Techno India NJR Institute of Technology

Roll No. _____ Plot-SPLT, Bhamashah (RIICO) Industrial Area Kaladwas, Udaipur-313003 (Rajasthan)

Total No. of Pages: 4

3E1207

3E1207

B. Tech. III - Sem. (Main / Back) Exam., February - 2023
Automobile Engineering
3AE3 – 04 Engineering Mechanics
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 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

(Answer should be given up to 25 words only)   [10×2=20]

All questions are compulsory

Q.1 State the different type of mechanics.

Q.2 Define Kinetics and Kinematics.

Q.3 Differentiate between 'Resultant' and 'Equilibrant'.

Q.4 State Varignon's Theorem.

Q.5 State Lami's theorem with a sketch.

Q.6 Define principal axes and principal moment of inertia.

Q.7 State the Law of Conservation of Momentum.

Q.8 Give mathematical definitions of velocity and acceleration.

Q.9 Classify the types of friction.

Q.10 Define angle of repose.

PART – B

(Analytical/Problem solving questions)   [5×4=20]

Attempt all five questions

Q.1 A lift has an upward acceleration of 1 m/s2. What pressure will a man weighing 600 N exerts on the floor of the lift? What force would he exert if the lift had an acceleration of 1.0 m/s^2 downwards?

Q.2 Define couple and explain its characteristics. With the help of a sketch, explain how a force can be resolved into a force and a couple.

Q.3 Define instantaneous centre of rotation. A link AB is moving such that it is inclined at 40° to horizontal at A. The point A is moving horizontally with a velocity 8 m/sec towards right and point B is moving vertically upward. Locate the instantaneous centre and find the velocity of the end B of the link.

Q.4 Derive the length of an open belt drive.

Q.5 Explain screw jack with the help of a neat sketch.

Q.6 Explain different types of belt drives.

Q.7 Describe (i) Worm and worm wheel (ii) Conservation of angular momentum

PART – C

Attempt any three questions

Q.1 Block A weighing 1000 N rests on a rough inclined plane whose inclination to the horizontal is 45°. It is connected to another block B, weighing 3000 N rests on a rough horizontal plane by a weightless rigid bar inclined at an angle of 30° to the horizontal as shown in fig. Find the horizontal force required to be applied to the block B just to move the block A in upward direction. Assume angle of friction as 15° at all surfaces where there is sliding.
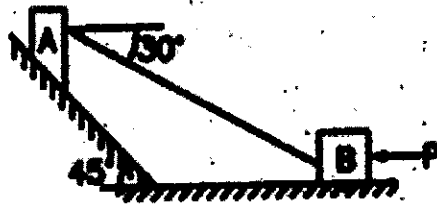

Q.2 Two blocks of weight 150N and 50N are connected by a string, passing over a frictionless pulley as shown in fig. Determine the velocity of 150N block after 4 seconds. Also, calculate the tension in the string.
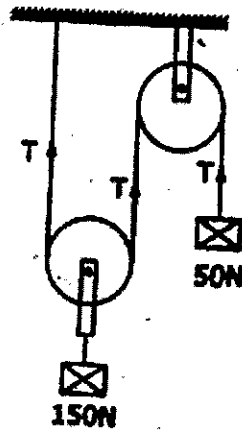
Q.3 Two weights of 50 N and 10 N are connected by a weightless string which passes over a smooth pulley. The weight 10 N is resting on an inclined plane which makes an angle of 20° with horizontal and another weight 50 N hangs vertically downwards. Find the acceleration of the system, tension in the string and distance moved by the body in 3 seconds starting from rest. Take coefficient of friction as 0.2 for inclined plane and 'g' as 9.81 m/s2.

Q.4 Members OA, OB and OC form a three member space truss. A weight of 10 KN is suspended at the joint 'O' as shown in fig. Determine the magnitude and nature of forces in each of the three members of the truss.
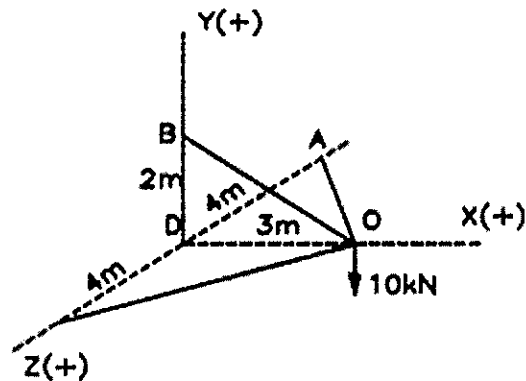
Q.5 A ladder of length 5m and weight 300N is placed against a vertical wall with which it makes an angle of 45°. The coefficient of friction between the floor and the ladder is 0.5 and that between the wall and the ladder is 0.4. In addition to its own weight, the ladder has to support a man of weight 500N at 1m from the top along the ladder. Determine the minimum inclination of the ladder with the horizontal so that there is no slipping.

3E1208

3E1208

B. Tech. III - Sem. (Main / Back) Exam., February - 2023
Automobile Engineering
3AE4-05 Engineering Thermodynamics
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 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. Steam Tables and Mollier Chart   2. NIL _____

PART – A

(Answer should be given up to 25 words only)   **[10×2=20]**

All questions are compulsory

Q.1   State the first law for a closed system undergoing a cycle.

Q.2   When is work said to be done by a system?

Q.3   What is a thermal energy reservoir? Explain 'source' and 'sink'.

Q.4   What is a heat pump? How does it differ from a refrigerator?

Q.5   What do you understand by the degree of superheat and the degree of sub-cooling?

Q.6   Why does the Gibbs function remain constant during phase transition?

