ME-L

1-3

3E1206

Roll No. _____ Total No. of Pages: 3

3E1206

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

Automobile Engineering

3AE2 – 01 Advance Engineering Mathematics - I

AN, AG, AE, CE, CR, EC, EI, ME, MH, 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 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 Find the Laplace transform of -

$$f(t) = \begin{cases} \cos t & 0 < t < 2\pi \\ 0 & t > 2\pi \end{cases}$$

Q.2 What is unit step function?

Q.3 Find the Z-transform of sequences -

$\{u_n\} = \{25, 10, 5, 3, 2, 1, 0, 5\}$ $-3 \le n \le 4$

Q.4 Find the inverse Z-transform of $\log\left(\frac{z}{z+1}\right)$ by power series method.

Q.5 State Convolution Theorem for Fourier transform.

Q.6 Find the Fourier transform of $f(x) = \begin{cases} 1 & \text{for } |x| < 1 \\ 0 & \text{for } |x| > 1 \end{cases}$.

Q.7 Prove $E = 1 + \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$.

Q.8 By using Lagrange's formula, find x corresponding to y = 10 of following data -

x	10	15	17	20
y	3	7	11	14

Q.9 Find the first approximation value of x by Newton-Raphson method of $f(x) = xe^x - 2$ upto three decimal places.

Q.10 Write formula of Milne's Predictor Corrector Method.

PART – B

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

Attempt all five questions

Q.1 Find the inverse Laplace transform of $\frac{2s^2-1}{(s^2+1)(s^2+4)}$.

Q.2 Find Fourier sine and cosine transform of -

$$f(x) = \begin{cases} x & \text{for } 0 < x \leq 1 \\ 2 - x & \text{for } 1 < x < 2 \\ 0 & \text{for } x \geq 2 \end{cases}$$

Q.3 If $\bar{u}(z) = \frac{2z^2 + 3z + 4}{(z-3)^3}$, $|z| > 3$, then show that $u_1 = 2$, $u_2 = 21$ and $u_3 = 139$.

Q.4 Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using –

(i) Trapezoidal rule

(ii) Simpson 1/3 rule

Q.5 Given $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$. Determine y (0.02) and y (0.04) by using modified Euler's method.

Q.6 By using Stirling formula, find u_{32} from the following data -

$u_{20} = 14.035$, $u_{25} = 13.674$, $u_{30} = 13.257$

$u_{35} = 12.734$ $u_{40} = 12.089$, $u_{45} = 11.309$

Q.7 Solve linear difference equation $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ given $u_0 = 1 = u_1$.

PART – C

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

Attempt any three questions

Q.1 From the following table of values of x and y find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.2 -

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.72	3.32	4.06	4.96	6.05	7.39	9.02

Q.2 If $\frac{dy}{dx} = x + y^2$ use Runge-Kutta method to find an approximate value of y for x = 0.2, given that y = 1 when x = 0. Use Laplace transform to solve.

Q.3 $(D^2 + 9)y = \cos 2t$, $y(o) = 1$, $y(\pi/2) = -1$.

Q.4 Obtain the Fourier transform of $f(x) = \begin{cases} x^2 & |x| \le a \\ 0 & |x| > a \end{cases}$. Hence evaluate

$$\int_0^\infty \cos\left(\frac{as}{2}\right)\frac{(a^2s^2 - 2)\sin as + 2as\cos as}{s^3}.ds$$

Q.5 Find Z $\{a^{|n|}\}$ and hence find Z $\left\{\left(\frac{1}{2}\right)^{|n|}\right\}$.

3E1101

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3E1101

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

Aeronautical Engineering

3AN2-01 Advanced Engineering Mathematics-I

AE, AG, AN, CE, CR, EC, EI, ME, MH, MI

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. Use of non-programmable scientific calculator is allowed in this paper 2. NIL

PART – A

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

All questions are compulsory

Q.1 Find the value of $\Delta^3(x^2 - 1)$ if h = 1.

Q.2 Write Simpson's one – third rule.

Q.3 Write Adam's predicator – corrector formula.

Q.4 Write the condition for Newton – Raphson method to be convergent.

Q.5 Define function of class A.

Q.6 Find inverse Laplace transform of $\frac{pe^{-ap}}{p^2 - w^2}, a > 0$.

Q.7 Define complex Fourier transform.

Q.8 State Convolution Theorem for Fourier transform.

Q.9 Define Z – transform.

Q.10 Find inverse Z – transform of $\frac{z}{z-a}, |z| > a$.

PART – B

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

Attempt any five questions

Q.1 Find the value of $\frac{\Delta^2}{E}\sin(x+h) + \frac{\Delta^2 \sin(x+h)}{E\sin(x+h)}$.

Q.2 Find first and second derivatives of function f(x) at x = 7.50 from given data –

x	7.47	7.48	7.49	7.50	7.51	7.52	7.53
f(x)	0.193	0.195	0.198	0.201	0.203	0.260	0.208

Q.3 Use Euler's modified method find y at x = 0.1 by taking h = 0.05, given

$\frac{dy}{dx} = x^2 + y; y(0) = 1.$

Q.4 Find inverse Laplace transform of $\frac{p^2}{p^4 - 4a^4}$.

Q.5 Solve ordinary differential equation by using Laplace transform $(D^2 + 1)\, y = t \cos 2t$

Given, $y = 0, \frac{dy}{dt} = 0$ when $t = 0$.

