

Time: 03 Hours

Marks: 80

- N. B. (1) Question No. 01 compulsory.
 (2) Attempt any three questions out of remaining five questions.
 (3) Justify your answer with neat sketches.
-

| | | |
|-------|--|----|
| Q. 01 | Attempt any <u>four</u> out of six. | 20 |
| | i) What are the requirements of Passenger seat? | |
| | ii) What are the effects of loads on vehicle body? | |
| | iii) Explain various forces acting on the vehicle body. | |
| | iv) What are the various types of metal section used for vehicle body? | |
| | v) Draw the chassis frame with location of different chassis components. | |
| | vi) Explain Sheet Stamping process. | |
| Q. 02 | A) Explain methods of preliminary design of Passenger Car. | 10 |
| | B) How to calculate the center of gravity for the vehicle. | 10 |
| Q. 03 | A) Classify the motor vehicle with neat sketches. | 10 |
| | B) Explain the recent trends in body design with respect to safety consideration. | 10 |
| Q. 04 | A) Explain in brief properties of vehicle body materials. | 10 |
| | B) Explain methods improving visibility and space in cars. | 10 |
| Q. 05 | A) Explain various body optimization techniques for minimum drag. | 10 |
| | B) Explain in brief commercial vehicle body details. | 10 |
| Q. 06 | A) Explain various loading cases acting on vehicle. | 10 |
| | B) Explain various power plant locations on chassis frame with Advantages and disadvantages. | 10 |



(3 Hours)

Max. Marks: 80

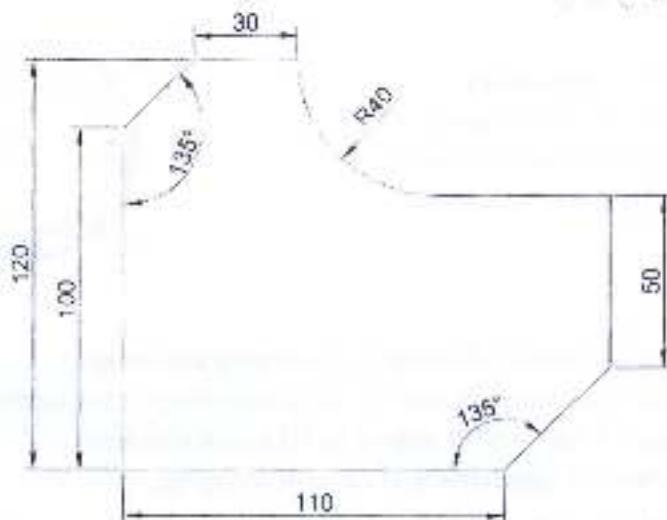
Note:

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



| | | |
|-----|--|------------------|
| Q.1 | a) Explain Cohen-Sutherland Line clipping algorithm. b) Explain the roughing and finishing canned cycle for turning. c) Explain rotation with respect to 3D transformation. d) Explain the significance of rapid prototyping. | 5 5 5 5 |
| Q.2 | a) Plot the Beizer curve having end points $P_0(1, 1)$ and $P_3(3, 1)$. The other control points are $P_1(2, 1)$ and $P_2(4, 3)$. Also find the midpoint of the curve. b) Explain Feature based Modeling | 10 10 |
| Q.3 | a) Describe the transformation M_x of a object about a link K which makes an angle ϕ with x-axis. It has slope m and y intercept as $(0, C)$ with y-axis as shown in Figure. | 10 |
| | | |
| Q.4 | a) Explain Direct Numerical Control(DNC). b) What is the need for concatenation of transformation? Explain with example why the homogeneous coordinate system is generally used in graphics, in particular for software implementation. | 10 10 |

- Q.5** a) Write a part program in APT for the component shown in Fig using end mill cutter of 20mm diameter. Clearly show the axes system chosen with a sketch and the direction of the cutter for the motion statements. 10



- b) Socio-Techno-Economic aspects of CIM. 10
- Q.6** Write short note on any **Four**: 20
- a) Use of CAE in Engineering Analysis.
 - b) Constructive solid geometry and Boundary representation
 - c) Automated Storage/Retrieval System(AS/RS)
 - d) 3D Printing
 - e) APT statements



(03 Hours)

Marks: 80

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 Design considerations of cylinder. What are dry and wet Cylinder liners?
- (b) What are the design requirements of piston? Name two criteria for calculating the thickness of piston head.
- (c) An universal coupling is used to connect two mild steel shafts transmitting a torque of 6500 N-m. Assuming that the shafts are subjected to torsion only, find the diameter of the shafts and pins. The allowable shear stresses for the shaft and pin may be taken as 65 MPa and 30 MPa respectively.
- (d) Why are connecting rods made of I-section? Explain Whipping stress.
- (e) Prepare a list of brake lining and clutch lining materials used in automotive. Specify their characteristics.

2. (a) The bore of a cylinder of the four stroke diesel engine is 150 mm.

(15)

The maximum gas pressure inside the cylinder is limited to 4.5 MPa. The cylinder head is made of cast iron and allowable tensile stress is 45 N/mm^2 . Determine the bore and length of the cylinder liner, thickness of cylinder liner, thickness of cylinder head.

The studs which are made of steel, have allowable stress as is 60 N/mm^2 .

Calculate (i) number of studs, (ii) nominal diameter of studs, and (iii) pitch of studs.

Draw the neat diagram for each component.

Any other data required for the design may be assumed.

