USN | | | | | | | | | | |

06MAT31

Third Semester B.E. Degree Examination, June-July 2009
Engineering Mathematics-III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Obtain Fourier series for the function

$$f(x)=\begin{cases}\pi x & \text{for } 0\le x\le 1\\ \pi(2-x) & \text{for } 1\le x\le 2\end{cases}$$ and hence deduce that $\frac{\pi^2}{8}=\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$ **(07 Marks)**

b. Obtain the half range cosine series for the function $f(x) = \sin x$ in $0 \le x \le \pi$. **(07 Marks)**

c. Express y as a Fourier series up to first harmonics given

x :	0	60°	120°	180°	240°	300°	360°
y :	7.9	7.2	3.6	0.5	0.9	6.8	7.9

(06 Marks)

2 a. Find the Fourier transform of

$$f(x)=\begin{cases}1 & \text{for } |x|<1\\ 0 & \text{for } |x|>1\end{cases}$$ Hence evaluate $\int_0^{\infty}\frac{\sin x}{x}dx$ **(07 Marks)**

b. Find the Fourier cosine transform of $f(x)=\frac{1}{1+x^2}$ **(07 Marks)**

c. Solve the integral equation $\int_0^{\infty} f(\theta)\cos\alpha\theta\, d\theta=\begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}$ Hence evaluate $\int_0^{\infty}\frac{\sin^2 t}{t^2}dt$ **(06 Marks)**

3 a. Find the partial differential of all planes which are at constant distance from the origin. **(07 Marks)**

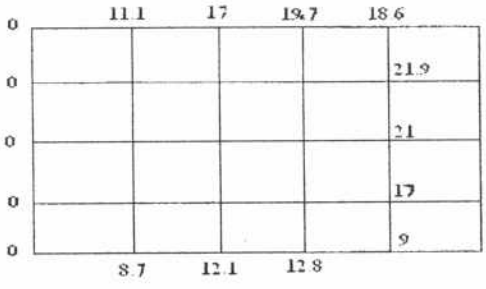
b. Using the method of separation of variables solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ where $u(x, 0) = 6e^{-3x}$ **(07 Marks)**

c. Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ **(06 Marks)**

4 a. Derive one dimensional heat equation. **(07 Marks)**

b. Obtain D'Alembert's solution of wave equation $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$ **(07 Marks)**

c. Solve the Laplace's equation $U_{xx} + U_{yy} = 0$ given that



(06 Marks)

PART – B

5 a. Using Newton-Raphson method find the real root of the equation $3x = \cos x + 1$ **(07 Marks)**

b. Solve the following system of equations using Gauss-Jordon method

$$x + y + z = 9$$
$$2x - 3y + 4z = 13$$
$$3x + 4y + 5z = 40$$

(07 Marks)

c. Find the largest eigen value and the corresponding eigen vector of the following matrix by using power method

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$ Take $(1, 0, 0)^T$ as initial eigen vector. Carry out four iterations. **(06 Marks)**

6 a. A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time t sec. Find the velocity and its acceleration when $t = 0.3$ sec.

t	0	0.1	0.2	0.3	0.4	0.5
x	30.13	31.62	32.87	33.64	33.95	33.81

(07 Marks)

b. Given the values of x and y

x :	1.2	2.1	2.8	4.1	4.9	6.2
y :	4.2	6.8	9.8	13.4	15.5	19.6

Find the value of x corresponding to $y = 12$ using Lagrange's technique. **(07 Marks)**

c. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Weddle's rule taking 7 ordinates. **(06 Marks)**

7 a. Find the extremal of the functional $\int_0^1 \left[(y')^2 + 12xy\right]dx$ with $y(0)=0$ and $y(1) = 1$. **(07 Marks)**

b. Find the curve passing through the points $(x_1\ y_1)$ and $(x_2\ y_2)$ which when rotated about the x-axis gives a minimum surface area. **(07 Marks)**

c. Show that the geodesics on a plane are straight lines. **(06 Marks)**

8 a. Find the Z-transform of the following:

i) $(n+1)^2$

ii) $\sin(3n + 5)$

(07 Marks)

b. Find the inverse Z-transform of $\frac{z^3 - 20z}{(z-2)^3(z-4)}$ **(07 Marks)**

c. Solve the difference equation $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z-transforms. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME32A

