10ME, CV

USN | | | | | | | | | |

10MAT31

Third Semester B.E. Degree Examination, December 2012
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the Fourier series of $f(x) = x - x^2$, $-\pi \le x \le \pi$. Hence deduce that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots\dots\dots\dots = \frac{\pi^2}{12}$$

Is the above deduced series convergent? (Answer in Yes or No) **(07 Marks)**

b. Define : i) Half range Fourier sine series of f(x)
ii) Complex form of Fourier series of f(x)
Find the half range cosine series of $f(x) = x$ in $0 < x < 2$. **(07 Marks)**

c. Obtain a_0, a_1, b_1 in the Fourier expansion of y, using harmonic analysis for the data given.

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(06 Marks)

2 a. Find the Fourier transform of

$$f(x) = 1 - x^2 \quad \text{for} \quad |x| \le 1$$
$$= 0 \quad \text{for} \quad |x| > 1$$

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cos\left(\frac{x}{2}\right) dx$ **(07 Marks)**

b. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$ **(07 Marks)**

c. Find the Fourier cosine transform of

$$f(x) = 4x \;,\quad \text{for} \quad 0 < x < 1$$
$$= 4 - x \;,\quad \text{for} \quad 1 < x < 4$$
$$= 0 \;,\quad \text{for} \quad x > 4$$

(06 Marks)

3 a. i) Write down the two dimensional heat flow equation (p d e) in steady state (or two dimensional) Laplace's equation. Just mention.
ii) Solve one dimensional heat equation by the method of separation of variables. **(07 Marks)**

b. Using D'Alembert's method, solve one dimensional wave equation. **(07 Marks)**

c. A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form of $y = a \sin(\pi x/l)$ from which it is released at time $t = 0$. Show that the displacement of any point at a distance x from one end at time t is,

$$y(x,t) = a\sin\left(\frac{\pi x}{\ell}\right)\cos\left(\frac{\pi ct}{\ell}\right)$$

Start the answer assuming the solution to be

$$y = (C_1\cos(px) + C_2\sin(px))(C_3\cos(cpt) + C_4\sin(cpt))$$ **(06 Marks)**

4 a. Fit a linear law, $P = mW + C$, using the data

P	12	15	21	25
W	50	70	100	120

(06 Marks)

b. Find the best values of a and b by fitting the law $V = at^b$ using method of least squares for the data,

V (ft/min)	350	400	500	600
t (min)	61	26	7	26

Use base 10 for algorithm for computation. (07 Marks)

c. Using simplex method,
Maximize $Z = 5x_1 + 3x_2$
Subject to, $x_1 + x_2 \le 2$; $5x_1 + 2x_2 \le 10$; $3x_1 + 8x_2 \le 12$; $x_1, x_2 \ge 0$. (07 Marks)

PART – B

5 a. Use Newton-Raphson method, to find the real root of the equation $3x = (\cos x) + 1$. Take $x_0 = 0.6$. Perform two iterations. (06 Marks)

b. Apply Gauss-Seidel iteration method to solve equations

$$20x + y - 2z = 17$$
$$3x + 20y - z = -18$$
$$2x - 3z + 20z = 25$$

Assume initial approximation to be $x = y = z = 0$. Perform three iterations. (07 Marks)

c. Using Rayleigh's power method to find the largest eigen value and the corresponding eigen vector of the matrix.

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

Take $[1\ \ 0\ \ 0]^T$ as the initial approximation. Perform four iterations. (07 Marks)

6 a. Use appropriate interpolating formula to compute y(82) and y(98) for the data

x	80	85	90	95	100
y	5026	5674	6362	7088	7854

(07 Marks)

b. i) For the points (x_0, y_0) (x_1, y_1) (x_2, y_2) mention Lagrage's interpolation formula.
ii) If $f(1) = 4$, $f(3) = 32$, $f(4) = 55$, $f(6) = 119$; find interpolating polynomial by Newton's divided difference formula. (07 Marks)

c. Evaluate $\int_0^6 \frac{1}{1+x^2} dx$, using

i) Simpson's 1/3rd rule ii) Simpson's 3/8th rule iii) Weddele's rule, using

x	0	1	2	3	4	5	6
$f(x) = \frac{1}{1+x^2}$	1	0.5	0.2	0.4	0.0588	0.0385	0.027

(06 Marks)