Q.7   What do you understand by the dead state?

Q.8   What is an air standard cycle? Why are such cycles conceived?

Q.9   What are the three basic components of a gas turbine plant?

Q.10 What is a cogeneration plant? What are the thermodynamic advantages of such a plant?

PART – B

(Analytical/Problem solving questions)   [5×4=20]

Attempt any five questions

Q.1 The mass rate of flow into a steam turbine is 1.5 kg/s and the heat transfer from the turbine is 10 kW. The following data are known for the steam entering and leaving the turbine. Determine the power output of the turbine.

|	Inlet Conditions	Outlet Conditions
Pressure	25 bar	1 bar
Temperature	400°C	
Quality		90%
Velocity	100 m/s	200 m/s
Elevation from reference plane	10 m	5 m

Q.2 An ideal gas of molecular weight 30 and $\gamma = 1.3$ occupies a volume of 1.5 m³ at 100 kPa and 77°C. The gas is compressed according to the law, $pv^{1.25}$ = constant to a pressure of 3 MPa. Calculate the volume and temperature at the end of compression and heating, work done, heat transferred and the total change of entropy.

Q.3 Explain the various processes of Carnot cycle with the help of schematic diagram. Draw its P-v and T-s diagram and state the Carnot Corollaries.

Q.4 Explain Joule Kelvin effect. What is inversion temperature and why does the hydrogen gas need to be precooled before being throttled to get the cooling effect?

Q.5 Derive an expression for the air standard efficiency for ideal Brayton cycle. Show the cycle on P-v and T-s diagram.

Q.6 An engine working on Otto cycle has a clearance of 17% of stroke volume and initial pressure of 1 bar and temperature of 300 K. If the pressure at the end of constant volume heating is 30 bar, determine –
(i) An air standard efficiency
(ii) Maximum temperature of the cycle
(iii) Mean effective pressure

Q.7 Discuss the desirable characteristics of an ideal working fluid in vapour power cycle. What are open and closed feed water heaters?

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)   [3×10=30]
Attempt any three questions

Q.1 A reversible heat pump is used to maintain a temperature of 0°C in a refrigerator when it rejects the heat to the surrounding at 25°C. If the heat removal rate from the refrigerator is 1440 kJ/min, determine the C.O.P. of the machine and work input required. If the required input to run the pump is developed by a reversible engine which receives heat at 380°C and rejects heat to atmosphere, then determine the overall C.O.P. of the system.

Q.2 Steam generated at a pressure of 6 MPa and a temperature of 400°C is supplied to a turbine via a throttle valve which reduces the pressure to 5 MPa. Expansion in turbine is adiabatic to a pressure of 0.2 MPa. The isentropic efficiency (actual enthalpy drop/isentropic enthalpy drop) being 82%. The surroundings are at 0.1 MPa, 20°C. Determine the availability of steam before and after the throttle valve and at the turbine exhaust and calculate the specific work output from the turbine. The K.E. and P.E. changes are negligible.

Q.3 With the help of Maxwell's relations and TdS equations, prove that the enthalpy and internal energy of an ideal gas are functions of temperature only.

Q.4 Derive an expression for the air standard efficiency and mean effective pressure of an ideal Diesel cycle. Show the cycle on P-v and T-s diagram.

Q.5 A steam power station uses the following cycle:
Steam at boiler outlet: 150 bar and 550°C, reheat at 40 bar to 550°C and condenser at 0.1 bar. Using the Mollier chart and assuming ideal processes, determine the quality of steam at turbine exhaust, the cycle efficiency and steam flow rate.
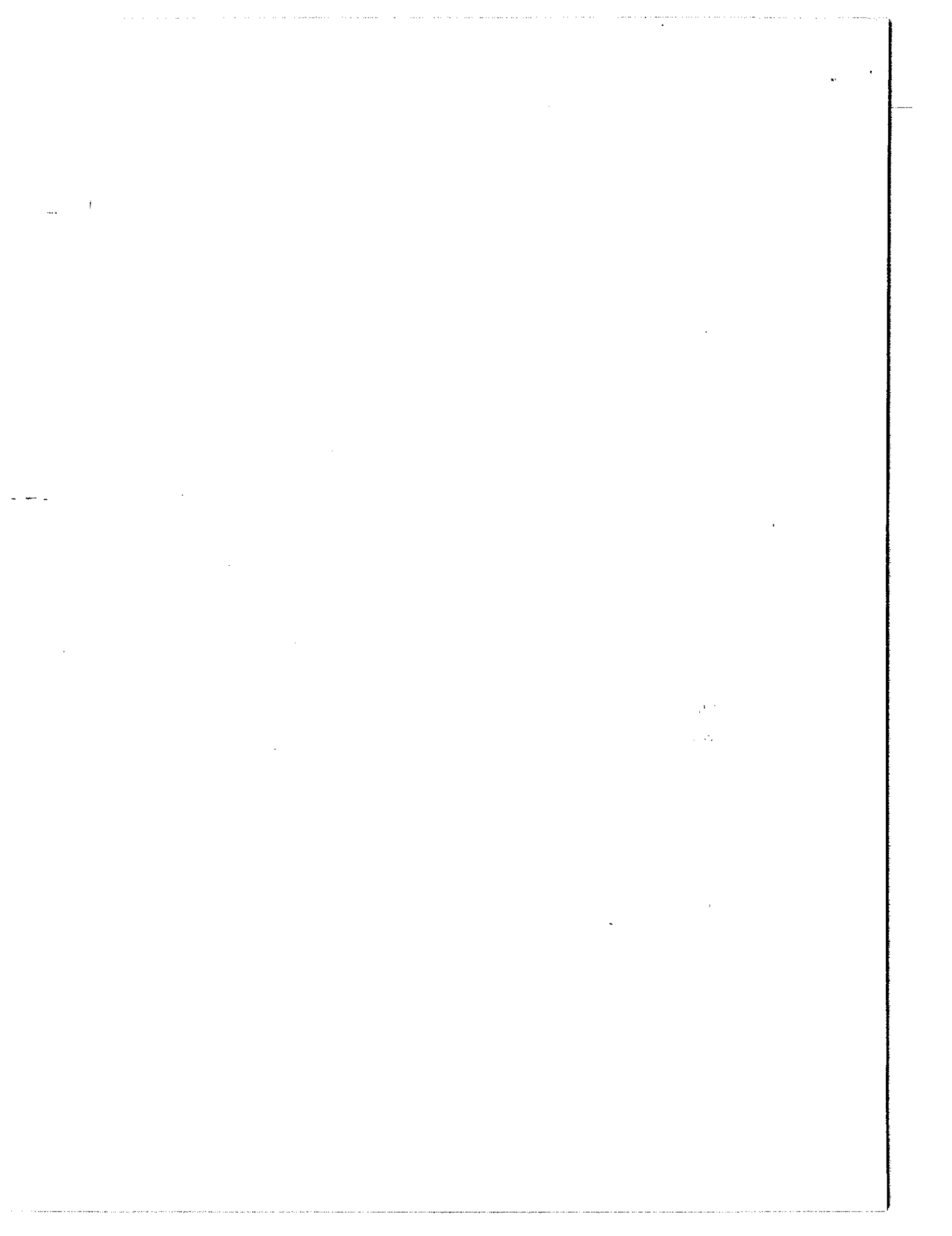
3E1209