(b) A centrifugal clutch, transmitting 25 kW at 850 rpm consists of four shoes.

(05)

The clutch is to be engaged at 700 rpm. The inner radius of the drum is 185 mm. The radius of the center of gravity of the shoes is 160 mm, when the clutch is engaged. The coefficient of friction is 0.25, while the permissible pressure on friction lining is 0.2 N/mm^2 .

Calculate: (i) the mass of each shoe; and (ii) the dimensions of friction lining.



3. (a) Determine the dimensions of cross-section of the connecting rod, using the following data: 10

| | |
|-----------------------------------|-------------|
| Cylinder bore | = 100 mm |
| Stroke | = 120 mm |
| Length of connecting rod | = 290 mm |
| Speed | = 2200 rpm |
| Mass of reciprocating parts | = 1.5 kg |
| Maximum gas pressure | = 3.625 MPa |
| Factor of safety against buckling | = 5 |

(b) Design an exhaust valve for a horizontal diesel engine using the following data: (10)

| |
|---|
| Cylinder bore = 250 mm |
| Length of stroke = 300 mm |
| Engine speed = 600 rpm |
| Maximum gas pressure = 4 MPa |
| Seat angle = 45° |
| Mean velocity of gas through port = 50 m/s |
| Allowable bending stress for valve = 50 N/mm ² |

Calculate: (i) Diameter of the valve port; (ii) Diameter of the valve head; (iii) Thickness of the valve head; (iv) Diameter of the valve stem

4. (a) A semi-elliptic multi-leaf spring is used for the suspension of the rear axle of a truck. (10)

It consists of two extra full-length leaves and 12 graduated-length leaves including the master leaf. The centre-to-centre distance between the spring eyes is 1.2 m. The leaves are made of steel $\sigma = 600 \text{ N/mm}^2$ and $E = 2 \times 10^5 \text{ N/mm}^2$. The spring is to be designed for a maximum force of 40 kN. The leaves are pre-stressed so as to equalize stresses in all leaves. Determine

- (i) The cross-section of leaves; and
- (ii) The deflection at the end of the spring.

Any other data required for the design may be assumed.

(b) Design of a cast iron piston for a single acting four stroke for the following data: (10)

| |
|---|
| Cylinder bore = 100 mm; |
| Stroke = 120 mm; |
| Maximum gas pressure = 6 N/mm ² |
| Indicated mean effective pressure = 0.8 N/mm ² |
| Mechanical efficiency = 85% |
| Fuel consumption = 0.15 kg per brake power per hour; |
| Higher calorific value of fuel = $42 \times 10^3 \text{ kJ/kg}$ |
| Speed = 2000 r.p.m. |

Any other data required for the design may be assumed.



5. (a) An automobile vehicle weighing 13.5 kN is moving on a level road at a speed of 95 km/h. When the brakes are applied, it is subjected to a uniform deceleration of 6 m/s^2 . There are brakes on all four wheels. The tyre diameter is 750 mm. The kinetic energy of the rotating parts is 10% of the kinetic energy of the moving vehicle. The mass of each brake drum assembly is 10 kg and the specific heat capacity is $460 \text{ J/kg}^\circ\text{C}$. (10)

Calculate

- (i) the braking time;
- (ii) the braking distance;
- (iii) the total energy absorbed by each brake;
- (iv) the torque capacity of each brake; and

(b) A 4 forward speed sliding mesh gearbox contains Speed ratio of clutch shaft gear and lay shaft gear is 2. Calculate the number of teeth in all the gears with the assumptions that minimum number of teeth required for any gear to avoid interference is 18. Finally, calculate actual gear ratios. The gearbox should have the following speed ratios approximately: (10)

First gear = 5

Second gear = 3.38

Third gear = 2.25

Fourth gear = 1

Reverse speed gear = 5.5

Also calculate the Centre distance between shafts by assuming module.

6.(a) Design a centre crankshaft for single cylinder vertical engine using the following data (10)

Cylinder bore = 125 mm

Stroke = 150 mm

(L/r) ratio = 4.5

Speed = 2000 rpm

Weight of flywheel cum belt pulley = 1kN

Maximum gas pressure = 3 MPa

Total belt pull = 2 kN

Width of hub for flywheel cum belt pulley = 250 mm

The torque on the crankshaft is maximum when the crank turns through 22° from TDC and at this position the gas pressure inside the cylinder is 2.5 MPa. The belts are in horizontal direction.



(b) An automotive plate clutch uses six helical compression springs which are arranged in parallel (10) and provide the axial thrust of 1200 N. The springs are compressed by 8 mm to provide this thrust force. The springs are identical and the spring index is 6. The springs are made of cold-drawn steel wires with ultimate tensile strength of 1200 N/mm^2 . The permissible shear stress for the spring wire can be taken as 30% of the ultimate tensile strength ($G = 81,370 \text{ N/mm}^2$). The springs have square and ground ends. There should be a gap of 1 mm between adjacent coils when the springs are subjected to the maximum force. Design the springs and calculate: (i) mean coil diameter; (ii) total number of coils; (iii) solid length; (iv) free length; (v) required spring rate

3 Hours

(80 Marks)

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

Q1. Write short notes on the following

- (a) Innovative thinking (05)
(b) Design for environment (05)
(c) Concept selection (05)
(d) Design of Experiments (DOE) (05)



Q2. (a) Explain in detail industrial design process. (10)
(b) Explain the steps in concept testing. (10)