7 a. Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to u(0, t), u(4, t) = 0. $u_t(x, 0) = 0$ and $u(x, 0) = x(4 - x)$ by taking h = 1, k = 0.5 upto four steps. **(07 Marks)**

b. Solve two dimensional Laplace equation at the pivotal or nodal points of the mesh shown in Fig.Q7(b). To find the initial values assume $u_4 = 0$. Perform three iterations including computation of initial values. **(07 Marks)**

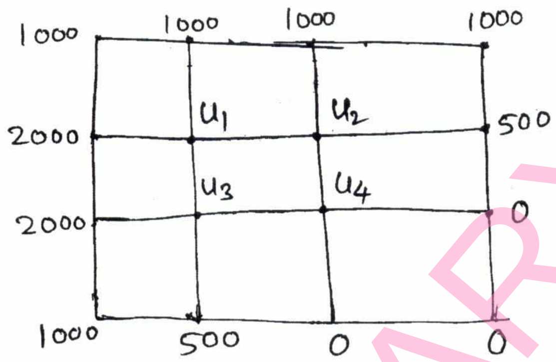


Fig.Q7(b)

c. Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, subject to the conditions $u(x, o) = \sin\pi x$, $o \le x \le 1$; $u(0, t) = u(1, t) = 0$. Carry out computations for two levels, taking h = 1/3 , k = 1/36. **(06 Marks)**

8 a. Find the z-transform of

$$\frac{n}{3^n} + 2^n n^2 + 4\cos(n\theta) + 4^n + 8$$ **(07 Marks)**

b. State and prove i) Initial value theorem ii) Final value theorem of z-transforms. **(07 Marks)**

c. Using the z-transform solve

$u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ with $u_0 = 0$, $u_1 = 1$. **(06 Marks)**

* * * * *

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

10ME32A/AU32A/TL32

Third Semester B.E. Degree Examination, December 2012
Material Science and Metallurgy

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Define atomic packing factor and calculate atomic radius and packing factor for BCC structure. **(08 Marks)**
b. With a neat sketch, explain the line dislocation. **(06 Marks)**
c. State and explain the first Fick's law of diffusion. **(06 Marks)**

2 a. With the help of a neat schematic conventional stress-strain diagram for mild steel under tension, explain clearly the behaviour of the material till fracture. **(08 Marks)**
b. Explain non-linear elastic properties when a material is subjected to static tension. **(06 Marks)**
c. What is work hardening? Explain the reasons for the same. **(06 Marks)**

3 a. Explain with neat figure ductile fracture using both stress-strain and stages of fracture. **(08 Marks)**
b. What is mean by stress relaxation? Explain with figure. **(06 Marks)**
c. With the help of sketch, discuss the different types of stress cycles which bring about fatigue failure. **(06 Marks)**

4 a. Explain with neat sketches the different stages of mechanisms of solidification. **(08 Marks)**
b. Define solid solution. Explain the substitutional and interstitial solid solution. **(08 Marks)**
c. Explain the factors governing the formation of substitutional solid solutions. **(04 Marks)**

PART – B

5 a. Draw and explain the Iron - Iron carbide equilibrium diagram and label all the points and fields. **(10 Marks)**
b. Construct a phase diagram using the following data and label all the fields:

Melting point of Ag = 961°C	Melting point of Cu = 1083°C
Eutectic temperature = 780°C	Eutectic composition = 28% Cu.
Max. solubility of Cu in Ag = 9% at 780°C	Max. solubility of Cu in Ag = 2% at 0°C
Max. solubility of Cu in Ag = 9% at 780°C	Max. solubility of Cu in Ag = 0% at 0°C

Determine the following:
i) Solidification start and end of temperature for 30% Ag alloy.
ii) Temperature at which a 15% Cu alloy has 50% liquid phase and 50% solid phase.
iii) Percentage composition of liquid and solid phase in 20% Ag alloy at 900°C. **(10 Marks)**