Q.6 Find the Fourier sine and cosine transform of –

$$f(t) = \begin{cases} t, & 0 < t < 1 \\ 2 - t, & 1 < t < 2 \\ 0, & t > 2 \end{cases}$$

Q.7 Find Z – transform of $n^2, n \geq 0$.

PART – C

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

Attempt any four questions

Q.1 (a) Use Gauss forward interpolation formula to find f(128) from given data. [7]

x	120	125	130	135	140
f(x)	49225	48316	47236	45926	44306

(b) Find the value of integral $\int_{0.2}^{1.4}(\sin x - \log_e x + e^x)\,dx$ using Simpsons 3/8 rule by dividing range into 6 equal parts. [8]

Q.2 (a) Find real root of equation $x^3 - 3x - 5 = 0$ corrected upto 4 decimal place using Newton–Raphson method. [7]

(b) Compute y(1.4), using fourth order Runge–Kutta method with step size h = 0.2 given $\frac{dy}{dt} = \frac{t}{y}$, y(1) = 2. [8]

Q.3 (a) Evaluate Laplace Transform of function $\sin at - at\cos at + \frac{\sin t}{t}$. [5]

(b) An infinite long string having one end x = 0 is initially at rest on the x – axis. The end x = 0 undergoes a periodic transverse displacement given by $A_0 \sin \omega t$, t > 0. Find the displacement of any point on the string at any time. [10]

Q.4 (a) Find the Fourier cosine transform of e^{-t2}. [7]

(b) Find inverse Fourier sine transform of $\frac{p}{1+p^2}$. [8]

Q.5 Find inverse Z – transform of $F(z) = \frac{1}{(z-2)(z-3)}$ if region of convergence is –

(a) |z| < 2 [5]

(b) 2 < |z| < 3 [5]

(c) |z| > 3 [5]

3E1200

Roll No. _____

Total No. of Pages: 4

3E1200

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

Artificial Intelligence & Data Science

Managerial Economics and Financial Accounting

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 Define Managerial Economics.

Q.2 Define National Income.

Q.3 What do you mean by Law of Demand?

Q.4 Define price elasticity of demand.

Q.5 Define Production Function.

Q.6 What is opportunity cost?

Q.7 What do you mean by Monopoly?

Q.8 Define Financial Statement Analysis.

Q.9 What is Pay Back Period?

Q.10 Explain Debtors Turnover Ratio.

PART – B

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

Attempt any five questions

Q.1 Distinguish between deductive and inductive methods in Economics.

Q.2 Discuss the various concepts of national income – Gross National Products, Net National Products, Personal Income and Disposable Income.

Q.3 Explain the various methods of demand forecasting.

Q.4 Distinguish between monopolistic competition and perfect competition.

Q.5 Explain the degrees of price elasticity of demand.

Q.6 The following table gives the total cost schedule of the firm. It is also given that the Average Fixed Cost (AFC) at 4 units of output is ₹ 5.

Quantity (Q)	Total Cost (TC)
1	50
2	65
3	75
4	95
5	130
6	185

Find the Total Variable Cost (TVC) and Total Fixed Cost (TFC) schedules of the firm for the corresponding values of output.

Q.7 Define Balance Sheet. Give two characteristics of balance sheet.

PART – C

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

Attempt any three questions

Q.1 The following is the Balance Sheet of Riddhima Motors -

Balance Sheet as on 31st March, 2022

Liabilities	₹	Assets	₹
Equity Share Capital	2,00,000	Fixed Assets	4,60,000
Preference Share Capital	1,00,000	Investments (Long Term)	15,000
General Reserve	50,000	Stock	50,000
Profit & Loss Account	70,000	Debtors	20,000
Debentures	1,00,000	Cash	15,000
Creditors	30,000		
Bank Overdraft	10,000		
	5,60,000		**5,60,000**

Calculate the following ratios :

(a) Current Ratio (b) Liquid Ratio/Quick Ratio (c) Debt Equity Ratio (d) Proprietary Ratio

(e) Solvency Ratio

Q.2 Discuss the nature and scope of Managerial Economics.

Q.3 Explain the Law of Variable Proportions. Explain various stages of this law with the help of diagram.

Q.4 How the price and output is determined under perfect competition during short period?

Q.5 A company has to select one of the two alternative projects whose particulars are given below -

	Project A (₹)	Project B (₹)
Initial Investment/Initial Outlay	1,18,720	1,00,670
Net cash inflow at the end of the year :		
1	1,00,000	10,000
2	20,000	10,000
3	10,000	20,000
4	10,000	1,00,000

The company can arrange necessary fund at 10%. Compute Net Present Value (NPV) of each project and comment on the result.

The PV factor of ₹ 1 received at the end of each year at 10% discount rate are as follows -

Year	1	2	3	4
10%	0.909	0.826	0.751	0.683

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(3)

3E1103

Roll No. _____ Total No. of Pages: 2

3E1103

B. Tech. III - Sem. (Back) Exam., February - 2023
HSMC Aeronautical Engineering
3AN1-03 Managerial Economics & Financial Accounting
All branches

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

(Answer should be given up to 25 words only) **[5×2=10]**

All questions are compulsory

Q.1 What do you mean by Economic?

Q.2 Define Law of Supply.

Q.3 Define production function.

Q.4 What you mean by perfect competition?

Q.5 What is capital budgeting?

PART – B

(Analytical/Problem solving questions) **[4×10=40]**

Attempt any four questions

Q.1 Discuss the scope of Managerial Economics.

Q.2 Explain Law of Demand.

Q.3 Explain the relationship between Average Cost (AC) and Marginal Cost (MC).

Q.4 Distinguish between monopoly and perfect competition.