Q3. (a) Explain the role of concurrent engineering in product design and development (10)
(b) Explain the concept of product architecture with examples. (10)

Q4. (a) Differentiate between value engineering and value analysis. (10)
(b) Describe the various elements of product costing. (10)

Q5. (a) Explain quality function deployment technique. (10)
(b) Explain psychological and physiological considerations in product design. (10)

Q6. (a) Classify rapid prototyping techniques. Explain any one rapid prototyping technique. (10)
(b) Explain how product specifications are established during product development process. (10)

(3Hrs)

80 Marks

- N.B.: (1) Question No. 1 is compulsory.
 (2) Attempt any 3 questions out of 5 questions.
 (3) Figures to the right indicates full marks.
 (4) Illustrate your answers with sketches wherever necessary.

| | | |
|-----|---|----|
| Q.1 | Solve any four from remaining in six questions | 20 |
| a) | Explain Registration Mark system of Passenger car and Transport Vehicle | 05 |
| b) | What are the advantages of Signals & controls | 05 |
| c) | Explain procedure of obtaining Driver's License | 05 |
| d) | Write a note on Bus Transport Fares | 05 |
| e) | What are the duties of Surveyor and Loss assessor? | 05 |
| f) | Explain Straight Line Scale Method and Tapered Scale Method | 05 |
| Q.2 | | 20 |
| a) | List out the different Offences and Penalties as per the Motor Vehicle Act | 10 |
| b) | Explain the working of research organizations any one in detail | 06 |
| c) | Discuss procedure of claiming compensation for accidental Vehicle | 04 |
| Q.3 | | 20 |
| a) | Explain various types of bookings in Goods Transport Organization | 10 |
| b) | Explain the Bus and crew scheduling procedure of STU. | 05 |
| c) | Explain various Requirements and Problems on fleet management | 05 |
| Q.4 | Write a detail note on Traffic navigation and Global positioning system | 20 |
| a) | State and explain the Rules regarding safety of vehicles. | 10 |
| b) | Explain Marketing and Servicing Divisions of Motor Industry | 10 |
| Q.5 | | 20 |
| a) | Describe the procedure of Transfer of ownership of Vehicle | 10 |
| b) | Explain the significance of Bus Depot along with Layouts. | 10 |
| Q.6 | Solve any four from remaining in six questions | 20 |
| a) | Compare between Rural Transport and Urban Transport | 05 |
| b) | List and explain basic elements of Transport system | 05 |
| c) | Write a note on Third Party Insurance | 05 |
| d) | Define Articulated Vehicle, Invalid carriage | 05 |
| e) | List and Explain the various Modes of Transport | 05 |
| f) | state functions of State Transport Authority And Regional Transport Authority | 05 |

(3 Hours)

- N.B. 1) Question No. 1 is compulsory
 2) Solve Any Three from remaining Five questions.
 3) Use of standard data book is permitted
 4) Assume suitable data if necessary, giving justification



| | | |
|-------|---|----|
| Q1 | Answer any Four from the following | |
| a) | Suggest suitable materials for the following parts stating the special property which makes it more suitable for use in manufacturing: | 5 |
| | 1. Diesel engine crankshaft 2. Automobile tyres 3. Roller bearings | |
| b) | Why the area of the inlet valve port is made larger than the area of exhaust valve port? | 5 |
| c) | What are the desirable properties of cylinder materials? Name the material used for engine cylinder. | 5 |
| d) | Explain characteristics of brake lining material. | 5 |
| e) | What are the different materials used in advanced automotive body structures | 5 |
| Q2 | A four stroke internal combustion engine has the following specifications: Brake power = 7 KW; Speed = 1000 r.p.m.; Indicated mean effective pressure = 0.35 N/mm ² ; Maximum gas pressure = 3.9 N/mm ² ; Mechanical efficiency = 85 %. Determine: 1. The dimensions of the cylinder, if the length of stroke is 1.4 times the bore of the cylinder 2. Wall thickness of the cylinder, if the hoop stress is 35 MPa 3. Thickness of the cylinder head and the size of studs when the permissible stresses for the cylinder head and stud materials are 55 MPa and 85 MPa respectively. | 20 |
| Q3 a) | The following particulars refer to a four stroke cycle diesel engine: Cylinder bore = 140 mm; Stroke = 187.5 mm; R.P.M. = 1000; Maximum gas pressure = 5.5 N/mm ² ; Mass of reciprocating parts = 2 kg. 1. The dimensions of an I-section connecting rod with an elastic limit compressive stress of 350 MPa. The ratio of the length of connecting rod to the length of crank is 4 and the factor of safety may be taken as 5 2. The wrist pin and crankpin dimensions on the basis of bearing pressures of 10 N/mm ² and 6.5 N/mm ² of the projected area respectively and 3. The dimensions of the small and big ends of the connecting rods, including the size of the securing bolts of the crankpin end. Assume that the allowable stress in the bolts, is not to exceed 45 N/mm ² . Draw dimensioned sketches of the connecting rod showing the provisions for lubrication. | 15 |
| Q3 b) | Discuss the design considerations of crankshaft for an internal combustion engine. | 05 |