B. Tech. III - Sem. (Main/Back) Exam., February - 2023

Automobile Engineering

3AE4-06 Materials Science and Engineering

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 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 coordination number? Write the value of coordination number in Cubic, BCC, FCC and HCP cells.

Q.2   Name the steel with carbon percentage below and above 0.8%.

Q.3   Draw miller plane for (011).

Q.4   Write phase transfer equation of binary isomorphous alloy system.

Q.5   Which property is measured in Izod impact test?

Q.6   What are the % composition of 18-4-1 steel tool?

Q.7 Jominey end quench test is used for measurement of?

Q.8 What are the different medium of cooling in quenching process?

Q.9 What is critical temperature in Fe-C diagram?

Q.10 What is elastic and plastic deformation?

PART – B   [5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 Explain Frank read mechanism of dislocation.

Q.2 Discuss different line defects with diagram and example.

Q.3 Draw TTT diagram and discuss micro constituents of diagram.

Q.4 Discuss the effect of alloying Al, Cr, C and Mn in steel.

Q.5 Discuss the properties and applications of PVC polymers and fiber reinforced composites.

Q.6 Discuss the properties and applications of AL_2O_3 ceramic and discuss nano crystals.

Q.7 Discuss BIS standards.

PART – C   [3×10=30]

## (Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 Discuss recovery, recrystallization and grain growth process with suitable diagram.

Q.2 Describe Iron-Carbon diagram and discuss its micro constituents of diagram.

Q.3 Explain binary Eutectic phase diagram for steel.

Q.4 Write different mechanical properties of material and explain testing of hardness by brinell hardness machine.

Q.5 Discuss and explain -

(a) Carborizing case hardening process

(b) Austempering process

(c) Spheroidising annealing process

(d) Hardening heat treatment process
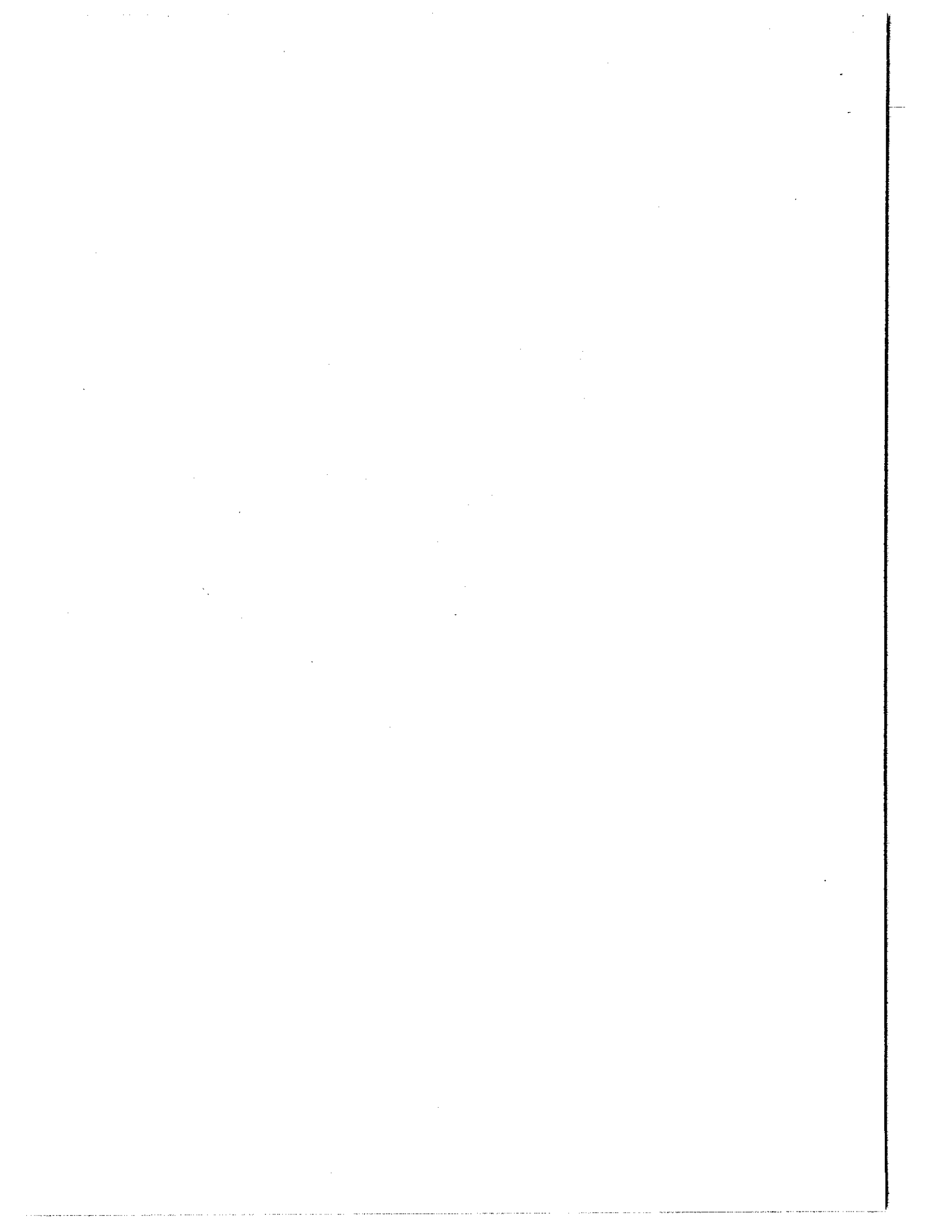
3E1210

