4E1308

4E1308

B. Tech. IV - Sem. (Main / Back) Exam., - 2025
Automobile Engineering
4AE2-01 Data Analytics
AE, ME, PT

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 may 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.   NIL _____   2.   NIL _____

PART – A   [10×2=20]

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

Q.1   Discuss the need of Data Analytics.

Q.2   What is multivariate analysis?

Q.3   What is the principle behind hierarchical clustering technique?

Q.4   Write the Key points of oblique rotation.

Q.5   What is ANOVA?

Q.6   What is perceptual map?

Q.7   Why sigmoid function is used in logistic regression?

Q.8   What is the need of dimensionality reduction of a data set?

Q.9   List the names of any two visualizations tools.

Q.10 Distinguish between the standard error of the estimate and its square.

PART – B

[5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 Illustrate the K-means algorithm in detail with its advantages.

Q.2 What is the use of confusion matrix? Define all the related terms of a confusion matrix.

Q.3 What is Big data? Explain 3 V's of Big data.

Q.4 Compare simple discriminant analysis and multiple discriminant analysis.

Q.5 Write important steps of ARIMA model for time series data analysis.

Q.6 Draw data analytics lifecycle and give brief description about all phases.

Q.7 Given data {2, 3, 4, 5, 6, 7; 1, 5, 3, 6, 7, 8}. Compute the principal component using PCA algorithm.

PART – C

[3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 Differentiate between CHAID and CART. How CHAID is better than CART?

Q.2 Explain the conjoint analysis by showing all necessary steps.

Q.3 Compare various types of Support vector and Kernel methods of data analytics.

Q.4 Explain briefly MANOVA and MANCOVA.

Q.5 Discuss the objectives and scope of data in the industry.

4E1303

B. Tech. IV - Sem. (Main / Back) Exam., - 2025
Aeronautical Engineering
4AN1-02 Technical Communication
All Branches

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 missing may 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. NIL _____   2.   NIL _____

PART – A

[10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1 What are the four language skills?

Q.2 What is linguistic ability?

Q.3 What is a technical manual?

Q.4 Name any two kinds of technical documents.

Q.5 What is a 'draft' in writing?

Q.6 What is information collection?

Q.7 What is 'editing'?

Q.8 What are official notes?

Q.9 What is a technical report?

Q.10 What is a technical proposal?

PART – B [5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 Discuss the importance of technical communication.

Q.2 What is the difference between writing for print and online media?

Q.3 Discuss the technical writing process.

Q.4 What is an 'email'? Discuss.

Q.5 What are the different types of technical reports?

Q.6 What are the different types of technical articles?

Q.7 What are the characteristics of technical reports?

PART – C [3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 Discuss the technical communication skills in detail.

Q.2 Discuss interpreting and summarising technical texts in detail.

Q.3 What are the editing strategies to achieve appropriate technical style?

Q.4 Discuss the structure of technical proposals.

Q.5 Write an application for job. Invent necessary details, attach your resume.

4E1309

4E1309
B. Tech. IV - Sem. (Main / Back) Exam., - 2025
Automobile Engineering
4AE3-04 Digital Electronics
AE, ME

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 may 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.   NIL _____   2.   NIL _____

PART – A   [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1   Draw the ideal VI characteristic of a diode.

Q.2   State the difference between half and full wave rectifier.

Q.3   Mention various advantages of negative feedback.

Q.4   Define CMRR and Slew Rate.

Q.5   Write the application of unity gain buffers.

Q.6   State the difference between Analog and Digital signals.

Q.7 Simplify the following Boolean expression -

$(A + \bar{B} + AB)(A + \bar{B})(\bar{A}B)$

Q.8 Design AND gate using 2:1 MUX.

Q.9 What is the difference between microprocessor and microcontroller?

Q.10 Define the basic elements of communication system.

PART – B

[5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 What is Zener breakdown? Explain the use of Zener diode as voltage regulator.

Q.2 Draw the diagram of ± 5V regulated power supply and explain its working also.

Q.3 Draw the circuit diagram for an differentiator and also explain its working.