- Q4 Design a rocker arm of *I*-section made of cast steel for operating an exhaust valve of a gas engine. The effective length of the rocker arm is 200 mm and the angle between the arm is 135° . The exhaust valve is 85 mm in diameter and the gas pressure when the valve begins to open is 0.4 N/mm^2 . The greatest suction pressure is 0.03 N/mm^2 below atmospheric. The initial load may be assumed as 0.05 N/mm^2 of valve area and the valve inertia and friction losses as 120 N. The ultimate strength of cast steel is 750 MPa. The allowable bearing pressure is 8 N/mm^2 and the permissible stress in the material is 75 MPa. 20
- Q5 a) A multiple disc clutch has three discs on the driving shaft and two on the driven shaft, providing four pairs of contact surfaces. The outer diameter of the contact surfaces is 250 mm and the inner diameter is 150 mm. Determine the maximum axial intensity of pressure between the discs for transmitting 18.75 kW at 500 r.p.m. Assume uniform wear and coefficient of friction as 0.3. 15
- Q5 b) Explain the Design Consideration of Propeller Shaft 05
- Q6 a) Design a propeller shaft for an automobile engine developing 30 HP at 1500 rpm. The bottom gear ratio being 3.2 and ratio of external diameter of propeller shaft and its internal diameter is 1.8. Assume a safe shear stress of 50 MPa for the material of shaft. Any other data required can be assumed. 10
- Q6 b) An automotive-type internal expanding double shoe brake is shown in following figure 1. The face width of the friction lining is 40 mm and the maximum intensity of normal pressure is limited to 1 N/mm^2 . The coefficient of friction is 0.32. The angle Θ_1 can be assumed to be zero. Calculate
i) The actuating force P_1 and
ii) The torque absorbing capacity of the brake.

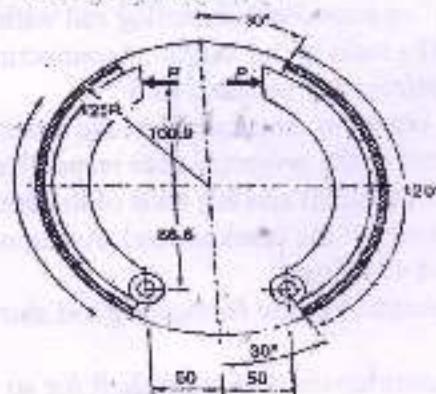


Figure 1

Time: 3 Hours

(80 Marks)

- 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.

1. Write short notes on the following. (Any four)
 - (a) Morphology of Design (05)
 - (b) Value engineering (05)
 - (c) Quality Function Deployment (05)
 - (d) Patents & IP Acts (05)
 - (e) Reverse Engineering (05)
2. (a) Explain Modern product development process. (10)
 (b) What is significance of Industrial design process. (10)
3. (a) What is product architecture. Explain with suitable examples. (10)
 (b) Describe elements of Product Costing. (10)
4. (a) Explain methods of designing for manufacturing and assembly. (10)
 (b) With the help of example explain Failure Mode Effect Analysis approach. (10)
5. (a) Enlist creativity techniques and explain any one in detail. (10)
 (b) Describe Concurrent Engineering. (10)
6. (a) With the help of neat sketch explain any one Rapid Prototyping technique. (10)
 (b) Explain consideration of Ergonomics factors during product design. (10)



(3 hours)

Total Marks : 80

- N.B.: 1) Question No. 1 is compulsory.
 2) Attempt any three questions from remaining Five.
 3) Assume suitable Data wherever necessary.
 4) Justify your answers with diagrams and graphs.



| | | |
|---------|---|----|
| Q.1 | Write short notes on any four:- i) Mechanical Dust collector. ii) Run-off river plant iii) Different types of Tariff methods. iv) Classification of nuclear power plants. v) Advantages of Gas power plant over other power plants. | 20 |
| Q.2 (a) | Explain CANDU type nuclear reactor with neat sketch mentioning type of fuel, moderator used. Give advantages and disadvantages. | 10 |
| Q.2 (b) | The incremental fuel costs for two generating units A and B of a power plant are given as: $dF_A / dP_A = 0.065P_A + 25$ $dF_B / dP_B = 0.08P_B + 20$ Where F is fuel cost in rupees per hour and P is power output in MW. Find: i) The economic loading of two units when the total load supplied by the power plant is 160 MW. ii) The loss in fuel cost per hr if the load is equally shared by both units. | 10 |
| Q.3(a) | Explain BWR. How does it differ from PWR? | 10 |
| Q.3(b) | What are the advantages of a pumped storage hydro-power plant ? Draw a neat sketch and explain. | 10 |
| Q.4 (a) | From the following data, estimate the generating cost of the power delivered by the station and find the reserve capacity available. Installed capacity of the plant: = 142.5Mw Annual Load factor: = 60% Capacity factor: = 50% Capital cost of the plant: = Rs. 130×10^6 Annual cost of coal, oil, tax and salary: = Rs. 18.8×10^6 Rate of Interest and Depreciation each: = 5 % of Capital Units of energy used to run plant auxiliary: = 6% of total units supplied. | 10 |
| Q.4 (b) | Define the following: i) Load factor, ii) Diversity factor, iii) Plant capacity factor iv) Plant use factor and v) demand factor . | 10 |

- Q.5 (a)** With neat sketch explain combined cycle power generation with merits and demerits. 10
- Q.5 (b)** Explain Sodium Graphite Reactor with it's advantages and disadvantages. 10
- Q.6** Write short notes on **any four** of the following: 20
- i) Surge Tank
 - ii) Rainfall measurements
 - iii) Parameters affecting Thermodynamic efficiency of combined cycle
 - iv) Pneumatic ash handling system
 - v) Classification of power plants.



