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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: ME210

Course Name: METALLURGY AND MATERIALS ENGINEERING (MA,ME,MP)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10marks. Marks

1	a)	Sketch within a cubic unit cell the following planes (1 1 $\bar{1}$), (1 $\bar{1}$ 0), (0 0 1) and directions [1 1 1], [1 0 1]	(5)
	b)	Calculate the radius of iridium atom, having FCC crystal structure, a density of 22.4 gm/cc and atomic weight of 192.2 gm/mol.	(5)
2	a)	What is a slip system? Describe the slip systems in FCC, BCC and HCP metals	(6)
	b)	What is the minimum cation to anion radius ratio for a coordination number of 8 is 0.732?	(4)
3	a)	Differentiate between edge dislocation and screw dislocation with neat sketches	(6)
	b)	Explain vacancy diffusion and interstitial diffusion with neat sketches.	(4)
4	a)	Describe working of SEM with a neat sketch.	(8)
	b)	Define grain size number.	(2)

PART B

Answer any three full questions, each carries 10marks.

5		Describe the changes in microstructure with suitable sketch, when cooled slowly from austenite to room temperature for i) Hypo eutectoid plain carbon steelsii) Eutectoid plain carbon steels iii) Hyper eutectoid plain carbon steels	(10)
6		What is hardenability? Describe hardenability test. What are the factors affecting hardenability?	(10)
7		Give the microstructure, composition, properties and applications of i) Gray Cast Iron ii) Malleable cast iron.	(10)
8		Explain thestages of age hardening of aluminium alloys.	(10)

PART C

Answer any four full questions, each carries 10marks.

9	a)	Distinguish between ductile and brittle fracture.	(4)
	b)	What is ductile to brittle transition in steel DBTT? What are the factors affecting ductile to brittle transition?	(6)
10		Explain the process of crack initiation and crack propagation in fatigue.	(10)
11	a)	Explain how fatigue limit of a ferrous material is determined.	(6)
	b)	Explain notch sensitivity index in fatigue.	(4)
12		Write short note on i) Shape memory alloys ii) Super alloys.	(10)
13	a)	Define creep. Explain different stages of creep.	(6)
	b)	What is superplasticity?	(4)
14	a)	List two applications of composites. Differentiate between particle reinforced and fibre reinforced composites	(6)
	b)	What is composite biomaterial? Give example.	(4)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: ME205

Course Name: THERMODYNAMICS (MA, ME, MP, AN)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks. Marks

1 a) Define property of a system with any two examples. Why thermodynamic properties are taken as coordinates in thermodynamics? (3)

b) Explain free expansion? Why the displacement work is absent in free expansion? (4)

c) List any 6 applications of thermodynamics. (3)

2 a) What is PMM1? Why it is not possible? (3)

b) Define enthalpy. Prove that for ideal gas enthalpy is a function of temperature alone. (3)

c) Explain the working of thermocouple with neat sketch. (4)

3 a) A rigid tank of $2m^3$initially contains air at 100kPa and 25^0C. The tank is connected to a supply line which contains air at 600kPa and 25^0C through a valve. The valve is opened and air is allowed to enter the tank until the pressure in the tank reaches the line pressure at which the valve is closed and the temperature of the air inside the tank at this instant measures 80^0C. Determine (a) the mass of air that has entered the tank and (b) the amount of heat transfer. (6)

b) What is total energy of a system? Prove that total energy is thermodynamic property of a system. (4)

4 a) Derive steady flow energy equation. (5)

b) In an adiabatic gas turbine, air expands at 1200kPa and 500^0C to 100kPa and 150^0C. Air enters the turbine with a velocity of 40m/s through an opening of area $0.2m^2$ and exhausts through a $1m^2$ opening. Determine (a) mass flow rate of air through the turbine and (b) the power produced by the turbine. (5)

PART B

Answer any three full questions, each carries 10 marks.

5 a) Give two statements of second law of thermodynamics and prove its equivalence (5)

b) State and explain principle of increase of entropy. Discuss its physical significance. (5)

6 a) State and prove Clausius inequality. (6)

b) What is meant by (i) exergy (ii) dead state (iii) availability (4)

7 a) State and prove Carnot's theorem. (5)

b) Define dryness fraction. Draw the p-v-T surface of a substance that contracts on freezing. (5)

8 Derive the expression for availability of flow process. (10)

PART C

Answer any four full questions, each carries 10 marks.

