any three from the remaining five questions.
(iii) Assume suitable data whenever required with proper justification.
(iv) Answers to questions should be grouped and written together.
(v) Figures to the right indicate full mark

Q1.Attempt any four.   [20M]
   a) What are the steps followed in vibration analysis? Briefly explain.
   b) Write a short note on Holzer's method.
   c) Explain Motion Transmissibility with neat diagrams, related formulae, and graphs.
   d) Write a short note on balancing of a reciprocating engine
   e) Write short notes on a vibrometer. Also, sketch the related frequency response curve.
   f) Difference between the Columbus and viscous damping.

Q.2 (a) Find the system's natural frequency shown in Figure 01.   [10M]

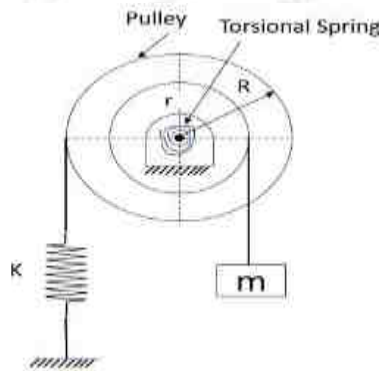   Fig.01   [10M]

 (b) In the damped vibrating system, the mass having 20 kg makes 40 oscillations in 25 seconds. The amplitude of the natural vibration decreases to one-eighth of the initial value after 8 oscillations. Determine:
   I. The logarithmic decrement
  II. The damping factor and the damping coefficient and
 III. The spring stiffness

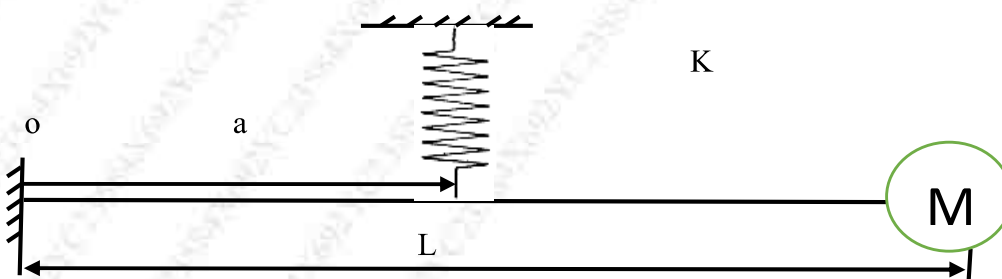3(a) Determine the natural frequency of the vibration of the system shown in the Fig.2. [10M]

               Fig.02

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(b)Drive the expression for the damped natural frequency of vibration for the system shown in figure 03.Also find the critical damping coefficient of the dash-pot. The weightless rigid rod pivoted at point O. [10M]
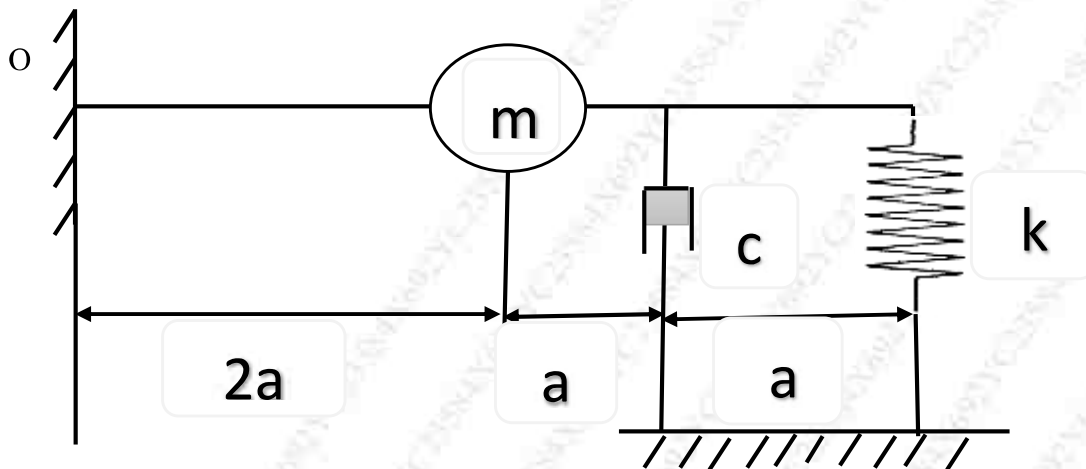