(3 Hours)

Total Marks: - 80

- N.B: (1) Question no 1 is compulsory.
 (2) Attempt any three out of remaining five questions.
 (3) Figures to the right indicate full marks.
 (4) Illustrate your answers with sketches wherever necessary.



- | | | |
|------------|---|----|
| Q.1 | Attempt any four from following six. | 20 |
| a. | Explain the rules and regulations regarding construction of motor vehicle. | 05 |
| b. | Write short note on tax exemption offered to different class of motor vehicle. | 05 |
| c. | What are the different points noted in surveyors report? | 05 |
| d. | What are different theories of fares and explain any one in detail? | 05 |
| e. | Explain elements of transport system. | 05 |
| f. | Explain the importance of traffic navigation. | 05 |
| Q.2 | a. Explain administrative structure of "Motor Vehicle Department". | 10 |
| b. | What are objectives of taxation and explain methods of laying tax.? | 10 |
| Q.3 | a. Explain the difference between third party and comprehensive insurance available for motor vehicle. Vehicle A has been mate with accident on 1 st January 2018. At the time of accident , the Cheque which has been issued by owner of vehicle in the year of 2017 for renewal of insurance policy for the said motor vehicle has been bounced failing to credit the payment in the account of company which have provided the insurance policy for the motor vehicle. Is owner liable to get the claim compensation? If so i.e. Yes/ No , justify your answer with suitable reasoning. | 10 |
| b. | Explain Depot Layout. | 10 |

- Q.5 (a)** With neat sketch explain combined cycle power generation with merits and demerits. **10**
- Q.5 (b)** Explain Sodium Graphite Reactor with it's advantages and disadvantages. **10**
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(3 Hours)

Total Marks: - 80

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(4) Illustrate your answers with sketches wherever necessary.



- Q.1** Attempt any four from following six. 20
- Explain the rules and regulations regarding construction of motor vehicle. 05
 - Write short note on tax exemption offered to different class of motor vehicle. 05
 - What are the different points noted in surveyors report? 05
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 - Explain the importance of traffic navigation. 05
- Q.2** a. Explain administrative structure of "Motor Vehicle Department". 10
b. What are objectives of taxation and explain methods of laying tax.? 10
- Q.3** a. Explain the difference between third party and comprehensive insurance available for motor vehicle. Vehicle A has been made with accident on 1st January 2018. At the time of accident, the Cheque which has been issued by owner of vehicle in the year of 2017 for renewal of insurance policy for the said motor vehicle has been bounced failing to credit the payment in the account of company which have provided the insurance policy for the motor vehicle. Is owner liable to get the claim compensation? If so i.e. Yes/ No , justify your answer with suitable reasoning. 10
b. Explain Depot Layout. 10

- Q.4** a. What are the rules and regulation regarding transport and storage of petroleum products? 10
 b. What are requirements and problems on fleet management? 10
- Q.5** a. What is the need of "Motor Accident Claim Tribunal" and also explain its functioning in detail. 10
 b. Explain any five traffic offences and penalty in detail. 10
- Q.6** Attempt any four from following six. 20
 a. Explain various traffic control signs 05
 b. Write short note on tax renewal meant for motor vehicle. 05
 c. What are the duties of driver in case of accident? 05
 d. Write short note on training offered to drivers and conductors of passenger transport vehicle. 05
 e. Explain the importance of MIS in goods transport operation. 05
 f. Write short note on licensing of drivers and conductors 05





Q.P. Code: 24939



Time: (3HRS)

[TOTAL MARKS: 80]

N.B:-

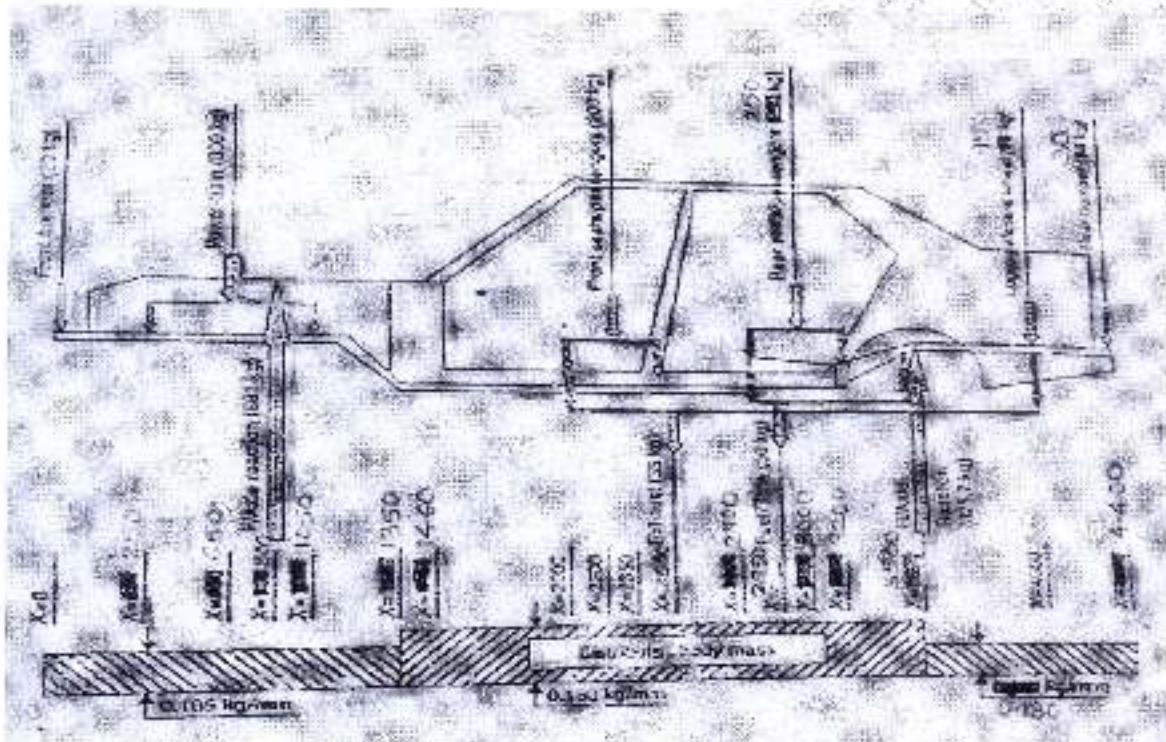
- 1) Question no 1 is compulsory
- 2) Attempt any three out of remaining six questions
- 3) Assume any suitable data wherever required but justify the same
- 4) Illustrate answers with neat sketches wherever required
- 5) Answers to questions should be grouped and written together.