Third Semester B.E. Degree Examination, June-July 2009
Material Science & Metallurgy

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is a crystal imperfection? Give the list of crystal imperfections. **(06 Marks)**

b. Define atomic packing factor. Calculate the atomic packing factor for FCC. **(06 Marks)**

c. Copper has FCC structure and an atomic radius of 1.278 $\mathring{A}$. Calculate its density. Given mol. wt. = 63.54 g/mol. **(08 Marks)**

2 a. Define i) Resilliance ii) Tensile strength iii) Hardness iv) Ductility **(08 Marks)**

b. With the help of stress-strain curves show for the Engg stress-strain and True stress-strain. Explain briefly. **(06 Marks)**

c. Explain the Brinell hardness & Rockwell Hardness with sketches & equations. **(06 Marks)**

3 a. With the help of neat sketches explain the different stages of ductile cup & cone fracture. **(06 Marks)**

b. What is fatigue? What are the factors affecting the fatigue life? **(08 Marks)**

c. What is Griffith's theory of brittle fracture? Explain and give the equation for critical stress for crack propagation. **(06 Marks)**

4 a. What are Hume-Rothery's rules? **(05 Marks)**

b. Explain two types of phase diagrams & their interpretation. **(10 Marks)**

c. Differentiate between substitutional and interstitial solid solutions. **(05 Marks)**

PART – B

5 a. Draw neatly Iron-Carbon diagram and label all the parts. **(08 Marks)**

b. With the help of above diagram, explain cooling of steel with 0.6% carbon showing the microstructure at different stages. **(08 Marks)**

c. Draw TTT diagram for plain carbon eutectoid steels. Label the details. **(04 Marks)**

6 a. Define Hardenability. Explain with neat sketches how you find it by Jomeny-end Quench test. **(08 Marks)**

b. Explain any two types of case hardening, with sketches. **(06 Marks)**

c. Distinguish between Normalising and Annealing. **(06 Marks)**

7 a. Give the composition and uses of various cast-irons. **(06 Marks)**

b. Give the list of various copper alloys. Write a short note on copper alloys. **(08 Marks)**

c. What are the various effects of alloying elements on steels? **(06 Marks)**

8 a. What is corrosion? Explain any four methods of preventing corrosion. **(10 Marks)**

b. Write short notes on any TWO:
   i) Single metal galvanic cell corrosion.
   ii) Corrosion mechanism.
   iii) Passivation. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME33

Third Semester B.E. Degree Examination, June-July 2009
Basic Thermodynamics

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least Two full questions from each part.*
2. Use of steam Table, Mollier chart is allowed.

PART – A

1 a. Distinguish between
i) Macroscopic and Microscopic approach of study.
ii) Intensive and Extensive properties.
iii) Closed, Open and Isolated systems. **(07 Marks)**

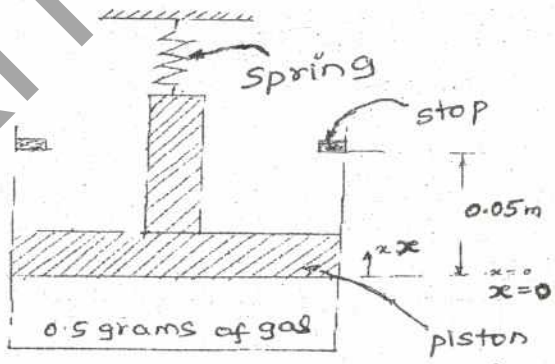
b. What you mean by Thermodynamic equilibrium' of a system. **(05 Marks)**

c. A thermometer is calibrated at '0' degree mark with boiling point of carbon Tetrachloride and 100 degree mark with melting point of lead, when used to measure temperature, the device indicates 16 degrees. Carbon tetrachloride boils at 76.75°C and lead melts at 327°C. Convert reading of device to the equivalent reading on Celsius scale. **(08 Marks)**