B. Tech. III - Sem. (Main / Back) Exam., February - 2023

Automobile Engineering

3AE4-07-Mechanics of Soilds

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 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   State Hooke's Law.

Q.2   Distinguish between longitudinal and lateral strain.

Q.3   Define the terms Principal Planes and Principal Stresses.

Q.4   What is a composite bar?

Q.5   Define Poisson's ratio and write its value for steel and rubber.

Q.6   Differentiate between a point load and a uniformly distributed load.

Q.7   What is complementary shear stress?

Q.8   Define the terms Torsion and Torsional Rigidity.

Q.9   Name the important theories of failure.

Q.10 Write the use of Mohr's circle of stresses.

PART – B   [5×4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1   The loading on a steel bar of 30 mm diameter is as shown in Fig-1 below. Find the elongation of the bar. Take E_s = 205 GPa
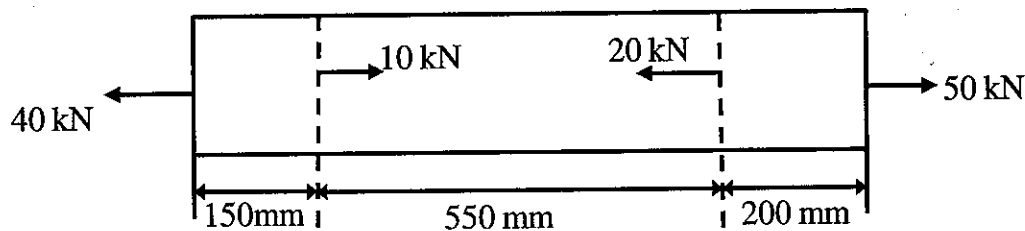

Fig.1

Q.2   Draw the shear force and bending moment diagram of overhanging beam carrying uniformly distributed load of 2 kN/m over the entire length as shown in the Fig-2 below:
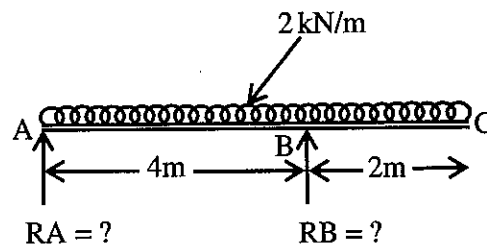

Fig - 2

Q.3 Explain the different methods of determining the deflection of statically intermediate beams.

Q.4 Prove that torque transmitted by a solid shaft when subjected to torsion is given by:

$$T= \left(\frac{\pi}{16}\right)\tau D^3$$

Where D = Diameter of solid shaft and τ = Maximum shear stress

Q.5 Define and explain the following theories of failure:

(i) Maximum principal stress theory

(ii) Maximum shear stress theory

Q.6 Derive an expression showing relation between modulus of elasticity and modulus of rigidity.

Q.7 Derive equation for equivalent twisting and bending moment.

PART – C   [3×10=30]

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any three questions

Q.1 Write the assumptions made in the simple/pure theory of bending. Derive the relation:

$$\frac{M}{I}=\frac{\sigma}{y}=\frac{E}{R}$$

Where M=Bending moment, I=Moment of inertia, σ=Bending stress, y=Distance for neutral axis, E=Young's modulus and R=Radius of curvature.

Q.2 Derive the expression for Euler's crippling load for a long column with both ends of column being hinged. Also brief the limitations of Euler's formula.