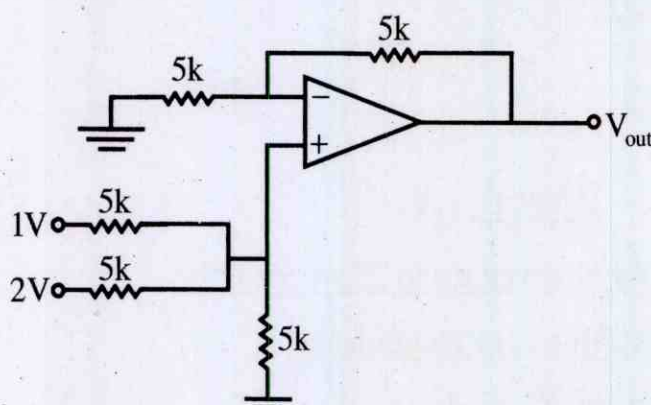Q.4 Find the output voltage for circuit as shown in Figure below -

Figure 1

Q.5 Implement the full adder using 3:8 decoder.

Q.6 Design the EX-OR gate using following -
   (i)   NAND Gate
   (ii) NOR Gate

Q.7 Explain the working of monostable multivibrator and mention its application also.

PART – C

[3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 (a) What are the various operating modes of 555IC? Explain in detail.

      (b) State the Barkhausen's criteria for oscillation.

Q.2 Design the full subtractor circuit using NAND gate.

Q.3 Minimize $F(w, x, y, z) = \sum (0, 2, 3, 4, 6, 8, 10) + d(1, 5, 7)$ using K-map.

Q.4 Design a Wien bridge oscillator for frequency of 10 kHz. Explain its working also.

Q.5 Write short note on the following -

      (i) FM modulation scheme

      (ii) 1EEE frequency spectrum

DO NOT WRITE ANYTHING HERE

4E1310

B. Tech. IV - Sem. (Main / Back) Exam., - 2025
Automobile Engineering
4AE4-05 Fluid Mechanics and Fluid Machines
AE, ME

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 may 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. __NIL__   2. __NIL__

PART – A   [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1   Define density and specific gravity.

Q.2   Explain the variation of viscosity with temperature.

Q.3   What is free vortex and forced vortex flow?

Q.4   Define energy and momentum correction factor.

Q.5   What are the factors influencing the frictional loss in pipe flow?

Q.6   What is the expression for head loss due to friction in Darcy formula?

Q.7   State Froude's dimensionless number.

Q.8   How are hydraulic turbines classified?

Q.9 What is meant by cavitation in turbines?

Q.10 Definition of heads and efficiencies of a centrifugal pump.

PART – B [5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 Prove that the pressure is exerted equally in all direction at any point in a liquid at rest.

Q.2 Find the displacement thickness and wall shear stress for the velocity distribution in a boundary layer $(u/U) = (y/\delta)$ where U is the Velocity and δ is the boundary layer thickness.

Q.3 Derive Darcy-Weisbach equation for calculating pressure drop in a pipe.

Q.4 What is an air vessel? Describe the function of the air vessel for reciprocating pump with neat sketch.

Q.5 What is the importance of a draft tube in a Francis turbine? Discuss different types of draft tubes.

Q.6 Explain various types of impellers used in centrifugal pump.

Q.7 With a neat sketch, explain the construction and working of Pelton wheel.

PART – C [3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 An inverted U-tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35cm. Determine the difference of pressure between the pipes.

Q.2 Derive the expression for flow through pipes in series and parallel. Also write about Hydraulic Gradient Line and Total Energy Line.

Q.3 Explain the principle of orifice meter and derive the equation to find the rate of flow of water through a pipe using the same.

Q.4 A single acting reciprocating pump has plunger of diameter 250mm and stroke of 350mm. if the speed of the pump is 60 is r.p.m. and it delivers 16.5 litres per second of water against a suction head of 5m and a delivery head of 20m, find the theoretical discharge, coefficient of discharge, the slip, the percentage slip of the pump and the power required to drive the pump.

Q.5 A Francis turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62m. The peripheral velocity = $0.26\sqrt{2gh}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gh}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine:

(a) The guide blade angle

(b) The wheel vane angle at inlet

(c) Diameter of the wheel at inlet

(d) Width of the wheel at inlet

DO NOT WRITE ANYTHING HERE

4E1311

B. Tech. IV - Sem. (Main / Back) Exam., - 2025
Automobile Engineering
4AE4-06 Manufacturing Processes
AE, ME

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 may 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.   NIL _____   2.   NIL _____

PART – A   [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1   What is a pattern in casting? Enlist different types of patterns.

Q.2   Explain the significance of moulding sand in casting.

Q.3   Define hot working and cold working.

Q.4   What are the advantages of rolling over forging?

Q.5   Define blanking and piercing in sheet metal operations.

Q.6   Define wire drawing and tube drawing.