Q.5 Write five merits and demerits of inductive and deductive methods.

Q.6 Explain the significance of ratio analysis.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 Explain the methods of measuring National Income.

Q.2 How the price and output is determined under monopoly during short period?

Q.3 A Ltd. is considering investing in a project requiring a capital outlay of ₹ 1,00,000. Forecast of annual income after depreciation but before tax is as follows -

Year	1	2	3	4	5
Amount	50,000	50,000	40,000	40,000	20,000

Depreciation may be taken at 20% on original cost and income tax at 50% of net income. Evaluate the project using pay-back method and Average Rate of Return (ARR).

3E1207

Roll No. _____ Total No. of Pages: 4

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.

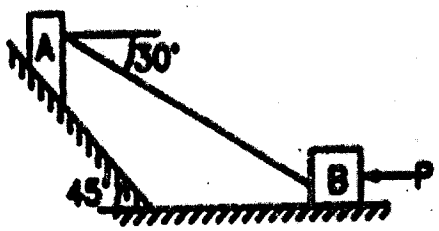
Q.7 Describe (i) Worm and worm wheel (ii) Conservation of angular momentum

PART – C

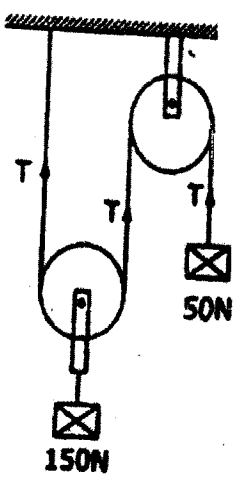
(Descriptive/Analytical/Problem Solving/Design Questions) **[3×10=30]**

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.



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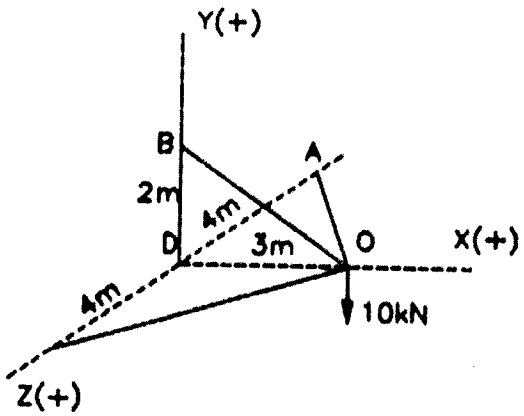
Q.3 Two weights of 50 N and 10 N are connected by a weightless string which passes over a smooth pulley. The weight 10 N is resting on an inclined plane which makes an angle of 20° with horizontal and another weight 50 N hangs vertically downwards. Find the acceleration of the system, tension in the 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.

3E1116

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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?

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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.

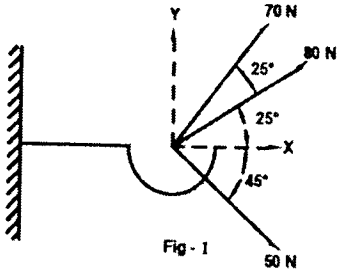

Fig - 1

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.

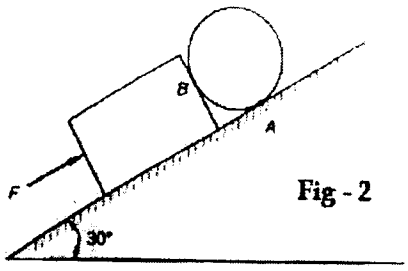

Fig - 2

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.

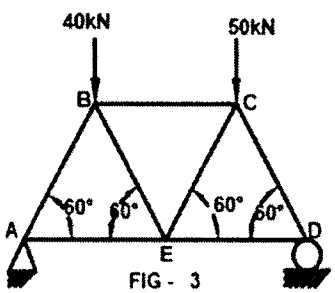

FIG - 3

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

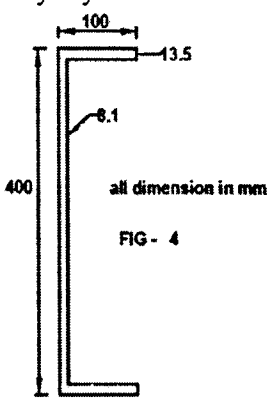

FIG - 4

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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 m^3 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.

3E1117

125

Total No. of Questions: Total No. of Pages: 2

Roll No. _____

B.Tech. III-Sem (Back) Jan. Feb. 2023
Automobile Engineering
3AE4-05 Engineering Thermodynamics
3E1117
AE,ME

Time: 3 Hours **Maximum Marks: 120**
Min. Passing Marks: 42

Attempt all ten questions from Part A, five question out of seven from Part B and four questions out of five from Part C.
Schematic diagrams must be shown wherever necessary. Any data you feel missing 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 Table and Mollier Diagram 2. NIL

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

Q.1 What is a thermodynamic cycle?
Q.2 What are intensive and extensive properties?
Q.3 What is the zeroth law of thermodynamics?
Q.4 State the first law for a closed system undergoing a change of state.
Q.5 What is a cyclic heat engine?
Q.6 Give the criteria of reversibility, irreversibility and impossibility of a thermodynamic cycle.
Q.7 What is available energy and unavailable energy?
Q.8 What is a pure substance? What do you understand by triple point?
Q.9 What do you understand by the mean temperature of heat addition?
Q.10 What is the application of the closed cycle gas turbine plant?

