



- N.B: (1) Question no 1 is compulsory.  
(2) Attempt any 3 out of remaining 5 questions.  
(3) Figures to the right indicate full marks.  
(4) Illustrate your answers with sketches wherever necessary.
- 1 a What are nomograms? How they are useful in Vehicle Body Weight analysis? 10  
b Explain Layout of Design and Preliminary design in detail. 10
- 2 a Explain the following with load path: 10  
1) Vertical Symmetric  
2) Vertical Asymmetric  
3) Longitudinal Load  
b What is aerodynamics? Explain various aerodynamic forces and moments acting on the vehicle. 10
- 3 a Explain in detail the following layout of structures with neat diagram for edge forces distribution in torsion and bending: 10  
1) Integral  
2) Open Integral  
3) Semi-Integral  
4) Flat or Punt type  
b Explain Vehicle Body panel terminology. Also define and identify sill panel, cant panel, scuttle panel and rain gutter. 10
- 4 a Explain general principle of the thin walled structures and behaviour in torsion. 10  
b Write short notes on: 05  
1) Master Model 05  
2) Vehicle Weight Distribution
- 5 a Explain various safety aspects incorporated in modern cars. 10  
b Give account of various plastics and rubbers going into automobile. 10
- 6 a What is Ergonomics? How is it used to design Drivers seat? Also explain different types of child seat. 10  
b Explain various power plant locations with its merits and demerits. 10

Note:

1. Question No. 1 is compulsory.
2. Attempt any Three questions from remaining.
3. Use of Design Data Hand book is permitted.
4. Assume suitable data if required.



1. Attempt any Four of the following

4 X 5 = 20

- (a) Explain the types of piston. What are design requirements of piston?
- (b) Why are connecting rods made of I sections? Name the materials used for connecting rod.
- (c) Name the materials used for crankshaft. What are the design considerations of crankshaft?
- (d) Prepare a list of brake lining and clutch lining materials used in automotive. Specify their characteristics.
- (e) Explain the utility of the centre bolt, U-clamp, and rebound clip in a leaf spring.

2. (a) Design of a cast iron piston for a single acting four stroke engine for the following data: 15

Cylinder bore = 90 mm;

Stroke = 130 mm;

Maximum gas pressure = 5 N/mm<sup>2</sup>Indicated mean effective pressure = 0.8 N/mm<sup>2</sup>

Mechanical efficiency = 85%

Fuel consumption = 0.20 kg per brake power per hour.

Higher calorific value of fuel =  $42 \times 10^3$  kJ/kg;

Speed = 2000 r.p.m.

Any other data required for the design may be assumed.

(b) Explain Design considerations of Crankshaft. What are the different types of crankshaft? 05

3. (a) The bore of a cylinder of the four stroke diesel engine is 120 mm. The maximum gas pressure inside the cylinder is limited to 4 MPa. The cylinder head is made of cast iron and allowable tensile stress is 40 N/mm<sup>2</sup>. Determine the thickness of cylinder head. The studs which are made of steel, have allowable stress as is 50 N/mm<sup>2</sup>. Calculate (i) number of studs, (ii) nominal diameter of studs, and (iii) pitch of studs. Draw the neat diagram for each component. 10

[TURN OVER]



(b) Determine the dimensions of cross section of a connecting rod for a high speed diesel engine using the following data: 11

Cylinder bore	= 110 mm
Stroke	= 120 mm
Length of connecting rod	= 300 mm
Speed	= 2500 rpm
Mass of reciprocating parts	= 1.5 kg
Maximum gas pressure	= 2.45 MPa
Factor of safety against buckling	= 5

4. (a) Explain the Whipping Stress of connecting rod. 05

(b) An automotive single plate clutch, with two pairs of friction surfaces transmits 290 N-m Torque at 1200 rpm. The outer and inner diameter of the friction disc are 300 mm and 200 mm respectively. The coefficient of friction is 0.30. The normal force on the friction surfaces is exerted by 8 helical compression springs, so that the clutch is always engaged. The clutch is disengaged when the external force further compresses the springs. Assume the spring index to be 6 and the number of active coils as 6. Assume a suitable material for the spring. Design the springs and specify the dimensions. 15

5. (a) Specifications for a centre crankshaft for single cylinder vertical engine is as follows 10

Cylinder bore	= 125 mm
Stroke	= 150 mm
(L/r) ratio	= 4.5
Speed	= 2000 rpm
Weight of flywheel cum belt pulley	= 1 kN
Maximum gas pressure	= 3 MPa
Total belt pull	= 2 kN
Width of hub for flywheel cum belt pulley	= 200 mm

Draw the force analysis diagram for the following cases:

- Crankshaft at TDC position
- Crankshaft is at angle of maximum torque

(b) Design an exhaust valve for the petrol engine using the following data: 10

Cylinder bore	= 200 mm
Stroke	= 300 mm
Speed	= 500 rpm
Effective length of each arm	= 165 mm
Angle between two arms	= 160°
Maximum gas pressure	= 3.5 MPa
Seat angle of valve	= 45°
Mass of valve	= 0.5 kg
Mean velocity of gas through port	= 50 m/s
Allowable bending stress for valve	= 50 N/mm <sup>2</sup>