Q.7   Differe.tiate between soldering and brazing.

Q.8   What is the principle of resistance welding?

Q.9   Define powder metallurgy and enlist the properties of metal powder.

Q.10   What is sintering in powder metallurgy?

PART – B   [5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1   Discuss the properties of moulding sand.

Q.2   Discuss the working principle of centrifugal casting along with application.

Q.3   Compare the hot working and cold working process.

Q.4   Explain the tube drawing process with a neat sketch.

Q.5   Discuss the principle and applications of Resistance welding.

Q.6   Compare the Ultrasonic welding and Explosive welding.

Q.7   Explain the atomization process for powder manufacturing.

PART – C   [3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1   What are pattern allowances? Explain different types of pattern allowances.

Q.2   What is forging? Explain various forging methods and compare their advantages and disadvantages.

Q.3   Describe different types of shearing operations such as parting, notching, trimming, and nibbling with neat sketches.

Q.4   Describe the working principle, process and applications of TIG and MIG welding.

Q.5   Explain the manufacturing and processing steps of powder metallurgy with suitable diagrams.

4E1312

4E1312

B. Tech. IV - Sem. (Main / Back) Exam., - 2025
Automobile Engineering
4AE4-07 Theory of Machines
AE, ME

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 may 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. NIL _____   2. NIL _____

PART – A   [10×2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1   Write the D'Alembert's Principle.
                                                                    [2]

Q.2   What do you mean be coefficient of friction?
                                                                    [2]

Q.3   Define the coefficient of fluctuation of speed.
                                                                    [2]

Q.4   Define the pressure angle of a gear.
                                                                    [2]

Q.5   Define the degree of freedom of a mechanism.
                                                                    [2]

Q.6   What is the purpose of a governor?
                                                                    [2]

Q.7 What are the advantages of using a pantograph? [2]

Q.8 Define the transmission angle of a four-bar mechanism. [2]

Q.9 Name the two methods of finding acceleration in a mechanism. [2]

Q.10 What is the function of a flywheel? [2]

PART – B [5×4=20]

(Analytical/Problem solving questions)
Attempt any five questions

Q.1 What is a kinematic pair? Classify kinematic pairs based on the type of contact between the links. [4]

Q.2 Explain the concept of instantaneous centre of rotation. How is it helpful in velocity analysis of mechanisms? [4]

Q.3 Describe the working of a quick return mechanism with a neat sketch. [4]

Q.4 In a slider-crank mechanism, the crank is 100 mm long and rotates at 300 rpm. The connecting rod is 400 mm long. Find the velocity and acceleration of the piston when the crank has turned through 45° from the inner dead centre position. [4]

Q.5 Explain the working of an epicyclic gear train with a neat sketch. Give an example of its application. [4]

Q.6 Describe the method of balancing a single rotating mass by a single mass rotating in the opposite plane. [4]

Q.7 Describe in brief the various inversions of a four-bar chain mechanism with neat sketches. [4]

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1   An open belt 100 mm wide connects two pulleys mounted on parallel shafts with their centres 2.4 m apart. The diameter of the larger pulley is 450 mm and that of the smaller pulley 300 mm. The coefficient of friction between the belt and the pulley is 0.3 and the maximum stress in the belt is limited to 14 N/mm width. If the larger pulley rotates at 120 rpm then find the maximum power that can be transmitted.   [10]

Q.2   A cam, with a minimum radius of 40 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below -   [10]

(i)   To move outwards through 30 mm during 90° rotation of the cam.

(ii)   To dwell for next 90°.

(iii)   To return to its starting position during next 100°.

(iv)   To dwell for the rest period of a revolution i.e. 80°.

Draw the profile of the cam when the line of stroke of the follower passes through the centre of the cam shaft and the displacement of the follower is to take place with SHM. Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.

Q.3 The number of teeth on the gear and the pinion of two spur gears in mesh are 30 and 18 respectively. Both the gears have a module of 6 mm and a pressure angle of 20°. If the pinion rotates at 400 rpm, what will be the sliding velocity at the moment the tip of the tooth of the pinion has contact with the gear flank? Take an addendum equal to one module. Also, find the maximum velocity of sliding. [10]

Q.4 A simple band brake is operated by a lever of length 500 mm. The brake drum has a diameter of 500 mm and the brake band embraces 5/8 of the circumference. One end of the band is attached to the fulcrum of the lever while the other end is attached to a pin on the lever 100 mm from the fulcrum. If the effort applied to the end of the lever is 2 kN and the coefficient of friction is 0.25, find the maximum braking torque on the drum. [10]