10 × 2 = 20

Part B(Analytical/Problem solving questions)
Attempt any Five questions

Q.1 A gas undergoes a thermodynamic cycle consisting of three processes beginning at an initial state where p_1= 1 bar, V_1= 1.5 m^3 and U_1= 512 kJ. The processes are as follows: (i) Process 1-2: Compression with pV = constant to p_2 = 2 bar, U_2 = 690 kJ (ii) Process 2-3: W_{23} = 0, Q_{23} = -150 kJ, and (iii) Process 3-1: W_{31} = +50 kJ. Neglecting KE and PE changes, determine the heat interactions Q_{12} and Q_{31}.

Q.2 Give a general expression for the first law of Thermodynamics which is applicable to a control volume. From this expression, deduce the simplified expression for following devices

: (i) Condenser (ii) Throttling valve (iii) Compressor. State the assumptions made in each case.

Q.3 A Carnot heat engine receives heat at 750 K and rejects the waste heat to the environment at 300 K. The entire work output of the heat engine is used to drive a Carnot refrigerator that removes heat from the cooled space at -15°C at a rate of 400 kJ/min and rejects it to the same environment at 300 K. Determine (a) the rate of heat supplied to the heat engine and (b) the total rate of heat rejection to the environment.

Q.4 State the principle of increase of entropy. Show that the mixing of two fluids is an irreversible process.

Q.5 Explain Joule-Kelvin effect and the inversion temperature. Why Joule-Thomson coefficient is zero for an ideal gas?

Q.6 Steam at 10 bar and 300 °C is cooled under constant pressure until the steam becomes 0.8 dry. Determine the initial and final specific volume and heat transfer per kg of steam.

Q.7 Derive an expression for the efficiency of Ideal Brayton cycle. Also derive an expression for the optimum pressure ratio for the maximum specific output of Brayton cycle

$5 \times 8 = 40$

Part C(Descriptive/Analytical/Problem Solving/Design questions)
Attempt any four questions

Q.1 Steam at a pressure of 1.4 MPa, 300 ° C is flowing in a pipe. Connected to this pipe through a valve is an evacuated tank. The valve is opened and the tank fills with steam until the pressure is 1.4 MPa, and then valve is closed. The process takes place adiabatically and kinetic energies and potential energies are negligible. Determine the final temperature of the steam.

Q.2 Derive the general expression for the maximum work of an open system which exchanges heat only with the surroundings.

Q.3 Write down the first and second *TdS* equations and derive the expression for the difference in heat capacities, C_p and C_v. What does this expression signify?

Q.4 In an air standard Otto cycle, the compression ratio is 7 and compression ratio begins at 300 K, 1 bar. The maximum temperature of the cycle is 1380 K. Determine (i) temperature and pressure at the cardinal points of the cycle (ii) heat supplied per kg of air (iii) the work done per kg of air (iv) the cycle efficiency (v) the m.e.p. of the cycle

Q.5 With the help of schematic diagram and T-s diagram, describe the various processes of Rankine cycle along with the effect of operating conditions on its efficiency. Explain the thermodynamic advantages of cogeneration plant briefly.

$4 \times 15 = 6$

127

3E1633

Roll No. _____ Total No. of Pages: 4

3E1633

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

Automobile Engineering

3AE3A Engg. Thermodynamics

AE, ME, PI

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing 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

UNIT- I

Q.1 (a) Write short notes on the following: [8]

(i) Open system and Closed system

(ii) Intensive and Extensive Properties

(iii) Thermodynamic System

(iv) Point function and Path function

(b) Air flows steadily at the rate of 0.4 kg/sec through an air compressor entering at 6 m/s with a pressure of 1 bar, specific volume 0.85 m^3/kg and leaving at 4.5 m/s, pressure of 7 bar and specific volume 0.16 m^3/kg. The internal energy of the air leaving is 90 greater than that of air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 60 kJ/sec. Calculate the following. [8]

(i) Power required to drive the compressor in kW

(ii) Ratio of inlet pipe diameter to outlet pipe diameter

OR

Q.1 (a) Give a general expression for the First Law of Thermodynamics which is applicable to a control volume. From this expression, deduce the simplified expression for following devices: [8]

(i) Turbine

(ii) Nozzle

(iii) Boiler

State the assumptions made in each case.

(b) Air initially at 0.75 bar, 1000 K occupying a volume of 0.12 m^3 undergoes two processes. The air is compressed isothermally until the volume is halved, then it undergoes a constant pressure process until the volume is halved again. Assuming the ideal gas behaviour, Sketch the process on p-v diagram and determine - [8]

(i) the total work for the two processes

(ii) the total heat transfer for the two processes

UNIT- II

Q.2 (a) State Kelvin Planck Statement and Clausius statement of Second Law of Thermodynamics. Prove that these statements are equivalent. [8]

(b) Prove that for a polytropic process, the change of entropy is given by - [8]

$$s_2 - s_1 = \frac{\gamma - n}{\gamma - 1} R. \ln \left(\frac{v_2}{v_1}\right)$$

where, the symbols have their usual meanings.