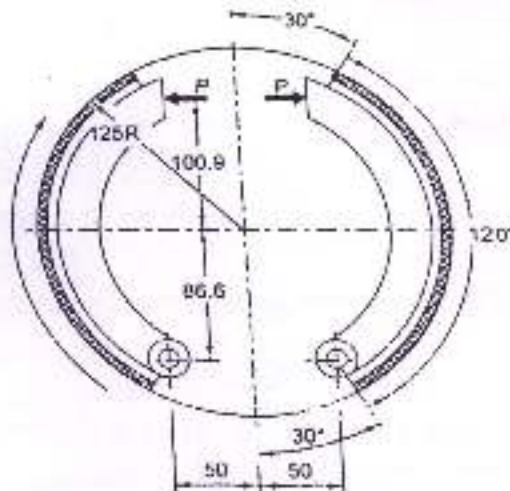
[TURN OVER]

6. (a)(i) Design a propeller shaft for an automotive, whose engine develops 40 kW at 1800 rpm. The lower gear ratio being 3.50. Assume a suitable diameter ratio and shear stress of 56 MPa for the material of the shaft 05

6. (a)(ii) A semi elliptic multi leaf spring is used for the suspension of the rear axle of a vehicle. It consists of two extra full length leaves and ten graduated length leaves including the master leaf. The center to center distance between the spring eyes is 1.2 m. The allowable stress for spring material is  $\sigma_{yc} = 1500 \text{ N/mm}^2$  and  $E = 2.1 \times 10^5 \text{ N/mm}^2$ . The factor of safety can be assumed as 2.5. Design the cross section of the leaves for a maximum force of 40 kN 05

(b) An automotive, internal expanding double shoe brake is shown in the figure below. The face width of the friction lining is 40 mm and the maximum intensity of normal pressure is limited to 1 MPa. The coefficient of friction is 0.32. The angle  $\theta$  can be assumed to be zero. Calculate: 10

- The actuating force P and
- The torque absorbing capacity of the brake.



(3 Hours)

[Marks : 80]

- Note : 1) Question number ONE is compulsory. Answer any THREE from remaining FIVE.  
2) All questions carry equal marks.  
3) Answer to each new question should be started on a fresh page.  
4) Figure in brackets on the right hand side indicate full marks.  
5) Assume suitable data if necessary.

- |    |  |    |
|----|--|----|
| 1. | (a) Explain bullwhip effect.   | 05 |
|    | (b) What are the different costs in inventory system?  | 05 |
|    | (c) Describe the Cycle view of Supply Chain.   | 05 |
|    | (d) What are the obstacles in achieving strategic fit?   | 05 |
| 2. | (a) Compare efficient and responsiveness in Supply Chain.                                      | 10 |
|    | (b) Draw a block diagram showing Process of Supply Chain Management.                           | 10 |
| 3. | (a) Explain with a block diagram Vendor development and evaluation process in SCM.             | 10 |
|    | (b) What is Reverse Logistics and what are the drivers of reverse logistics?                   | 10 |
| 4. | (a) What are Macro & Micro dimensions of logistics? How logistics interfaces with other areas. | 10 |
|    | (b) How does each supply chain driver use information?   | 10 |
| 5. | (a) Explain with sketch Competitive and supply chain strategies.                               | 10 |
|    | (b) Explain the role of warehouse in the logistics system.                                     | 10 |
| 6. | Write Short notes on <b>ANY TWO</b> of the following:  | 20 |
|    | a) CRM and SRM   |    |
|    | b) Purchasing policies.  |    |
|    | c) Role of IT in Supply Chain.   |    |

\*\*\*\*\*

..

**Note:**

1. Question 1 is Compulsory
2. Solve any three from remaining five
3. Figures to right indicate full marks
4. Assume suitable data if necessary



**Question**

		Marks
Q.1	a) Explain the convergence in FE analysis.	5
	b) Explain application of RP in MEMS.	5
	c) Explain the significance of Graphic Standards.	5
	d) Briefly explain the advantages and disadvantages of NC machines.	5
Q.2	a) A triangle PQR with vertices P(2,5), Q(6,7) and R(2,7) is to be reflected about the line $y=0.5x+3$ . Determine the final transformation matrix and the coordinates of the reflected triangle.	12
	b) How do you set work part zero, zero on a CNC machine?	04
	c) What are the feedback devices used in NC/CNC machine?	04
Q.3	a) Write a program in C++ using object oriented concept for 2D transformation which includes function for rotation.	08
	b) What do you mean by complex engineering problem? With suitable example, explain the complexities involved and the tools chosen to solve it.	08
	c) Enlist CIM hardware and software.	04
Q.4	a) What do you mean by Synthetic curves? What are the different types of synthetic curves and their continuity conditions?	10
	b) Write a manual part program in G - M codes for generating a part as shown in Figure 1 (on next page). Size of raw material is $\phi 85\text{mm}$ by $112\text{mm}$ . Explain each code. Assume suitable data if required. Use canned cycle code for Facing, Turning, and Taper Turning operations.	10

{TURN OVER