| | | |
|------|---|----------|
| Q. 1 | Attempt any <u>four</u> out of six. | 20 |
| | i). What is Master model? ii) Explain Sheet Stamping process. iii) Draw and Explain Coach Building. iv) What are the design requirements of Child seat? v) State different loads acting on a chassis. vi) Explain thin walled structure. | |
| Q. 2 | A) Explain layout of design and preliminary design of Passenger Car. B) Explain with neat diagram vertical asymmetric loading showing all calculations for condition of maximum height. | 10 10 |
| Q. 3 | A) What is Ergonomics? Write design considerations of driver's seat and explain different types of driver seats labeling all parameters and values based on its type. B) Explain in brief properties of vehicle body materials. | 10 10 |
| Q. 4 | A) Draw and Explain different types of Truck layout. B) Explain methods for improving visibility and space in cars. | 10 10 |
| Q. 5 | A) Explain the recent trends in body design with respect to safety consideration. B) Explain various power plant locations on chassis frame with Advantages and disadvantages | 10 10 |



Q.P. Code: 24939

- Q. 6 A) Explain various body optimization techniques for minimum drag. 10
 B) Calculate centre of gravity for the given load distribution as shown in figure below. 10



(3 Hours)

Max. Marks: 80

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

No.

Q.1 Explain any four of the following:

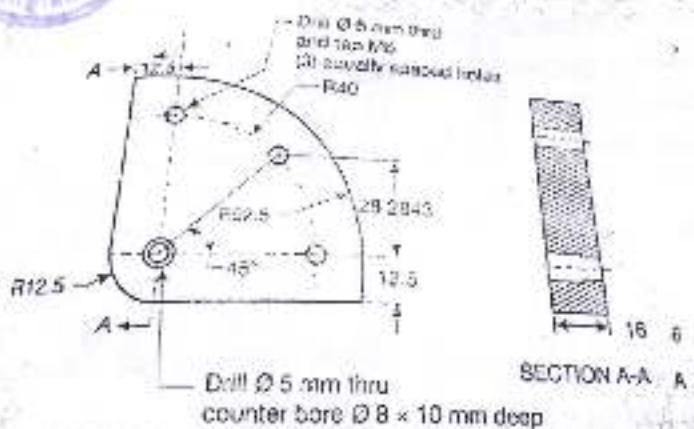
- (a) Viewing transformation.
- (b) Why is the rapid prototyping used?
- (c) Benefits of CIM
- (d) What is the need for concatenation of transformation?
- (e) Machining Centers and its types
- (f) Parameter optimization

- | | |
|-----|---|
| Q.2 | a) Determine the parametric representation of the line segment between the position vectors $P_1[1:1]$ and $P_2[4:5]$. Find the slope and tangent vectors for the line. 10 |
| | b) Explain Selective Laser Sintering (SLS). How is it different from 3D printing? 10 |
| Q.3 | a) Explain significance of (i) Data capture techniques and (ii) Socio-techno-economic aspects with respect to Computer Integrated Manufacturing (CIM) and technology driven practices. 10 |
| | b) A Square with an edge length of 10 units is located on the origin with one of the edges at an angle of 30° with the X-axis. Calculate the new position of the square if it is rotated about the Z-axis by an angle of 30° in the clockwise direction. 10 |
| Q.4 | a) What are the different types of errors which may get introduced while converting the CAD solid model into RPT compatible format? 6 |
| | b) What are the major steps to solve the problem using FEM? Whether it gives exact answer? Why it has become popular? 6 |
| | c) The coordinates of four data points P_0, P_1, P_2 and P_3 are $(2,2,0), (2,3,0), (3,3,0)$ and $(3,2,0)$ respectively. Find the equation of Bezier curve and determine the coordinates of points on the curve for $u=0, 0.25, 0.5$ and 0.75 . 8 |



- Q.5 a) Explain CAE Case study based on modeling and analysis of structural (vibration analysis) system. 10
 b) Write complete part program using the ISO codes for the different holes present in the component as shown in figure. The operations and tools required are given below. 10

| Op.No. | Description | Tools required |
|--------|-----------------------|----------------------|
| 1 | Drill one hole | Twist drill 5 mm dia |
| 2 | Counter bore one hole | End mill 8 mm dia |
| 3 | Drill three holes | Twist drill 5 mm dia |
| 4 | Tapping three holes | Machine Tap M6 |