Q.3 Draw the Shear Force (S.F.) and Bending Moment (B.M.) diagrams for the beam which is loaded as shown in Fig.3. Also find the points of contraflexure within the span AB.
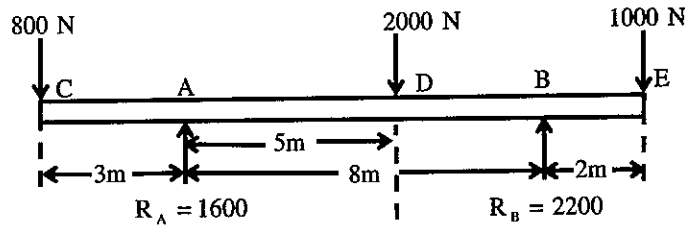

Fig. 3

Q.4 A rectangular block of material is subjected to a tensile stress of $110 N/mm^2$ on one plane and a tensile stress of $47 N/mm^2$ on the plane at right angles to the former as shown in Fig. 4. Each of the above stresses is accompanied by a shear stress of $63 N/mm^2$ and that associated with the former tensile stress tends to rotate the block anticlockwise. Find:

(i) The direction and magnitude of each of the principal stress

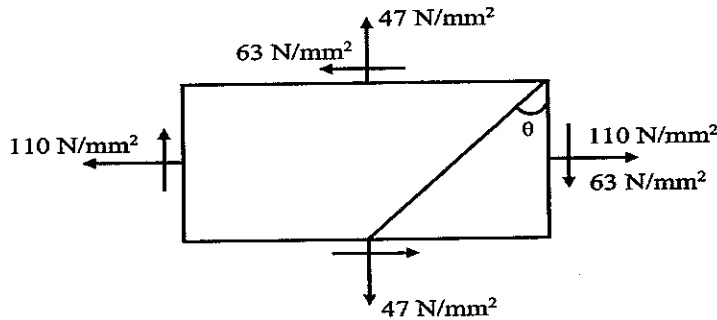(ii) Magnitude of the greatest shear stress.

Fig. 4

Q.5 Define thin cylinders. Show that in thin cylinder shells subjected to internal fluid pressure, the circumferential stress in twice the longitudinal stress.

3E1250

B. Tech. III - Sem. (Main / Back) Exam., February - 2023
Artificial Intelligence & Data Science
Technical Communication
Common to 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 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

(Answer should be given up to 25 words only)   [10×2=20]

All questions are compulsory

Q.1 What are the four main features of technical communication?

Q.2 What are linguistic abilities?

Q.3 Name the different types of manuals?

Q.4 Which is more reliable- Print Media or Online Media? Why?

Q.5 What is the meaning of document design?

Q.6 What are the steps in Technical Proposal Writing?

Q.7 Mention the types of technical article.

Q.8 How can you improve your Speaking Skills?

Q.9 What is the difference between Listening and Hearing?

Q.10 Why is reading important for improving Communication Skills?

PART – B

(Analytical/Problem solving questions)   [5×4=20]

Attempt any five questions

Q.1 Discuss the aspects of Technical Communication in detail.

Q.2 Draft a report on various curricular and co-curricular activities organized in your department/college to be published on RTU website.

Q.3 There is no canteen in your company. Write a proposal to establish a canteen in your College/Institute.

Q.4 Discuss the difference between agenda and minutes of meeting. What are the objectives of agenda?

Q.5 Correct the following sentences:
   (1) She always felt inferior than her younger sister.
   (2) I have visited Niagara Falls last weekend.
   (3) The woman which works here is from Rajasthan
   (4) She's married with a dentist.

Q.6 Explain the form/ format/ structure/ style of writing Official Notes.

Q.7 What are some strategies for an effective editing and proofreading?

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)   [3×10=30]

Attempt any three questions

Q.1 What is Style in Technical communication? Explain the guidelines for writing a good technical document.

Q.2 Define the term technical communication. Explain the process (cycle) of communication in detail.

Q.3 What is a Technical Report? Explain in detail about the type, characteristic and objectives of Technical Report.

Q.4 Describe the factor which influence information and document design.

Q.5 Evaluate your education, professional training, skills, accomplishments and achievement, interest/ activities and experience. Write a **resume** for the post of computer executive.

3E1116

3E1116
B. Tech. III - Sem. (Back) Exam., February - 2023
ESC Automobile Engineering
3AE3-04 Engineering Mechanics
AE, ME

Time: 2 Hours

Maximum Marks: 80
Min. Passing Marks: 28

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three 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   [5×2=10]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1   State the Triangle Law of Equilibrium.

Q.2   Define the "Polar Moment of Inertia".

Q.3   State the Law of Machine.

Q.4   Explain in brief the D'Alembert's Principle.

Q.5   What do you understand by the coefficient of restitution?

PART – B

[4×10=40]

(Analytical/Problem solving questions)

Attempt any four questions

Q.1 A load of 20 kN is to be lifted by the differential wheel and axle. It consists of differential axle of 250 mm and 300 mm diameter and the wheel diameter is 800 mm. Find the effort required if the efficiency of the machine is 55%.

Q.2 An open belt 100 mm wide and 3mm thick connects two pulleys mounted on a parallel shaft, at 2.5 m apart. The diameter of the larger wheel is 500 mm and that of the smaller is 300 mm.

Q.3 Determine the resultant of three forces acting on a hook as shown in fig – 1.

Fig - 1
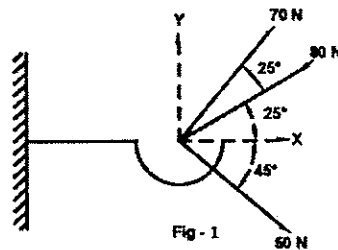
Q.4 A circular cylinder of radius 0.5 m and mass 200 kg is placed in contact with a rectangular block of mass 150 kg on an incline at 30° as shown in fig – 2. If the coefficient of static friction is 0.60, determine the minimum force F to be applied up the plane at the block to initiate an upward motion of the bodies.