9 a) What are reduced properties? State the law of corresponding states? (4)

b) A $0.5m^3$ rigid tank containing Hydrogen at 20^0C and 400kPa is connected by a valve to another $0.5m^3$ rigid tank that holds Hydrogen at 50^0C and 150kPa. Now the valve is opened and the system is allowed to reach thermal equilibrium with the surroundings, which are at 15^0C. Determine the final pressure in the tank and the amount heat transferred to the surrounding. Take γ=1.38 (6)

10 a) The volumetric analysis of mixture of gases is 30 percent Oxygen, 40 per cent Carbon dioxide and 30 percent Nitrogen. The mixture is heated from 20^0C to 200^0C while flowing through a pipe in which the pressure is maintained at 150kPa. Determine the heat transfer to the mixture per unit mass of the mixture. Take C_p values of Oxygen, Carbondioxide and Nitrogen as 0.918, 0.846 and 1.039kJ/kg K. (6)

b) What is virial expansion? Explain the term compressibility factor. (4)

11 a) What is Kay's rule? Give its importance. (4)

b) Explain law of partial pressures and Amagat's law of additive volumes for the mixture of ideal gases. (6)

12 a) Comment on the physical significance of Clasius- clapeyron equation. (4)

b) Define Gibbs and Helmholtz function. Give its significance on chemical reaction. (6)

13 a) What are Maxwell's equations? Also derive TDS equations. (5)

b) Define Joule-Thomson coefficient. What is its significance? Determine its value for an ideal gas. (5)

14 a) Define equivalence ration. What is its significance? (4)

b) Explain (i) enthalpy of combustion and (ii) enthalpy of formation. (6)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: ME203

Course Name: MECHANICS OF FLUIDS (ME)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks. Marks

1 a) Differentiate between ideal fluids and real fluids. Mark those on rheological diagram. (4)

b) A plate weighing 150N and measuring 0.8mx0.8m slides down an inclined plane over an oil film of 1.2mm thickness for an inclination of 30° and a velocity of 0.2m/s. Compute the dynamic viscosity of the fluid. (6)

2 a) What is metacentre? Explain the equilibrium conditions of floating bodies. (4)

b) A triangular plate of base width 2m and height 3m is immersed in water with its plane making an angle of 60° with the free surface of water. Determine the hydrostatic pressure force and the centre of pressure when the apex of the triangle lies 5m below the free water surface. (6)

3 a) Explain the working principle and use of the following devices. (6)
i) Hydraulic lift ii) Piezometer iii) Bourden tube pressure gauge

b) Differentiate between rotational and irrotational fluid flow. (4)

4 a) Define the following with example. (4)
i) Stream lines ii) Stream tube iii) Path lines iv) Streak lines

b) The stream function for a flow field is given by $\psi = 2xy$. Check whether the flow is continuous or irrotational. (6)

PART B

Answer any three full questions, each carries 10marks.

5 a) Derive Euler's equation of motion. Obtain Bernouli's equation from Euler's equation. (6)

b) What are the applications and limitations of Bernouli's equation? (4)

6 a) What is Venturimeter? Derive an expression for discharge through a venturimeter. (6)

b) Water flows at the rate of 15litre/s through a pipe 100mm diameter orifice used in a 200 mm diameter pipe. What is the difference of pressure head between upstream section and vena contracta section? Take coefficient of contraction as 0.6 and coefficient of velocity as 1. (4)

7 a) Differentiate between laminar and turbulent flows. (4)

b) Derive Darcy- Weisbach equation. (6)

8 a) Explain the causes of major and minor energy losses in pipe flows. (4)

b) Glycerine flows at a velocity of 5m/s in a 10cm diameter pipe. Dynamic viscosity and density of glycerine is assumed as 1.50Pa.s and 1260kg/m^3 respectively. Estimate: i) The boundary shear stress in the pipe due to the flow. (6)
ii) Head loss in a length of 10m of pipe.
iii) Power developed by the flow in a distance of 10m.

PART C

Answer any four full questions, each carries 10marks.