6 a. Draw the TTT diagram of austenite for eutectoid steel. Explain the various transformations product of austenite. **(08 Marks)**
b. Discuss the process temperature range, microstructure of products and applications of stress relief annealing. **(06 Marks)**
c. Explain with neat sketch induction hardening process. **(06 Marks)**

7 a. Give the composition, structure and their applications of
i) S.G. Iron ii) Malleable Iron iii) Gray cast iron. **(08 Marks)**
b. Name at least four important copper base alloys. Give composition microstructure and their applications. **(08 Marks)**
c. Write a note on Al-Si alloys. **(04 Marks)**

8 a. Explain the term composite materials with examples. State their advantages and limitations of composites in practice. **(08 Marks)**
b. Using neat sketch, explain the process of preparation of metal matrix composite using melting and casting method. **(08 Marks)**
c. What are FRPs? Give at least four examples. **(04 Marks)**

* * * * *

USN | | | | | | | | | | | 10ME/AU32B

Third Semester B.E. Degree Examination, December 2012
Mechanical Measurements and Metrology

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. Define the term 'Metrology', as applied to engineering industry. **(03 Marks)**

b. Discuss the following standards of measurement:
i) Line standard   ii) Wavelength standard   iii) End standard. **(09 Marks)**

c. Explain with an illustration how end standards can be derived from the line standards. **(08 Marks)**

2 a. Determine the type of fit after deciding the fundamental deviations and tolerances in the following:

Fit ϕ 70 H_9 e_7 diameters step (50 – 80)
Fundamental deviation for $e_{shaft} = -11\ D^{0.41}$
IT7 = 16i   IT9 = 40i
$i = 0.45\sqrt[3]{D} + 0.001D$ **(08 Marks)**

b. State and explain "Taylor's principle". **(06 Marks)**

c. Explain the different materials used for gauges. **(06 Marks)**

3 a. Explain the sources of error in sine bars. **(08 Marks)**

b. With a neat sketch, explain the sigma comparator. **(08 Marks)**

c. What is a need of a comparator? **(04 Marks)**

4 a. With a neat sketch, explain the terminology of screw thread. **(07 Marks)**

b. Derive an expression for the Best size wire. **(06 Marks)**

c. Explain the principle of Interferometry. **(07 Marks)**

PART – B

5 a. Explain the generalized measurement system. Give examples. **(06 Marks)**

b. Explain the following with respect to an instrument:
i) Sensitivity   ii) Threshold   iii) Hysteresis   iv) Loading effect. **(08 Marks)**

c. Discuss briefly with sketches of two types of elastic pressure transducers. **(06 Marks)**

6 a. Explain Ballast circuit. **(08 Marks)**

b. Explain the working principle of CRO and give its applications. **(08 Marks)**

c. Write a note on telemetry. **(04 Marks)**

7 a. With a neat sketch, explain the multiple lever system. **(10 Marks)**

b. Explain the working and application of Bridgman gauge. **(10 Marks)**

8 a. Explain the Laws of thermocouple. **(04 Marks)**

b. With a neat sketch, explain the optical strain gauge. **(06 Marks)**

c. Derive an expression for a gauge factor. **(10 Marks)**

* * * * *

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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

06ML81

Eighth Semester B.E. Degree Examination, December 2011

Embedded Systems Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the design metric parameters in ESD. **(06 Marks)**
b. Explain a single purpose processor (hardware) architecture design, with a neat diagram. **(08 Marks)**
c. What are the design technology parameters? Explain with respect to ideal to down design process. **(06 Marks)**

2 a. Design a combinational logic circuit for y = 1 if a = 1, or b and c = 1. z = 1 if b or c = 1, but not both (or, a, b and c are all 1). **(08 Marks)**
b. Compute a GCD of two numbers, using n source code and state diagram. **(06 Marks)**
c. What are the sequential components? Explain. **(06 Marks)**

3 a. Explain the general purpose processor basic architecture with data path and control unit. **(06 Marks)**
b. Explain pipelining operations in ESD. **(06 Marks)**
c. Explain single microprocessor architecture with instruction set and addressing mode. **(08 Marks)**