Fig - 2
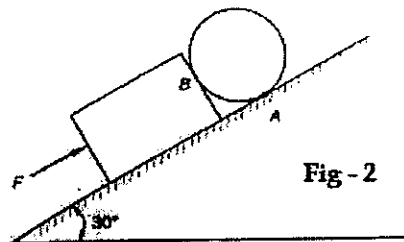
Q.5 Find the power of a locomotive, drawing a train whose weight including that of engine is 420 kN up an incline 1 in 120 at a steady speed of 56 kmph, the frictional resistance being 5 N/kN.

While the train is ascending the incline, the steam is shut off. Find, how far it will move before coming to rest, assuming that the resistance to motion remains the same?

Q.6 A golf ball is dropped from a height of 10 m on a fixed steel plate. The coefficient of restitution is 0.894. Find the height to which the ball rebounds on the first, second and third bounces.

PART – C

[2×15=30]

## (Descriptive/Analytical/Problem Solving/Design Questions)
Attempt any two questions

Q.1 A tennis player serves a ball with a speed of 30 m/s. The ball leaves the racquet at a height of 2.5 m and a horizontal distance of 12.25 m from the net. The height of the net is 0.91 m.
 (a) If the ball leaves the racquet horizontally, will the ball clear the net?
 (b) If the ball leaves the racquet at an angle of 10 below the horizontal, will the ball clear the net?
 (c) What is the minimum angle at which the ball must leave the racquet for it to clear the net?

Q.2 Determine the forces in all the members of the truss shown in fig – 3 and indicate the magnitude and nature of all the forces on the diagram of the truss. All inclined members are at 60° to horizontal and length of each member is 2 m.

FIG - 3
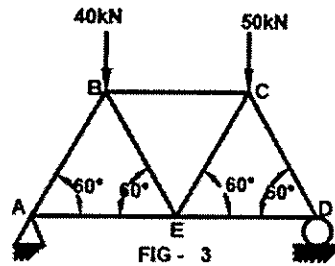
Q.3 Determine the second moment of area of the channel section shown in fig –4 about centroidal axis x – x and y – y.

FIG - 4
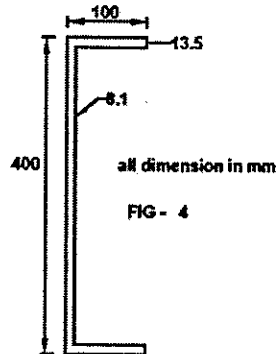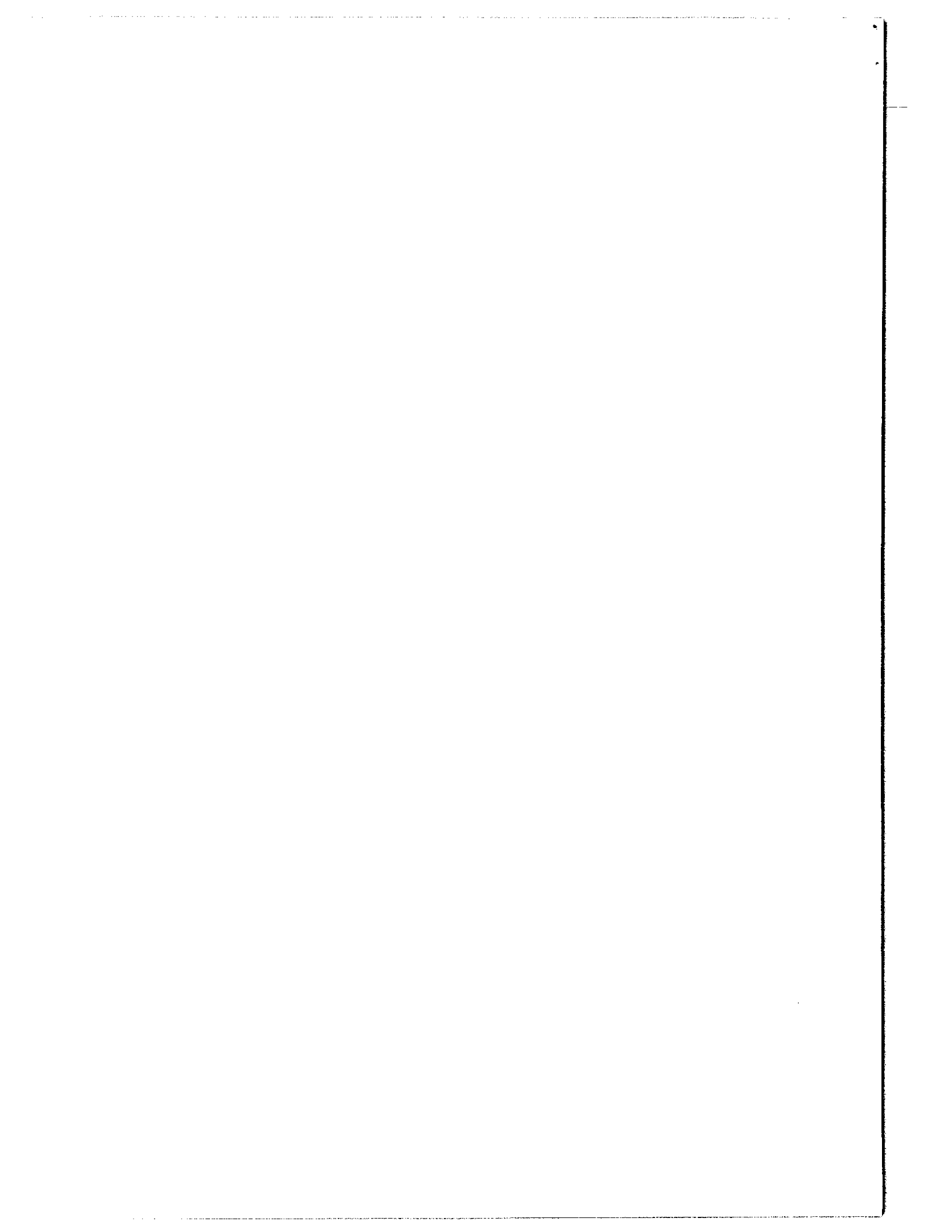
3E1118