OR

Q.2 (a) Explain the various process of Carnot cycle with the help of schematic diagram. Draw its P-v and T-s diagram and state the Carnot Corollaries. [8]

(b) Calculate the decrease in available energy when 25 kg of water at 95°C mix with 35 kg of water at 35°C, the pressure being taken as constant and the temperature of the surroundings being 15°C (c_p of water = 4.2 kJ/ kg K). [8]

UNIT- III

Q.3 (a) What do you understand by triple point? Draw the phase equilibrium diagram on p-v and p-T coordinates for a substance which shrinks in volume on melting and then for a substance which expends in volume on melting. [8]

(b) A mass of 0.25 kg of an ideal gas has a pressure of 300 kPa, a temperature of 80°C, and a volume of 0.07 m^3. The gas undergoes an irreversible adiabatic process to a final pressure of 300 kPa and final volume of 0.10 m^3, during which the work done on the gas is 25 kJ. Evaluate the c_p and c_v of the gas and the increase in entropy of the gas. [8]

OR

Q.3 (a) Write a short note on (any two) - [8]

(i) Pure substance and concept of phase

(ii) Ideal gas and Real gas

(iii) Gibb's Dalton law

(b) One kg of steam undergoes a reversible isothermal process from 5 bar, 200°C to a pressure of 10 bar. Calculate the heat-flow and the work done. Show the process on T-s diagram. [8]

UNIT- IV

Q.4 (a) Write down the first and second TdS equations and derive the expression for the difference in heat capacities, C_p and C_v. What does this expression signify? [7]

(b) In an air standard diesel cycle, the pressure and temperature of the air at the start of the compression and 1 bar and 330 K respectively. The compression ratio is 16 and the energy added at constant pressure is 1250 kJ/ kg. Determine the following-

(i) Maximum pressure and temperature of the cycle [9]

(ii) Air standard efficiency

(iii) Specific volume at the start of compression

(iv) Specific volume at the end of compression

OR

Q.4 (a) With the help of Maxwell relations TdS equation show that the internal energy of an ideal gas are function of temperature only. [8]

(b) Derive an expression for the air standard efficiency for ideal Brayton cycle. Show the cycle on P-v and T-s diagram. [8]

UNIT- V

Q.5 (a) With the help of component diagram, and T-s diagram, explain the various processes of Simple Rankine cycle. [8]

(b) Discuss the characteristics of an ideal working fluid in vapour power cycles. [8]

OR

Q.5 (a) How condenser pressure, boiler pressure and superheating affect the efficiency of Rankine cycle? What is cogeneration plant and what are the thermodynamic advantages of such plant? [8]

(b) Why is Carnot cycle not practicable for a steam power plant? What is the effect of regeneration on the - [8]

(i) specific output

(ii) mean temperature of heat addition

(iii) cycle efficiency

(iv) steam rate

3E1209

Roll No. _____ Total No. of Pages: 3

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 o 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

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3E1118

Roll No. _____ Total No. of Pages: 2

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

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3E1632

Roll No. _____ Total No. of Pages: 3

3E1632

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

Automobile Engineering

3AE2A Material Science and Engg.

AE, ME, PI

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing 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

UNIT- I

Q.1 (a) Describe Bravis crystal system and unit cells. [8]

(b) Discuss and differentiate slip and twinning mechanism of deformation. [4]

(c) What is strain hardening? Explain with suitable diagram. [4]

OR

Q.1 (a) Explain recovery, recrystallization and grain growth with suitable diagram. [8]

(b) Draw miller planes for the following indices (T O T) and (121). [4]

(c) Describe line defects. [4]

UNIT- II

Q.2 (a) Explain equilibrium diagram of binary system with limited solid solubility of terminal phase. [8]

(b) What is allotropic property of material? Explain with examples. [4]

(c) Discuss Gibb's phase rule. [4]

OR

Q.2 (a) Draw and explain iron-carbon diagram and explain its micro constituents. [8]

(b) Explain mechanism of nuclear formation and crystal growth during crystallization. [8]

UNIT- III

Q.3 (a) Draw and explain T-T-T curve, also discuss its micro constituents. [8]

(b) Explain full annealing, stress relieving, spherodizing and process annealing. [8]

OR

Q.3 Discuss the following heat treatment process - [4×4=16]

(a) Normalizing

(b) Hardening

(c) Austempering

(d) Nitriding

UNIT- IV

Q.4 (a) Discuss the properties and applications of PE, PP, PVC and PPS polymers. [8]

(b) Discuss the effect of alloying following metals in steel: Mn, Cr, Si, V and W. [8]

OR

Q.4 Explain the following - [4×4=16]

(a) Stainless steel

(b) Tool Steel

(c) HSLA Steel

(d) Substitutional and interstitial solutions

UNIT- V

Q.5 Explain the followings - [4×4=16]

(a) Management of hardness using Brinell hardness tester.

(b) Classify steel as per its constitution and discuss their properties.

(c) Properties and application of Al_2O_3, SiC ceramic materials.

(d) Nano structure materials.

OR

Q.5 Discuss the followings - [4×4=16]

(a) Measurement of input strength using Izod tester

(b) Different kind of fractures

(c) Fiber and particulate reinforced composites

(d) Nano crystals

3E1210

Roll No. _____ Total No. of Pages: 4

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

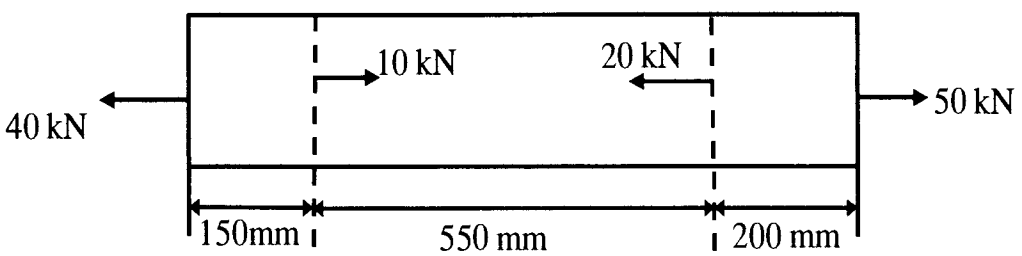


Fig.1

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:

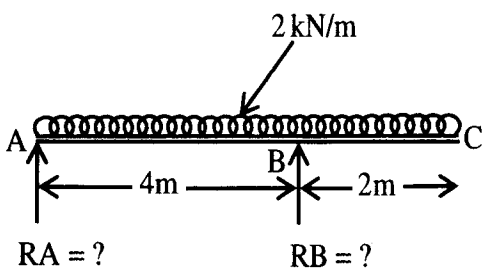


Fig - 2

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.