9 Determine the displacement thickness, momentum thickness and energy thickness in terms of normal boundary layer thickness δ in respect of the following velocity profile in the boundary layer on a flat plate $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ where u is the velocity at height y above plate surface and U is the free stream velocity. (10)

10 Obtain Von – Karman momentum integral equation from conservation principles. (10)

11 a) Derive an expression for i) displacement thiekness and ii) momentum thickness. (6)

b) A 2.5m ship model was tested in fresh water (ρ=1000kg/m^3) and measurements indicated that there was a resistance of 45N when the model was moved at 2m/s. Work out the velocity of 40m prototype. Also calculate the force required to drive the prototype at this speed through sea water (ρ =1025kg/m^3). (4)

12 a) Define the following: i) boundary layer thickness ii) displacement thickness iii) momentum thickness and iv) energy thickness. (4)

b) Explain: i)Geometric similarity ii)Kinematic similarity iii) Dynamic similarity. (6)

13 Show that the power P developed in a water turbine can be expressed as: $P = \rho N^3 D^5 \Phi\left\{\frac{D}{B}, (\rho D^2 N)/\mu, \frac{H}{D}, ND/\sqrt{gH}\right\}$ where D and B are diameter and width of runner, N is the speed in rpm; H is the operating head, μ and ρ are respectively the coefficient of dynamic viscosity and mass density of the liquid. (10)

14 Define the following dimensionless number with their field of application: (10)
i) Froude Number ii) Weber Number iii) Newton number iv) Mach number

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: ME201

Course Name: MECHANICS OF SOLIDS (ME,MP,MA,MT,AU,PE,SF)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10marks. Marks

1 a) Explain Hooke's law for linearly elastic isotropic material. (3)

b) A steel tie rod 40 mm in diameter and 2 m long is subjected to a pull of 80kN. To what length the bar should be bored centrally so that the total extension will increase by 20% for the same pull, the bore being 20 mm in diameter. Take E = 2 x 10^5 N/mm^2. (7)

2 a) Define the terms resilience and proof resilience. (3)

b) A copper strip 20 x 2.5 mm^2 in section is held between two strips of steel each 20 x 2.5 mm^2 in section. Find the stresses in steel and copper due to temperature rise of 6°C. Take α_s = 1.2 x 10^{-5} / °C, α_c = 1.85 x 10^{-5} / °C, E_s = 2 x 10^5 N/mm^2 and E_c= 1.2 x 10^5 N/mm^2. (7)

3 a) Define Poisson's ratio. (2)

b) A bar of circular cross section 20 mm diameter is subjected to an axial compressive load of 100 kN. The increase in diameter is found to be 0.0082 mm. Calculate the values of Poisson's ratio and modulus of elasticity. Take modulus of rigidity as 8 x 10^4 N/mm^2. (8)

4 A solid aluminium shaft 1 m long and 50 mm diameter is to be replaced by a tubular steel shaft of the same length and the same outside diameter such that each of the two shafts could have the same angle of twist per unit torsional moment over the total length. What must the inner diameter of the tubular steel shaft be? Modulus of rigidity of the steel is three times that of aluminium. (10)

PART B

Answer any three full questions, each carries 10marks.

5 A simply supported beam ABC with supports at A and B, 5m apart with an overhang BC 2m long carries a uniformly distributed load of 20 kN/m over the whole length as shown in Fig.1. Draw S.F and B.M diagrams and locate the point of contraflexure. (10)

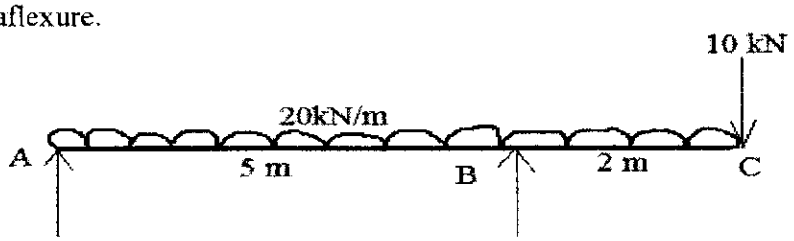

Fig. 1

6 a) What do you understand by the term 'point of inflection'? (2)

b) A simply supported beam of length 10 m carries a uniformly distributed load of 10 kN/m over a span length of 5 m from the left support. A point load of 15 kN and a moment of 10 kN-m are acting on the beam at a distance of 6.5 m and 8 m respectively from the left support. Draw the SF and BM diagrams. Find out the maximum bending moment and its location. (8)