4 a. Explain timer, counter and watchdog. **(06 Marks)**
b. What are the application specific instructions set processors? Explain. **(06 Marks)**
c. Explain UART for serial transmission protocols, used by two USRTs. **(08 Marks)**

PART – B

5 a. Design a pulse width modulation for controlling a DC motor. **(06 Marks)**
b. Design an ES for controlling a stepper motor using a driver (hardware). **(08 Marks)**
c. Given an analog input signal, whose voltage should range from 0 to 15 V and 8 bit digital encoding, calculate the correct encoding of 5V. **(06 Marks)**

6 a. Explain memory write ability and storage performance, with a neat sketch. **(08 Marks)**
b. Describe the memory system of HM6264 and 27C256 RAM/ROM devices, with neat illustrations. **(08 Marks)**
c. Write a note on the basic DRAM architecture. **(04 Marks)**

7 a. Explain the basic protocol concepts in interfacing. **(06 Marks)**
b. Write a note on port and bus based I/O in microprocessor architecture. **(06 Marks)**
c. What are the interrupts in a microprocessor? Explain with a neat table. **(08 Marks)**

8 a. Explain the advanced communication protocols. **(10 Marks)**
b. Discuss the different types of wireless protocols. **(10 Marks)**

* * * * *

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

10ME/AU/PM33

Third Semester B.E. Degree Examination, December 2012
Basic Thermodynamics

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Use of thermodynamic data handbook and steam tables is permitted.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Define the following with examples:
i) Open system ii) Closed system iii) Path function iv) Point function. **(08 Marks)**

b. Distinguish between:
i) Intensive and extensive properties
ii) Thermal equilibrium and mechanical equilibrium
iii) Microscopic and macroscopic point of view. **(06 Marks)**

c. State zeroth law of thermodynamics. The temperature, t, on a certain scale is defined in terms of the thermometric property X by the relation $t = a \ln \chi + b$ where a and b are constants. On this scale the temperature of ice and steam points are 0 and 100, respectively. Experiments reveal that $X_i = 1.86$ and $X_s = 6.81$. Find the temperature for an X value of 3.2 on this thermometer. **(06 Marks)**

2 a. List the similarities between heat and work. **(04 Marks)**

b. State and explain thermodynamic definition of work. **(04 Marks)**

c. Derive the expression for the displacement work in resisted polytropic process. (PV^n = Constant). **(06 Marks)**

d. A certain mass of air is compressed from 1 bar, 0.1 m^3 to 6 bar in a piston cylinder device according to $PV^{1.4}$ = constant. Find the work of compression for air. Had the compression been carried out hyperbolically between the same initial state and the same final pressure as above what would be the work done on air? **(06 Marks)**

3 a. State and explain the first law of thermodynamics. Give its equation with reference to a cyclic and non-cyclic process. **(06 Marks)**

b. A fluid is confined in a cylinder by spring loaded, frictionless piston so that the pressure in the fluid is linear function of the volume (P = a + bV). The internal energy of the fluid is given by the following equation:

$$U = 34 + 3.15\,PV$$

where U is in kJ, p in kPa and V in cubic metre. If the fluid changes from an initial state of 170 kPa, 0.03 m^3 to a final state of 400 kPa, 0.06 m^3, with no work other than that done on the piston, find the direction and magnitude of the work and heat transfer. **(08 Marks)**

c. Steam at a rate of 0.42 kg/s and enthalpy of 2785 kJ/kg and a velocity of 33.3 m/s is supplied to a steadily operating turbine. The steam leaves the turbine at 100 m/s and an enthalpy of 2512 kJ/kg. The inlet pipe is 3 m above the exit pipe. Rate of heat loss from the turbine casing is 0.29 kJ/s. What is the power output of the turbine? **(06 Marks)**

4 a. Why are engineers interested in reversible processes even though they can never be achieved? **(02 Marks)**

b. Define reversible engine. Show that of all the reversible heat engines working between any two constant but different thermal reservoir temperatures, the reversible reversed heat engine will have the maximum COP. **(08 Marks)**

c. A Carnot engine receives heat at 750 K and rejects the waste heat to the environment at 300K. The entire 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 to the same environment at 300K. Determine the i) the rate of heat supplied to the heat engine ii) the total rate of heat rejection to the environment. **(10 Marks)**