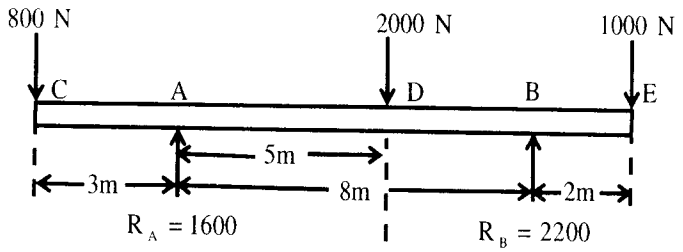


Fig. 3

Q.4 A rectangular block of material is subjected to a tensile stress of 110N/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.

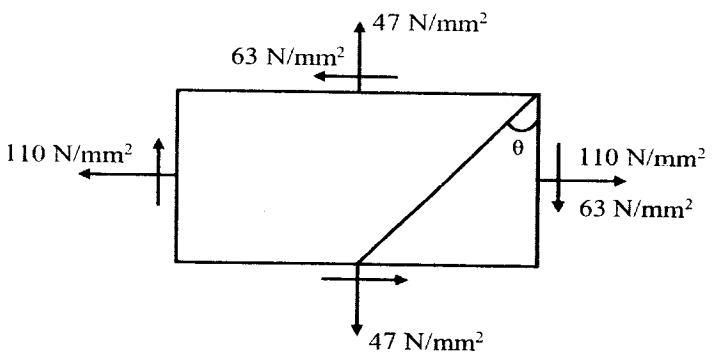


Fig. 4

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

1/4/5

3E1119

Roll No. _____ Total No. of Pages: 4

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?

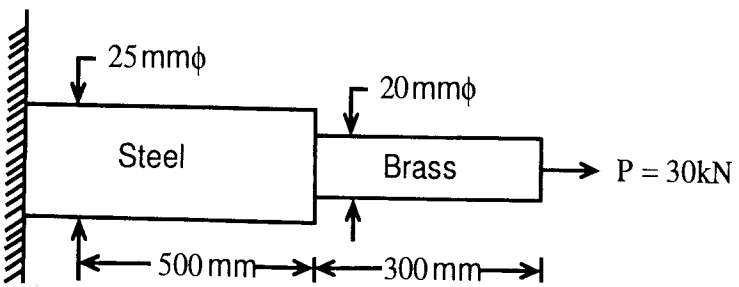
Q.10 Write down the expressions for slope and deflection of a cantilever beam subjected to point load at free end.

PART – B

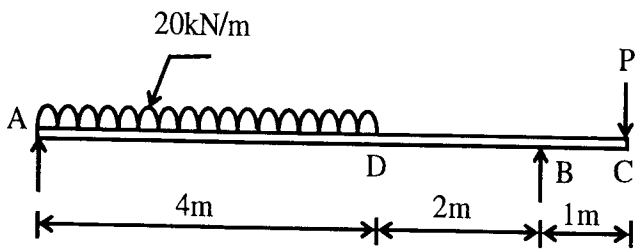
(Analytical/Problem solving questions) **[5×10=50]**

Attempt any five questions

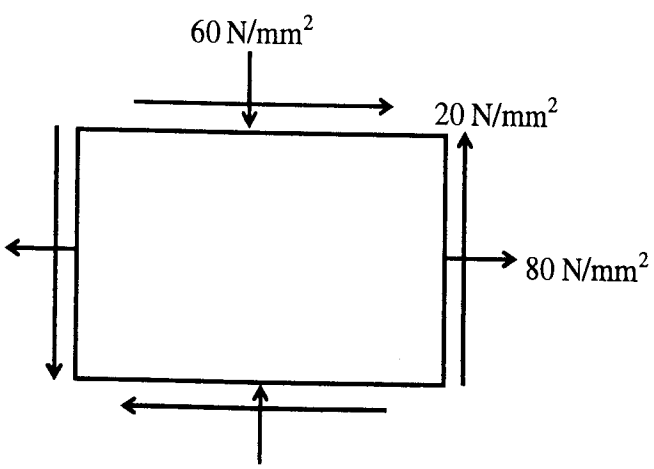
Q.1 The composite bar shown in figure is subjected to a tensile of 30kN. The extension observed is 0.44. Determine the Young's modulus of brass, if Young's modulus of steel is 2×10^5 N/mm2.



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.