2 a. State Thermodynamics definition of work. How it is superior to mechanics definition of work? List different forms of work. **(07 Marks)**

b. Derive expression for displacement work in a polytropic process. **(05 Marks)**

c. A cylinder piston assembly contains 0.5 grams of gas, as shown in Fig.Q2(c). Initially, the piston face at x = 0 sping exerts no force on piston. As a result of heat transfer, the gas expands, raising the piston until it hits the stops. At this point the piston location is x = 0.05m, and heat transfer stops. The force exerted by the spring varies linearly with 'x' according to the equation F = kx, where k is the spring constant = 10,000 N/m. Take mass of piston = 10 kg, area of piston = 0.0078 m^2, atmospheric pressure = 1.0 bar and specific internal energy at initial and final states as 214 KJ/kg and 337 KJ/kg respectively. Determine initial pressure, work done and heat transfer in the process. **(08 Marks)**



3 a. For Isothermal non flow and steady flow processes show that $\int_1^2 P.dv = -\int_1^2 vdp$ also state the assumptions. **(07 Marks)**

b. Show that internal energy is a property. **(05 Marks)**

c. The working fluid, in a steady flow process flows at a rate of 220 kg/min. The fluid rejects 100 KJ/s of heat passing through the system. The conditions of the fluid at inlet and outlet are given as velocity = 220 m/s, P_1 = 6.0 bar, u_1 = 2000 KJ/kg, v_1 = 0.36 m^3/kg and velocity = 140 m/s, P_2 = 1.2 bar, u_2 = 1400 KJ/kg, v_2 = 1.3 m^3/kg. The suffix '1' indicates condition at inlet and 2 at outlet. Determine the power capacity of the system in MW. **(08 Marks)**

4 a. Give Kelvin – Plank and clausius statements of second law of thermodynamics and show that they are equivalent. **(10 Marks)**

b. A reversible heat engine operates between two reservoirs at temperatures of 600^0C and 40^0C. The engine drives a reversible refrigerator, which operates between 40^0C and -20^0C. The heat transfer to the engine is 2000 KJ and network output from combined engine and refrigerator system is 360 KJ. Calculate heat transfer to the refrigerator and net heat transfer to the reservoir at 40^0C. **(10 Marks)**

PART – B

5 a. State and prove Clausius Inequality. **(07 Marks)**

b. Explain principle of increase of entropy of universe. **(05 Marks)**

c. 1.2 m^3 of air is heated reversibly at constant pressure from 300 K to 600 K and is then cooled reversibly at constant volume back to initial temperature. If the initial pressure is 1 bar, calculate net heat flow and overall change in entropy. Also represent the processes on T-S diagram. Take C_p = 1.005 KJ/kgk and R = 0.287 KJ/kgk. **(08 Marks)**

6 a. Explain Available, Unavailable energies. When does the system becomes dead? **(06 Marks)**

b. Derive expression for availability in a non-flow system. **(06 Marks)**

c. 2 kg of air at 5 bar, 80^0C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of surrounding which is at 1 bar and 5^0C. Determine : i) Maximum work, ii) Change in availability and iii) Irreversibility. **(08 Marks)**

7 a. Define the following with respect to steam formation.

i) Sub-cooled liquid
ii) Dryness fraction
iii) Latent heat of vaporization
iv) Degree of super heat. **(06 Marks)**

b. Describe with neat sketch working of separating and throttling calorimeter. **(06 Marks)**

c. Steam initially at a pressure of 15 bar and 0.95 dry expands isentropically to 7.5 bar and then throttled until it becomes just dry and saturated. Determine per kg of steam:
i) Change in internal energy; ii) change in enthalpy and iii) Change in entropy. **(08 Marks)**

8 a. Explain van-der-waals equation. **(06 Marks)**

b. Write a short note on compressibility chart **(04 Marks)**

c. In an engine cylinder a gas has volumetric analysis of 13% CO_2, 12.5% O_2, and 74.5% N_2. The temperature at the beginning of expansion is 950^0C. Gas mixture expands reversibly through a volume ration of 8:1 according to the law $Pv^{1.2} = C$. Calculate per kg of mixture i) Work done; ii) Heat transfer and iii) Change in entropy. Take C_p for constituent gases CO_2, O_2 and N_2 are 1.235, 1.008 and 1.172 KJ/kgk respectively. **(10 Marks)**

* * * * *

USN | 1 | K | T | 0 | 7 | M | E | 0 | 2 | 2 |

06ME34

Third Semester B.E. Degree Examination, June-July 2009
Mechanics of Materials

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least Two questions from each part.*