3E1118

B. Tech. III - Sem. (Back) Exam., February - 2023
Automobile Engineering
3AE4-06 Materials Science and Engineering
AE, ME

Time: 3 Hours

Maximum Marks: 120
Min. Passing Marks: 42

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 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

(Answer should be given up to 25 words only)   [10×2=20]
All questions are compulsory

Q.1 What is allotropic structures and temperatures of iron?

Q.2 Write carbon % in carbon steels.

Q.3 Which property mainly changes in recovery process?

Q.4 What is the main difference between cooling process of annealing and normalizing processes?

Q.5 What is general range of recrystallization temperature?

Q.6 Draw miller plane for (101).

Q.7 Name the processes which increases the ultimate strength of material.

Q.8 What does steel having combination of 6.67 % carbon and 93.33% iron known?

Q.9 What is atomic packing factor?

Q.10 What is an isotropic property of materials?

PART – B

(Analytical/Problem solving questions)   [5×8=40]

Attempt any five questions

Q.1 Discuss and differentiate slip and twinning mechanism.

Q.2 Explain Eutectic phase diagram for materials when constituents are soluble in liquid state and partly soluble in solid state.

Q.3 Discuss different point defects with diagram and example.

Q.4. Draw TTT diagram and discuss micro constituents of diagram.

Q.5 What is hardenability? Explain Jominey test of hardenability.

Q.6 Discuss the effect of alloying Ni, Cr, Al, Mn and S in steel.

Q.7 Discuss the properties and applications of PVC and PE polymers.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)   [4×15=60]

Attempt any four questions

Q.1 Describe Iron-Carbon diagram and discuss its micro constituents of diagram.

Q.2 Discuss recrystallization and grain growth process with suitable diagram.

Q.3 Explain the mechanism of solidification of metals. Discuss homogenous and heterogeneous nucleation.

Q.4 Write seven mechanical properties of material and explain testing of impact strength by Izod impact testing machine.

Q.5 Discuss and explain –

(a) Nitriding case hardening process

(b) Martempering process

(c) Full annealing process

3E1119

3E1119
B. Tech. III - Sem. (Back) Exam., February - 2023
PCC Mechanical Engineering
3ME4 – 07 Mechanics of Solids
Common for AE, ME

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 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

(Answer should be given up to 25 words only)   **[10×3=30]**
All questions are compulsory

Q.1   Define stress and strain.

Q.2   Define the terms 'elasticity and plasticity'.

Q.3   What is Poisson's ratio?

Q.4   State Hooke's Law.

Q.5   Enlist three types of beams and draw their diagrams.

Q.6   Enlist three types of loads on beams with their diagrams.

Q.7   Explain point of contra flexure.

Q.8   What is principal plane?

Q.9   What is slenderness ratio?

Q.10 Write down the expressions for slope and deflection of a cantilever beam subjected to point load at free end.
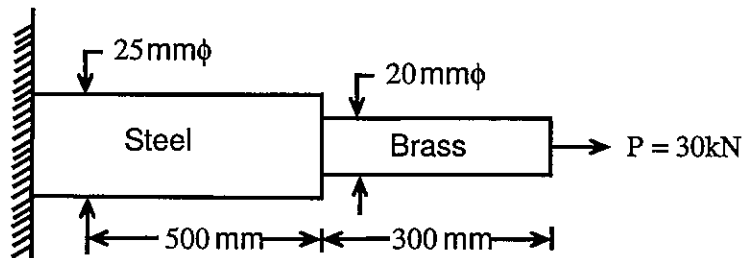
PART – B

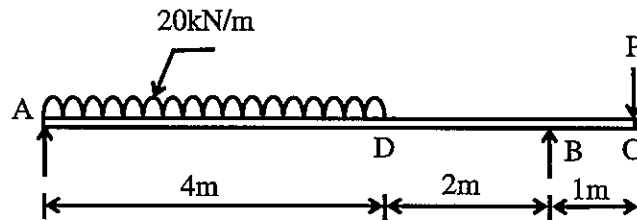## (Analytical/Problem solving questions)   [5×10=50]

Attempt any five questions

Q.1 The composite bar shown in figure is subjected to a tensile of 30kN. The extension observed is 0.44. Determine the Young's modulus of brass, if Young's modulus of steel is 2×10^5 N/mm2.

Q.2 Draw shear force diagram (SFD) indicating values at salient point for given beam.

Q.3 The state of stress in a material subjected to two-dimensional stress is as shown in figure. Determine principal stresses and the direction of planes on which they act.
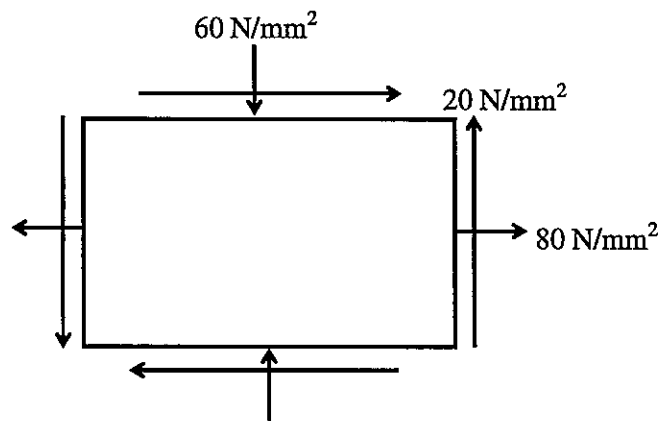
Q.4 Show that in a beam of solid circular section maximum shear stress is $\frac{4}{3}$q average.