Fig.03

4(a) Used Free body diagram method to drive the differential equation governing the motion of the system of the figure 4 using X_1,X_2,X_3 as generalised coordinates. [10M]
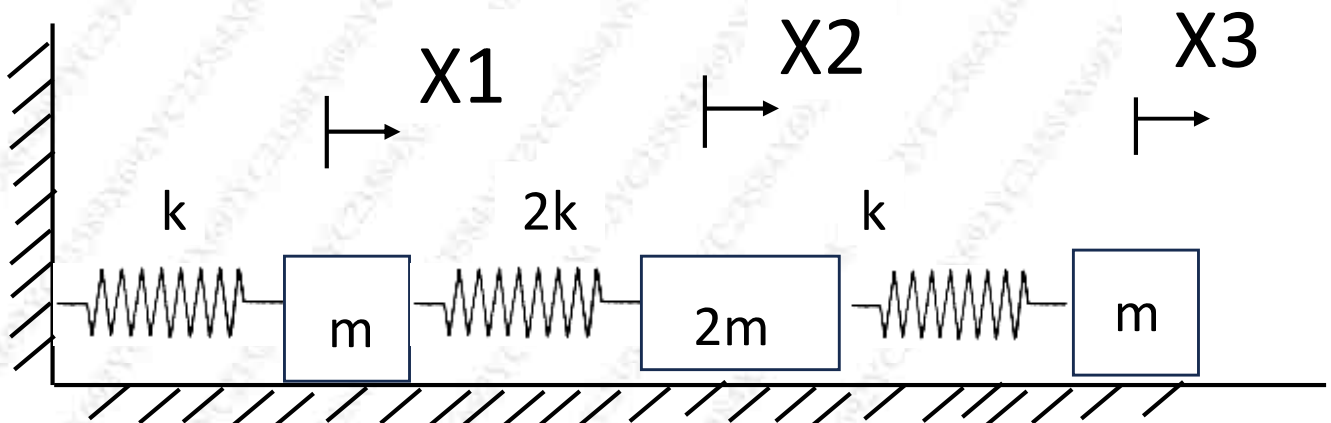

Fig.04

4(b) A mass of 50 kg is suspended by a spring of stiffness 12kN/m and acted the harmonic force of 40N on it. The viscous damping coefficient is 100 n-s/m. Find [10M]

i) Resonant amplitude ii) Resonant Phase angle iii) Peak Frequency iv) Peak Amplitude

v) Peak Phase angle

5(a) 20N at 30cm, 30N at 60cm, and 10N at 100cm from the fixed end are the loadings on the cantilever. The deflection under 30N load due to all loads is 2mm. What would be the natural frequency of the transverse vibration if 20 N is added at 80cm from the fixed end? Also find the frequency by Dunkerly's method. The deflection at the Section "i" due to unit load at section "j" is given by

$$Uij = Uji = \frac{Si^2(3Sj - Si)}{Constant} \qquad for\ si > Sj$$

Where S is the distance of section from the fixed end. [12M]

5(b) Define the whirling speed .Drive the equation for the critical speed of a light shaft with the single disc without damping. [08M]

6(a) The firing order of the six-cylinder vertical four-stroke in-line engine is 1, 4,2,6,3, and 5. The piston stroke is 80 mm and the length of the connecting rod is 180mm. The pitch distance between the cylinder centre lines is 80mm, 80mm120mm, 80mm, and 80mm, respectively. The reciprocating mass per cylinder is 1.2 kg, and the engine speed is 2400 rpm. Determine out-of-balance primary and secondary forces and couples on the engine, taking the plane midway between the cylinders 3 and 4 as the reference plane. [10M]

6(b) An Accelerometer has a natural frequency of 15 KHz. Determine the highest frequency it can measure within 1% accuracy. Assuming the damping ratio of 0.7. [10M]

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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**	(20)
A.	Explain Anti-Lock Braking system	(5)
B.	What are design requirements of child seat	(5)
C.	Write short note on visibility in vehicle	(5)
D.	Explain fail safe design	(5)
E.	Write short notes on Pedestrian Protection	(5)
Q2 A.	Write short note on Automotive standards	(10)
B.	Explain the structural crashworthiness considerations in vehicle body design.	(10)
Q3 A.	Explain universal Design	(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 aerodynamics forces and moments acting on vehicle body	(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.	Draw various Layouts of buses based on entry and exit locations	(10)
B.	Explain Passive safety with two examples	(10)

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