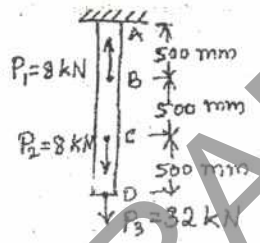
PART – A

1 a. Define the following terms:
i) Elastic limit; ii) True stress; iii) Factor of safety; iv) Poisson's ration. **(04 Marks)**

b. Prove that the extension of uniform bar due to self weight is half of the extension when the load equal to its self weight is applied at the end of the suspended bar. **(08 Marks)**

c. A prismatic bar ABCD is subjected to loads P_1, P_2 and P_3 as shown in the Fig.1(c). The bar is made of steel with modulus of elasticity E = 200 GPa and cross sectional area A = 225 mm^2. Determine the deflection 'δ' at the lower end of the bar due to applied loads. **(08 Marks)**

Fig.1(c).

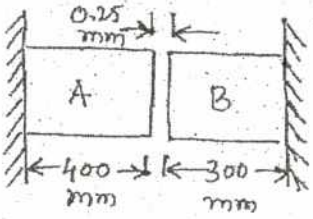


2 a. Establish a relationship between the modulus of elasticity and the modulus of rigidity. **(10 Marks)**

b. At room temperature the gap between bar A and bar B shown in Fig.2(b) is 0.25mm. What are the stresses induced in the bars, if the temperature rise is 35^0C?

Given $A_a = 1000\ mm^2$ $A_b = 800\ mm^2$
$E_a = 2 \times 10^5\ N/mm^2$ $E_b = 1 \times 10^5\ N/mm^2$
$\alpha_a = 12 \times 10^{-6}\ /^0C$ $\alpha_b = 23 \times 10^{-6}\ /^0C$
$L_a = 400\ mm$ $L_b = 300\ mm$ **(10 Marks)**

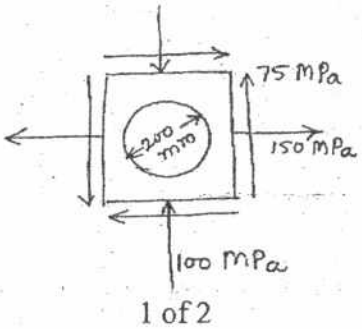
Fig.2(b).



3 a. Construct the Mohr's circle for a point in the machine member subjected to pure shear of 50 MPa. Determine the maximum and the minimum stresses induced and orientation of their planes. **(08 Marks)**

b. A point in a machine is subjected to stresses as shown in Fig.3(b). A circle of diameter 200 mm on the member is converted in to ellipse after the application of stresses. Determine major and minor axes of the ellipse and their orientations. Take E = 2 x 10^5 MPa and the Poisson's ratio, $\mu = 0.3$. **(12 Marks)**

Fig.3(b).



4 a. Briefly discuss the stresses developed and their distribution along the thickness of the walls of pressure vessels. **(04 Marks)**

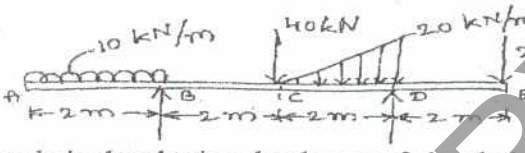
b. A thin cylinder of diameter 'd', thickness 't' is subjected to an internal pressure of 'p'. Prove that the change in volume, $dV = \frac{Pd}{4tE}(5-4\mu)\,V$, where, E = Young's modulus of elasticity, μ = Poisson's ratio and V = volume of the pressure vessel. **(08 Marks)**

c. A thick cylinder of internal diameter 160 mm is subjected to an internal pressure of 40 N/mm^2. If the allowable stress in the material is 120 N/mm^2, find the required wall thickness of the cylinder. **(08 Marks)**

PART – B

5 Draw the shear force and bending moment diagrams for a overhanging beam shown in Fig.5 and locate the points of contra flexure. **(20 Marks)**

Fig.5.