7 Derive from fundamentals pure bending equation $\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$. Also state the important assumptions. (10)

8 The T shaped cross section of a beam shown in Fig. 2 is subjected to vertical shear force of 100 kN. Calculate the shear stress at the neutral axis and at the junction of the web and the flange. Moment of inertia about the horizontal neutral axis is 1.134 x 10^8 mm^4. (10)

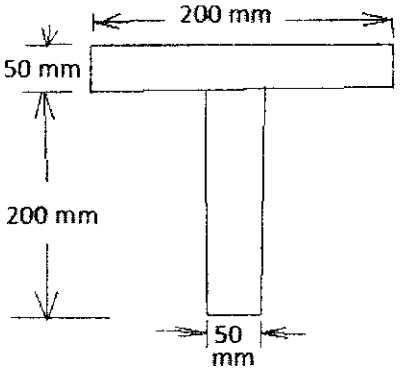

Fig. 2

PART C

Answer any four full questions, each carries 10marks.

9 A horizontal girder of steel having uniform section is 14 m long and is simply supported at its ends. It carries concentrated loads of 120 kN and 80 kN at two points 3 m and 4.5 m from the two ends respectively. I for the section of the girder is 16 x 10^8 $mm^4$and E_s = 210 kN/mm^2. Calculate the deflection of the girder at points under the two loads and maximum deflection using Macaulay's method. (10)

10 The principal stresses at a point are 200 N/mm^2 and 80 N/mm^2 both tensile. Find the normal, tangential and resultant stresses on a plane inclined at 55° to the direction of the major principal stress. (10)

11 A cantilever of uniform section has a length of AB = l, A is the free end and carries a point load W, while B is the fixed end. Find the deflection at a point C distant $\frac{l}{4}$ from the free end A. (10)

12 At a point in a bracket the stresses on two mutually perpendicular planes are 120N/mm^2 and 60 N/mm^2 both tensile. The shear stress across these planes is 30 N/mm^2. Find using the Mohr's stress circle the (10)
(i) principal stresses and
(ii) maximum shear stress at the point.

13 Derive Euler's buckling load for slender columns with one end fixed and other end hinged. (10)

14 Write short notes on the following: (10)
i) Stress and strain transformation ii) Compound stresses
iii) Rankine's crippling load for a column.

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: HS210

Course Name: LIFE SKILLS

Max. Marks: 50 Duration: 2 Hours

PART A

Answer all questions, each carries 6 marks. Marks

1	a)	What are the different levels of communication?	(3)
	b)	List and explain the different types of barriers in communication.	(3)
2	a)	How does six thinking hat method help in decision making?	(3)
	b)	Differentiate lateral thinking from vertical thinking. What are the four kinds of thinking tools used in lateral thinking?	(3)
3	a)	"A group focuses on individual contribution, while a team must focus on synergy." Explain.	(3)
	b)	Identify the type of group formed / constituted in each of the situations given below (i) An enquiry committee constituted to investigate a specific incident. (ii) The Engineering Department of a company. (iii) A group of members of a movie fans club.	(3)
4	a)	Compare and contrast Kohlberg theory and Gilligan's theory.	(4)
	b)	What ethical responsibilities does an engineer have towards the environment?	(2)
5		Explain the six styles of leadership.	(6)

PART B

Read carefully the following case and answer the questions given below, it carries 20 marks.

(Case study)

You are a trainee accountant in your second year of training within a small company. A more senior trainee has been on sick leave, and you are due to go on study leave. You have been told by your manager that, before you go on leave, you must complete some complicated reconciliation work. The deadline suggested appears unrealistic, given the complexity of the work. You feel that you are not sufficiently experienced to complete the work alone. You would need additional supervision to complete it to the required standard, and your manager appears unable to offer the necessary support. If you try to complete the work within the proposed timeframe but fail to meet the expected quality, you could face repercussions on your return from study leave. You feel slightly intimidated by your manager, and also feel pressure to do what you can for the practice in what are challenging times.