- Q.6 Write short note on : 20

 - a) Role of CAD/CAM in CIM.
 - b) Rapid Tooling
 - c) P & H refinement methods of CAE.
 - d) Feedback devices

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Q. P. Code: 2520

4. (a) Design various component of valve gear mechanism for horizontal petrol engine 15
for following data:

| | |
|---|-----------|
| Cylinder Bore | =250mm |
| stroke | =300mm |
| Effective length of each arm | =150mm |
| Angle between two arms | =165° |
| Speed | =450RPM |
| maximum gas pressure | =3.5MPa |
| mass of valve | =0.5kg |
| seat angle of valve | =45° |
| Back pressure when the exhaust valve open | =0.4 MPa |
| Maximum suction pressure | =-0.02MPa |

The valve opens 33° before outer dead center and closes 1° after inner dead center it opens with constant acceleration and deceleration for each half of the lift.

- (b) Explain design procedure for crankshaft. 5

5. (a) A centrifugal clutch transmitting 20kW at 750 rpm consists of four shoes. The clutch is to be engaged at 500 rpm the inner radius of the drum is 165 mm. The radius of the centre of gravity of the shoes is 140 mm, when the clutch is engaged. The coefficient of friction is 0.3, while the permissible pressure on friction lining is 0.1 N/mm². calculate the mass of each shoe; and the dimensions of friction lining 10

- (b) A sliding mesh gearbox contains 4 pairs of gears for providing 4 forward speeds and a reverse speed. Speed ratio of clutch shaft gear and lay shaft gear is 2.5, calculate the number of teeth in all the gears with the assumptions that minimum number of teeth required for any gear to avoid interference is 18. Finally, calculate actual gear ratios. The gearbox should have the following speed ratios approximately.

First gear=4.5
Second gear=3.38
Third gear=2.25
Fourth gear=1
Reverse speed gear=5.0

6. (a) A semi-elliptic multi leaf spring is used for the suspension of the rear axle of a truck. It consists of two extra full length leaves and ten graduated length leaves including the master leaf. The centre-to-centre distance between the spring eyes is 1.2m. The leaves are made of steel 55Si2Mo90 ($S_y = 1500 \text{ N/mm}^2$ and $E = 207000 \text{ N/mm}^2$) and the factor of safety is 2.5. The Spring is to be designed for a maximum force of 30kN. The leaves are pre-stressed so as to equalize stresses in all leaves. Determine

i) The cross-section of leaves; and
ii) The deflection at the end of the spring

- (b) Find the diameter of a solid steel shaft to transmit 20 kW at 200 rpm. The Ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter. When the ratio of inside to outside diameters is 0.5. 10

- N.B.: 1) Question No.1 is compulsory.
2) Attempt any three questions out of remaining five questions.
3) Assume suitable data if necessary.
4) Figures to the right indicate full marks.

Q.1 Explain the following (Any four)

- i) Anthropometry 05
- ii) Reverse Engineering 05
- iii) Design for Environment 05
- iv) Simultaneous Engineering Approach 05
- v) Patents and IP acts 05

Q.2 (a) Define value of a product. Explain various steps involved in value analysis with an example of your choice. (10)

(b) What are the different factors and general rules considered for Design for Manufacturing (DFM) in case of sheet metal process? Explain. (10)

Q.3 (a) Explain 7 phases of Morphology of design with an example. (10)

(b) How Design of Experiment (DOE) helps in Robust Design of new product or process development. (05)

(c) Describe different elements of product costing with example. (05)

Q.4 (a) Explain product FMEA with appropriate example. (10)

(b) Explain simple Man-Machine Interaction in Ergonomics with help of Block Diagram. (05)

(c) What is Industrial product design? Explain in brief. (05)

Q.5 (a) What are various physiological and psychological considerations in ergonomics? Explain. (10)

(b) What is Taguchi's loss function? Explain its importance in product design. (05)

(c) Explain various stages of product life cycle management. (05)

Q.6 (a) What is QFD? Explain the importance of quality house in Product Design with the help of Example. (10)

(b) What is Product Architecture? Explain its types with their applicability. (10)

[Time: Three Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B: 1. Question No.1 is compulsory.
 2. Attempt any three out of remaining five questions.
 3. Figures to right indicates full marks.

| | | |
|-----|--|----|
| Q.1 | Answer any four of the following | |
| a) | Write a short note on ' Fleet Maintenance' | 5 |
| b) | In short Explain the term' Solatium Fund' | 5 |
| c) | List out cases where vehicle Tax is exempted. | 5 |
| d) | Write a short note on 'Traffic Navigation' | 5 |
| e) | Explain in short' Traffic Parcel' | 5 |
| 2 | a) Discuss the economic significance of Road Transport. | 10 |
| | b) Explain any one advanced techniques in Traffic Management. | 10 |
| 3 | a) Explain the basic principles of fare charging in public transport. | 10 |
| | b) Explain the various terms included in Surveyors report. | 10 |
| 4 | a) Explain various offences, penalties set by RTO. | 10 |
| | b) Explain various Bus Depot Layouts. | 10 |
| 5 | a) State the short title and any five definitions included in Motor Vehicle Act. | 10 |
| | b) Explain structure and Methods of laying taxation. | 10 |
| 6 | a) Describe Vehicle numbering system in India. | 10 |
| | b) Explain the term' Bus and crew Scheduling. | 10 |