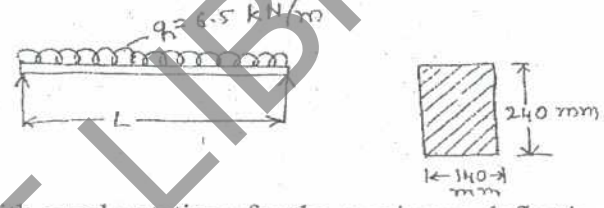


6 a. State the assumptions made in developing the theory of simple bending. **(04 Marks)**

b. Derive an expression for the bending stress and the radius of curvature for a straight beam subjected to pure bending. **(08 Marks)**

c. Determine the maximum allowable span length 'L' for a simple beam as shown in Fig.6(c). The beam is of rectangular cross section (140 mm x 240 mm) subjected to a uniformly distributed load q = 6.5 kN/m and the allowable bending stress is 8.2 MPa. **(08 Marks)**

Fig.6(b).



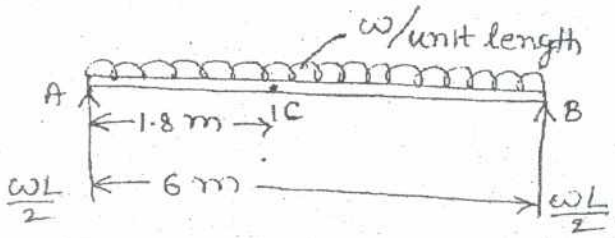
7 a. Derive an expression with usual notations for the maximum deflection in a beam subjected to point load at the mid span. **(08 Marks)**

b. A steel girder of 6m length acting as a beam carries a uniformly distributed load w N/m run throughout it's length, as shown in Fig.7(b). If I = 30 x 10^{-6} m^4 and depth 270 mm, calculate:

i) Magnitude of 'w' so that the maximum stress developed in the beam section does not exceed 72 MN/m^2.

ii) The slope and deflection in the beam at a distance of 1.8 m from one end. Take E = 200 GN/m^2. **(12 Marks)**

Fig.7(b).



8 a. A hollow steel shaft 3m long must transmit a torque of 25 kN-m. The total angle of twist in this length is not to exceed 2.5^0 and allowable shearing stress is 90 MPa. Determine inside and outside diameter of the shaft if G = 85 GPa. **(10 Marks)**

b. Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at it's both ends. Take E = 2.05 x 10^5 N/mm^2. Also, determine the crippling load by Rankin's formula using constants as 335 N/mm^2 and $\frac{1}{7500}$. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

06ME35

Third Semester B.E. Degree Examination, June-July 2009
Manufacturing Process – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least Two full questions from each part.***

PART – A

1 a. Show the classification of manufacturing processes with a neat schematic diagram. **(05 Marks)**
b. List and explain different steps involved in casting process. **(08 Marks)**
c. What is pattern? Explain the importance of pattern allowances. **(07 Marks)**

2 a. What are the types of moulding sands? Discuss the properties of moulding sand. **(08 Marks)**
b. With sketch explain the concept of gating and risering system. **(08 Marks)**
c. Mention various casting defects. **(04 Marks)**

3 a. Explain the following
i) Sweep mould; ii) CO_2 mould; iii) Shell mould. **(12 Marks)**
b. What is die-casting? Explain with sketch high pressure die casting process. **(08 Marks)**

4 a. Write a note on classification of melting furnaces. **(04 Marks)**
b. Explain the working principle of a gas fired pit furnace with a sketch. **(06 Marks)**
c. With help of sketch show the constructional detail of a cupola. Show different zones and reactions taking place in each zone. **(10 Marks)**

PART – B

5 a. What are the advantages and limitations of welding process? **(04 Marks)**
b. Sketch and explain TIG and MIG welding. **(08 Marks)**
c. Discuss the characteristics of neutral flame, carburising flame and oxidizing flame along with suitable sketches. **(08 Marks)**

6 a. Explain the principle of resistance welding. **(02 Marks)**
b. Sketch and explain following;
i) Seam welding
ii) Spot welding
iii) Butt welding
iv) Projection welding **(16 Marks)**
c. What are the advantages of electron beam welding? **(02 Marks)**

7 a. What is HAZ? Discuss the parameters, which affect HAZ. **(08 Marks)**
b. Explain the welding characteristics of
i) Cast iron; ii) Stainless steel; iii) Aluminium. **(09 Marks)**
c. Write a note on welding defects. **(03 Marks)**

8 a. Explain with suitable sketches soldering and brazing processes. What are their advantages and limitations? **(08 Marks)**
b. What is non-destructive testing? Explain any two non-destructive testing techniques. **(12 Marks)**

* * * * *