6	a)	Who are the affected parties in the above passage?	(1)
	b)	Identify relevant facts in the above situation.	(3)
	c)	Who should be involved in coming up with a solution to this problem?	(4)
	d)	Would it be right to attempt to complete work that is technically beyond your abilities, without proper supervision?	(4)
	e)	Can you refuse to perform the work without damaging your reputation within the practice?	(4)
	f)	What is the possible course of action that could be taken in this situation?	(4)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: MA201

Course Name: LINEAR ALGEBRA AND COMPLEX ANALYSIS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Find the points where Cauchy-Riemann equations are satisfied for the function $f(z) = xy^2 + i\,x^2\,y$. Where does $f'(z)$ exist? Is the function f(z) analytic at those points? (7)

b) If $v = e^x(x \sin y + y \cos y)$, find an analytic function f(z)=u+iv. (8)

2 a) Show that $u = x^2-y^2-y$ is harmonic. Also find the corresponding conjugate harmonic function. (7)

b) (i) Find a bilinear transformation which maps $(-i, 0, i)$ onto $(0, -1, \infty)$. (8)

(ii) Test the continuity at z = 0, if $f(z) = \frac{Im\, z}{|z|}, z \neq 0$

$= 0, z = 0$

3 a) Find the image of the lines x=1, y=2 and x>0, y<0 under the mapping $W= z^2$ (8)

b) Find the image of the semi-infinite strip $x > 0, 0< y < 2$ under the transformation w=iz+1. Draw the regions. (7)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Evaluate $\oint Re\, z^2 dz$ over the boundary C of the square with vertices 0, i, 1+ i,1 clockwise (8)

b) Evaluate $\int \frac{4-3z}{z(z-1)}$ dz over the circle $|z|=\frac{3}{2}$ (4)

c) Evaluate $\int \frac{3z^2+7z+1}{z+1}$ dz over the circle |z+ i |=1 (3)

5 a) Expand $\frac{z}{(z-1)(z-2)}$ in (1) $0<|z-2|<1$, (2) $|z-1|>1$ (8)

b) Evaluate $\int_0^{2\pi} \frac{1}{2+\cos\theta}\, d\theta$ (7)

6 a) Using Residue theorem evaluate $\int \frac{z^2}{(z-1)^2(z+2)}$ dz over the circle |z|=3 (7)

b) Find the Taylor series of $\frac{\sin z}{z-\pi}$ about the point $z= \pi$ (4)

c) Evaluate $\int \frac{\sin z}{z^6} dz$ over the circle |z|=2 using Cauchy's Residue theorem. (4)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Solve by Gauss-Elimination method x + y + z = 6, x+ 2y- 3z = -4, -x-4y+9z =18. (7)

b) Find the values of 'a' and 'b' for which the system of equations x + y + 2z =2, 2x-y+3z=10,5x-y+az=b has: (7)

(i) no solution (ii) unique solution (iii) infinite number of solutions.

c) Verify whether the vectors (1,2,1,2), (3,1,-2,1),(4,-3,-1,3) and (2,4,2,4) are linearly independent in R^4 . (6)

8 a) Write down the matrix associated with the quadratic form $8x_1^2+7x_2^2+3x_3^2-12x_1x_2 -8x_2x_3+4x_3x_1$. By finding eigen values, determine nature of the quadratic form. (7)

b) Diagonalise the matrix $A = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 0 & 2 \\ 0 & 2 & -1 \end{bmatrix}$ (7)

c) If A is a symmetric matrix, verify whether AA^T and A^TA are symmetric? (6)

9 a) Find the eigen vectors of $A = \begin{bmatrix} 3 & 0 & 0 \\ 5 & 4 & 0 \\ 3 & 6 & 1 \end{bmatrix}$ (8)

b) Find the null space of AX=0 if $A=\begin{bmatrix} 1 & 1 & 0 & 2 \\ -2 & -2 & 1 & -5 \\ 1 & 1 & -1 & 3 \\ 4 & 4 & -1 & 9 \end{bmatrix}$ (6)

c) Verify whether $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{bmatrix}$ is orthogonal. (6)

What can you say about determinant of an orthogonal matrix? Prove or disprove the result.

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