Q.5 (a) Establish a formula for the frictional torque transmitted by a cone clutch. [4]

(b) Define the following terms as applied to cam with a neat sketch - [6]

(i) Base circle

(ii) Pitch circle

(iii) Pressure angle

(iv) Stroke of the follower

4E1235

B. Tech. IV - Sem. (Back) Exam., - 2025
Automobile Engineering
4AE4-07 Theory of Machines

Time: 3 Hours

Maximum Marks: 160
Min. Passing Marks: 56

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 may 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. NIL _____   2.   NIL _____

PART – A

[10×3=30]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1   Mention any three applications of concepts learned in the Theory of Machines.

Q.2   List and explain any three types of Kinematic pairs.

Q.3   In a four-bar chain, the lengths of the links are:

AB = 100 mm, BC = 200 mm, CD = 150 mm, DA = 250 mm.

Check whether Grashof's law is satisfied or not.

Q.4   Draw a velocity diagram for a simple four-bar mechanism.

Q.5   State the difference between free and forced vibrations.

Q.6   Differentiate between simple and compound gear trains.

Q.7   Write the formula for relationship between center distance, module, and teeth.

Q.8   What is gyroscopic couple? Give one example.

Q.9   What are the advantages of a tangent cam over a radial cam?

Q.10   Differentiate between static and dynamic balancing.

PART – B   [5×10=50]

(Analytical/Problem solving questions)
Attempt any five questions

Q.1   Compare four-bar chain and slider-crank mechanism.

Q.2   Compare spur, helical and bevel gears in terms of application and construction.

Q.3   Explain the design considerations for power screws used in heavy-duty applications. Include strength, friction, and efficiency aspects.

Q.4   Two spur gears are in mesh with a module of 2.5 mm. The center-to-center distance between the gears is 300 mm. If the smaller (driver) gear has 80 teeth, determine the number of teeth on the larger (driven) gear.

Q.5   Why is pressure angle an important consideration in cam design? How does it affect wear and the performance of the follower?

Q.6   Four masses m1, m2, m3, m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2m.

Q.7   Discuss the combined roles of gyroscopic couple and centrifugal force in determining the lean angle of a bicycle in a steady turn.

PART – C

[4×20=80]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any four questions

Q.1 A sliding mesh type gear box with four forward speeds has following gear ratios: Top gear = 1, Third gear = 1.38, Second gear = 2.24, First gear = 4, Reverse gear = 4.2. Determine number of teeth on various gears. The minimum number of teeth on the pinion should not be less than 18. The gear box should have minimum size and variation in the ratios should be as small as possible.

Q.2 A cam is to give the following motion to a knife-edge follower: Rise of 40 mm during 120° of cam rotation with Simple Harmonic Motion (SHM), Dwell for the next 30°, Return to the original position during the next 90° with uniform acceleration and retardation motion (UARM), Dwell during the remaining 120°, the follower moves radially, and the cam rotates at a uniform speed of 600 rpm. The base circle radius is 50 mm.

(a) Draw the displacement diagram for the follower motion.

(b) Construct the cam profile assuming the knife-edge follower.

(c) Calculate the maximum velocity and acceleration of the follower during rise and return periods.

(d) Comment on the pressure angle and wear considerations for the given cam profile.

Q.3 A motorcycle of mass 200 kg (including rider) has wheel radius 0.33 m; both wheels rotate at 400 rpm. It takes a level turn of radius 50m at 20 m/s.

(a) Determine the gyroscopic couple from both wheels.

(b) Calculate the centrifugal force on the motorcycle.

(c) Find the resultant lean angle required for equilibrium.

(d) Comment on how any change in speed or wheel inertia would affect stability.

Q.4 A rotating shaft carries four masses A, B, C and D which are radially attached to it. The mass centres are 30mm, 38mm, 40mm and 35mm respectively from the axis of rotation. The masses A, C and D are 7.5 kg, 5 kg and 4 kg respectively. The axial distance between the planes of rotation of A and B are 400 mm and between B and C is 500 mm. The masses A and C are at right angle to each other. Find for a complete balance,

(a) the angles between the masses B and D from mass A,

(b) the axial distance between the planes of rotation of C and D,

(c) the magnitude of mass B.

Q.5 What is the difference between collar friction and pivot friction? Explain the terms: Self-locking and Overhauling of power screws and derive the expression for the frictional torque in a flat collar bearing using uniform pressure theory.