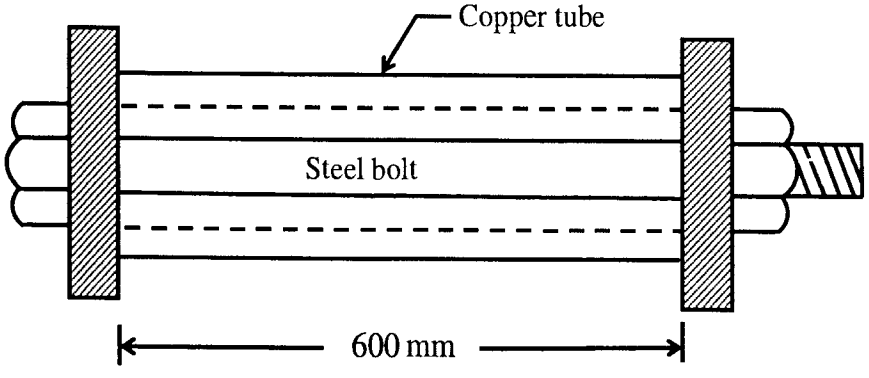
Q.7 A spherical shell of 1.20 m internal diameter and 6 mm thickness is filled with water under pressure until the volume is increased by 400×10^3 mm^3. Determine the pressure exerted by water on the shell. Take E=204 GPa and ν=0.3.

PART – C

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

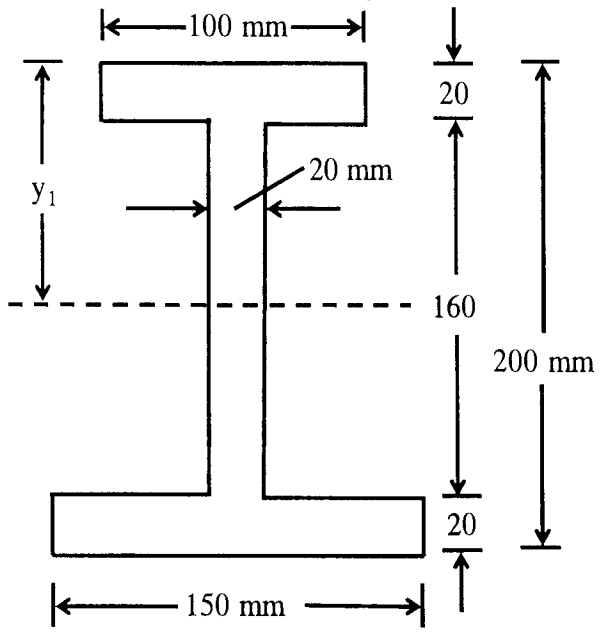
Attempt any four questions

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.

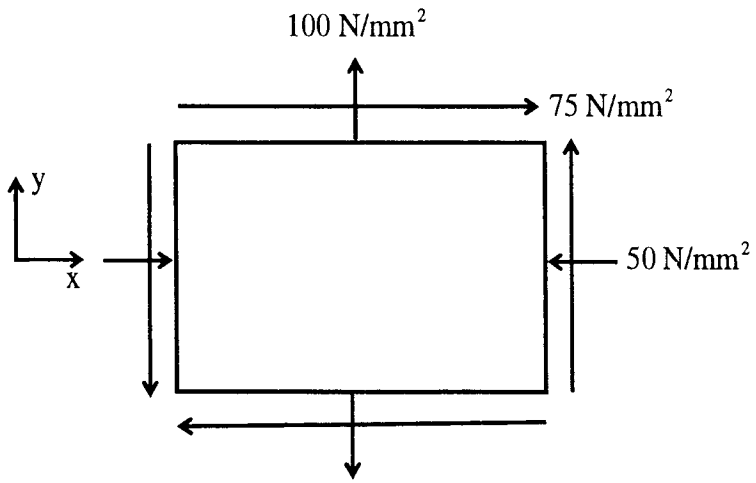


Q.2 Derive the expressions for slope and deflection at the ends of a simply supported beam of length l subjected to uniformly distributed load w(UDL) on whole span using double integration method.

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.

3E1631

Total No. of Questions: Total No. of Pages:

Roll No. _____

B.Tech. III-Sem (Back)
Aeronautical Engg.
3AN1 Mechanics of Solids
AE,ME,PI,AN
3E1631

Time: 3Hours Maximum Marks: 80
Min Passing Marks: 24

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing 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_____ 2. _____

UNIT-I

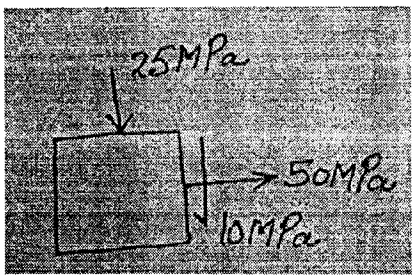
Q. 1 Prove $G= E/2(1+\vartheta)$. Here, G is the modulus of rigidity, E is the modulus of elasticity and Poisson`s ratio is represented by ϑ. (16)

OR

Q. 1 Prove $K = E/3(1-2\ \vartheta)$. Here, K is the bulk modulus, E is the modulus of elasticity and Poisson`s ratio is represented by ϑ. (16)

UNIT-II

Q. 2 Calculate followings
(i) principal stresses and their associated planes
(ii) maximum shear stress and its orientation



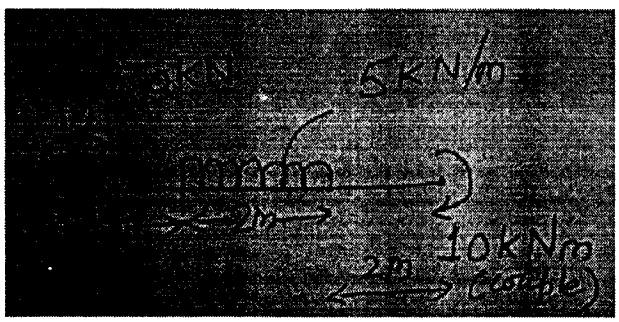
(16)