Q.5 Derive the torsion equation for a circular shafts.

$$\frac{T}{J} = \frac{G\theta}{l} = \frac{\tau}{r}$$

Q.6 Determine the expression of Euler buckling load for the axially loaded strut hinged at both ends.

Q.7 A spherical shell of 1.20 m internal diameter and 6 mm thickness is filled with water under pressure until the volume is increased by 400×10^3 mm^3. Determine the pressure exerted by water on the shell. Take E=204 GPa and v=0.3.

PART – C

## (Descriptive/Analytical/Problem Solving/Design Questions)   [4×20=80]

Attempt any four questions

Q.1 A steel bolt of 20 mm diameter passes centrally through a copper tube of internal diameter 28 mm and external diameter 40 mm. The length of whole assembly is 600 mm. After tightfitting of the assembly, the nut is over tightened by quarter of a turn. What are the stresses introduced in the bolt and tube, if pitch of nut is 2 mm? Take modulus of elasticity for steel as $E_s=2\times10^5$ N/mm^2 and for copper $E_c=1.2\times10^5$ N/mm^2.
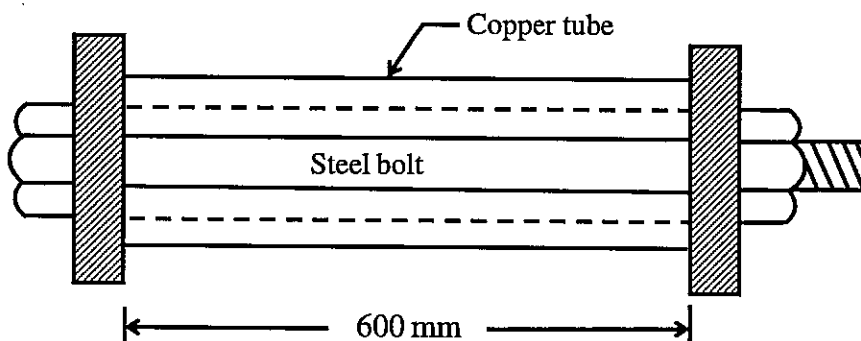

Q.2 Derive the expressions for slope and deflection at the ends of a simply supported beam of length l subjected to uniformly distributed load w(UDL) on whole span using double integration method.

Q.3 The unsymmetrical I-section shown in figure is the cross-section of a beam, which is subjected to a shear force of 60 kN. Determine the shear stress at salient points and draw the shear stress variation diagram across the depth.
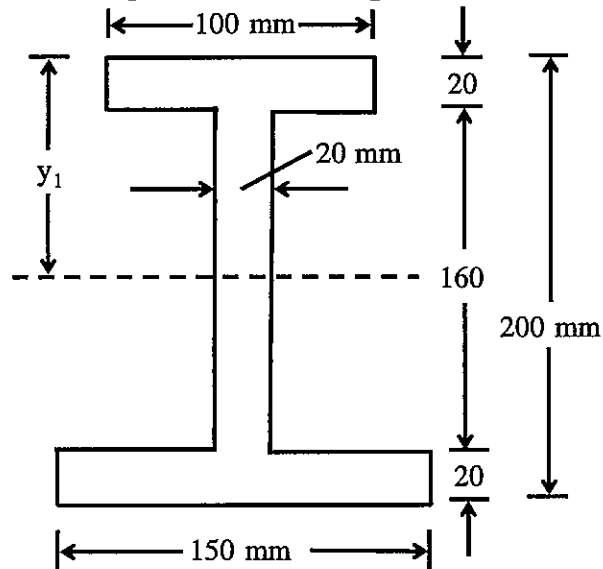
Q.4 State of stress at a point in a material is as shown in the figure.
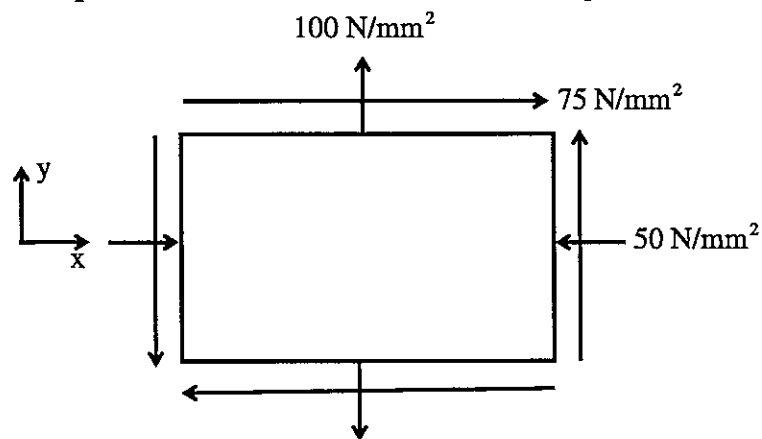
Determine –
(i) Principal stresses
(ii) Maximum shear stress
(iii) Plane of maximum shear stress
(iv) The resultant stress on the plane of maximum shear stress.

Q.5 What is the application of theories of failure? Explain any four theories of failure.