Q. P. Code : 27997

[Time : 3 hours]

[Marks : 80]

- N.B. : 1) Question No. 1 is compulsory.
 2) Attempt any three questions from remaining Five.
 3) Assume suitable Data wherever necessary.
 4) Justify your answers with diagrams and graphs.



| Q.1 | Write short notes on any four:- i) Methods of ash disposal. ii) Electrostatic precipitator. iii) Half life and radioactive decay. iv) Modified rankine cycle. v) Advantages of combined cycle power plants. | 20 | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|----------|----------|-----------|------|----------|-------|----|----------|----|------|----|------|----|------|----|------|----|------|----|------|----|-------|----|-------|----|
| Q.2 (a) | Prove that efficiency of power plant will be maximum at load where heat rate is equal to incremental heat rate. | 10 | | | | | | | | | | | | | | | | | | | | | | | | |
| Q.2 (b) | Calculate cost of generation per unit delivered from power plant if installed capacity is 200 MW, annual load factor is 0.4, capital cost of power plant is 280 lac, annual expenses are 60 lac and interest and depreciation is 13%. | 06 | | | | | | | | | | | | | | | | | | | | | | | | |
| Q.2 (c) | The turbine is to operate under a head of 24 m at 200 r.p.m. The discharge is $8.5 \text{ m}^3/\text{s}$, if overall efficiency is 88 % determine power generated and specific speed of turbine. | 04 | | | | | | | | | | | | | | | | | | | | | | | | |
| Q.3(a) | An electrical system of 120 MW capacity experiences linear changes in load such that its daily load curve is identified as follows | 08 | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Time</th> <th>Load (MW)</th> <th>Time</th> <th>Load(MW)</th> </tr> </thead> <tbody> <tr> <td>12 PM</td> <td>24</td> <td>12.30 PM</td> <td>48</td> </tr> <tr> <td>2 AM</td> <td>12</td> <td>1 PM</td> <td>60</td> </tr> <tr> <td>6 AM</td> <td>12</td> <td>5 PM</td> <td>60</td> </tr> <tr> <td>8 AM</td> <td>60</td> <td>6 PM</td> <td>84</td> </tr> <tr> <td>12 AM</td> <td>60</td> <td>12 PM</td> <td>24</td> </tr> </tbody> </table> | | | Time | Load (MW) | Time | Load(MW) | 12 PM | 24 | 12.30 PM | 48 | 2 AM | 12 | 1 PM | 60 | 6 AM | 12 | 5 PM | 60 | 8 AM | 60 | 6 PM | 84 | 12 AM | 60 | 12 PM | 24 |
| Time | Load (MW) | Time | Load(MW) | | | | | | | | | | | | | | | | | | | | | | | |
| 12 PM | 24 | 12.30 PM | 48 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 AM | 12 | 1 PM | 60 | | | | | | | | | | | | | | | | | | | | | | | |
| 6 AM | 12 | 5 PM | 60 | | | | | | | | | | | | | | | | | | | | | | | |
| 8 AM | 60 | 6 PM | 84 | | | | | | | | | | | | | | | | | | | | | | | |
| 12 AM | 60 | 12 PM | 24 | | | | | | | | | | | | | | | | | | | | | | | |
| Plot the chronological and load duration curve for the system. find the load factor and utilization factor. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Q.3(b) | Describe in plant coal handling scheme. | 08 | | | | | | | | | | | | | | | | | | | | | | | | |
| Q.3(c) | Explain working of saddle siphon spillway. | 04 | | | | | | | | | | | | | | | | | | | | | | | | |



Q.4 (a) The nature of the load required for 24 hours and thermal efficiencies of the plant at the respective loads are as follows: 12

| Time period | Load(MW) | Thermal efficiency |
|--------------|----------|--------------------|
| 10 AM - 6 PM | 120 | 32% |
| 6 PM - 8 PM | 60 | 24% |
| 8 PM - 12 AM | 30 | 15% |
| 12 AM - 6 AM | 15 | 10% |
| 6 AM - 10 AM | 75 | 25% |

- i) Find total input to thermal plant if the load is supplied by the Single thermal plant only.
- ii) If the above load is taken by combined thermal and hydro power Plants then find the % saving in the input to the plant.
Take Thermal efficiency at full load = 32 %
- iii) Find overall efficiencies in both cases.

In hydraulic plant pump efficiency is 82% and turbine efficiency is 92%.

Q.4 (b) What is depreciation? Explain different methods to calculate depreciation cost. 08

Q.5 (a) A gas turbine unit with pressure ratio of 6:1 and maximum cycle temperature of 610°C , has the isentropic efficiencies of the compressor and turbine; 0.8 and 0.82 respectively. Calculate the power o/p in kW of an electric generator geared to the turbine when air enters compressor at 15°C at the rate of 16 kg/s. Take $C_p = 1.005 \text{ kJ/kg K}$ and $\gamma = 1.4$ for compression and $C_p = 1.005 \text{ kJ/kg K}$ and $\gamma = 1.3$ for expansion process. 10

Q.5 (b) What are the methods of reducing the wheel or rotor speed of steam turbines? 10

Q.6 Answer any Four:- 20

- i) Classify nuclear reactors,
- ii) Write short note on selection of type of dam.
- iii) Compare steam power plant and hydroelectric power plant.
- iv) Write short note on Spreader stoker.
- v) What is chain reaction? What is significance of multiplication Factor?