OR

Q. 2 Explain followings
(i) Equivalent twisting and bending moments
(ii) Theories of failure (any two) (16)

UNIT-III

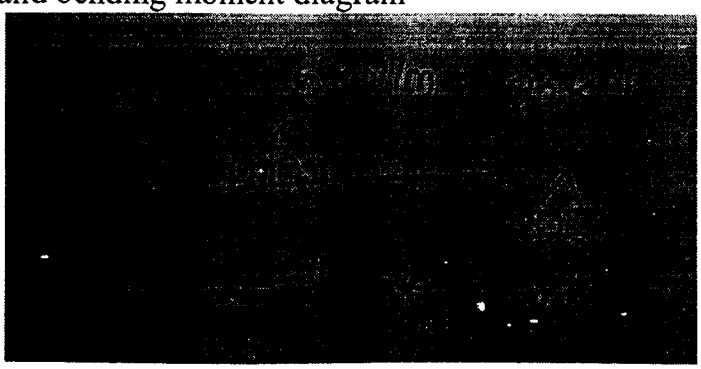
Q. 3 Draw shear force and bending moment diagram for following



(16)

OR

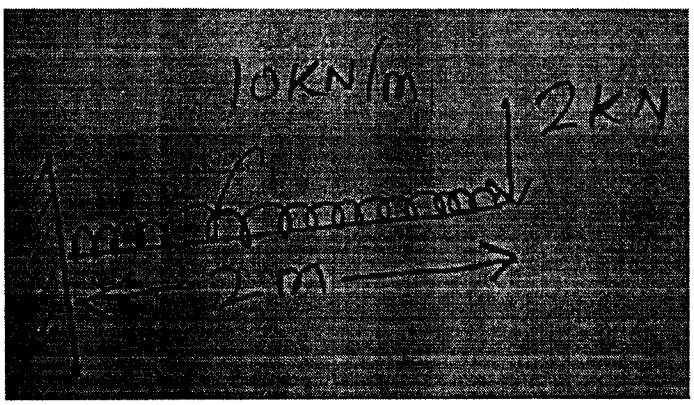
Q.3 Draw shear force and bending moment diagram



(16)

UNIT-IV

Q.4 A cantilever beam of length 2m fails when a point load of 2KN is applied at the free end and uniformly distributed load 10 kN/m applied over the whole span. If the section is 40mmx60mm, find the stress at the failure. You may consider bending effects only.



(16)

OR

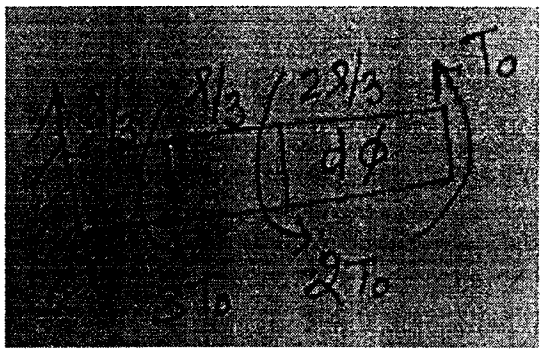
Q. 4 A beam is simply supported and carries a uniformly distributed load of 40KN/m run over the whole span. The section of the beam is rectangular having depth as 500mm. If the maximum stress in the material of the beam is $120N/mm^2$ and moment of inertia of the section is $7x10^8mm^4$, find the span of the beam. You may consider bending effects only.

(16)

UNIT-V

Q. 5 (i) Calculate angle of twist at free end for following figure. Use

T_o = 5 kNm, d = 50 mm, l = 3m and modulus of rigidity (G) = 80 GPa.



(12)

(ii) Why hollow shaft is preferred than solid shaft for the power transmission? (4)

OR

Q. 5 (i) Derive Euler's formula for crippling load for columns having both ends hinged. (12)

(ii) What do you mean by buckling? (4)

3E1635

Roll No. _____ Total No. of Pages: 2

3E1635

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

Aeronautical Engineering

3AN5 Object Oriented Programming in C++

AE, ME, AN

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing 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

UNIT- I

Q.1 Explain the basic concepts of object oriented programming. [16]

OR

Q.1 (a) Explain the uses of scope resolution operator and memory management operators. [8]

(b) Explain pass-by-reference parameter passing mechanism with suitable example. [8]

UNIT- II

Q.2 (a) What are arrays? Explain different types of arrays with suitable examples. [8]

(b) What are pointers? Explain its declaration and initialization. [8]

OR

Q.2 (a) What are strings? Explain ANY FOUR predefined string functions. [8]

(b) Write a program that input a line of text and count and print the number of characters, words, vowels and consonants in the text. [8]

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UNIT- III

Q.3 (a) What are friend functions? Write its special characteristics. [8]

(b) What are constructors? Write its special characteristics. [8]

OR

Q.3 (a) Write a program to over load binary plus (+) operator to add two matrices of size 3×3 using member function. [8]

(b) Explain different types of inheritance. [8]

UNIT- IV

Q.4 (a) What are templates? Explain class templates and functions templates. [8]

(b) What are containers? Explain different types of container classes. [8]

OR

Q.4 (a) Explain different methods for opening a file with suitable examples. [8]

(b) Explain the following member functions for I/O operations on files – [8]

(i) put ( ) (ii) get ( ) (iii) Write ( ) (iv) read ( )

UNIT- V

Q.5 Write a program in C++ to create a singly linked list and perform the following operations – [16]

(a) Traverse the linked list

(b) Insert a node at begin

(c) Insert a node after a given node

OR

Q.5 Write a program in C++ to perform the following operations on queue – [16]

(a) Insert

(b) Delete

(c) Display