PART – B

5 a. Define inequality of Clausius and entropy of a system. Show that for an irreversible process $ds \geq \delta Q/T$. **(10 Marks)**

b. 1.5 kg of air initially at 25°C is heated reversibly at constant pressure until volume is doubled and heated reversibly until pressure is doubled at constant volume. For the total path, determine i) the work transfer ii) the heat transfer and iii) the change in entropy. **(10 Marks)**

6 a. Sketch the T-P phase diagram for water. Mark on it the following: Solid region, liquid region, vapour phase, triple point and critical point. **(05 Marks)**

b. State whether the following samples of steam are wet, dry or superheated. Justify your answer. i) Pressure = 1 MPa absolute, enthalpy = 2880 kJ/kg, ii) Pressure = 500 kPa absolute, Volume = $0.35 m^3/kg$ iii) Temperature = 200°C, Pressure = 1.2 MPa. iv) Temperature = 100°C , entropy = 6.88 kJ/kgK v) Pressure = 10 kPa, enthalpy = 2584.8 kJ/kg. **(05 Marks)**

c. 0.1 kg saturated steam expands reversibly from 10 to 1 bar in a piston-cylinder device according $PV^{1.3}$ = constant. Find the work and heat interactions during the expansion process. **(10 Marks)**

7 a. Distinguish between i) Universal gas constant and particular gas constant ii) Perfect gas and semiperfect gas. **(08 Marks)**

b. 1 kg of air undergoes a cylic process comprising three process 1-2, 2-3 and 3-1. At state 1, the pressure and temperature are 1 MPa and 27°C. 1-2 is an irreversible adiabatic constant pressure process, 2-3 is reversible adiabatic process and 3-1 is a reversible isothermal process. At state 3, p = 100 kPa.

i) Sketch the cycle on P-V and T-S coordinates,
ii) Find the heat and work interactions in each of the three processes and the net work per cycle and
iii) Analyse quantitatively whether the cycle is reversible or irreversible. **(12 Marks)**

8 a. Explain the following:
i) Compressibility factor ii) Law of corresponding states iii) Compressibility chart iv) Van der Waals equation of state. **(12 Marks)**

b. A mixture of 0.5 kg of carbon dioxide and 0.3 kg of N_2 is compressed from P_1 = 1 atm, T_1 = 20°C to P_2 = 5 atm in a polytropic process for which n = 1.3. Find i) The final temperature ii) The work iii) The heat transfer iv) The change in entropy of the mixture. **(08 Marks)**

* * * * *

USN

Third Semester B.E. Degree Examination, December 2012

Mechanics of Materials

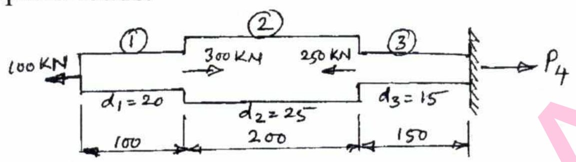
Time: 3 hrs. Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting at least TWO questions from each part.*
2. *Missing data, if any, may be suitably assumed.*

PART – A

1 a. Define: i) Ductility, ii) True stress, iii) Principle of super position. **(06 Marks)**

b. Determine the stresses in various segments of the circular bar shown in Fig.Q1(b).
i) Compute its total elongation assuming Young's modulus of steel to be 195 GPa.
ii) Determine the length of the middle segment so that the bar length does not change under the applied loads.



All dimensions are in mm

Fig.Q1(b) **(08 Marks)**

c. Derive an expression for the extension of uniformly tapering rectangular bar subjected to axial load P. **(06 Marks)**

2 a. A C.I. flat, 300 mm long, 50 mm wide, and 30 mm thick, is acted upon by the following forces. 25 kN tensile in the direction of length; 350 kN compressive, in the direction of width; and 200 kN tensile, in the direction of thickness. Determine:
i) Change in volume of the flat ii) Modulus of rigidity iii) Bulk modulus
Take E = 140 GN/m^2 and 1/m = 0.25. **(10 Marks)**

b. A steel bar is placed between two copper bars, each having the same area and of length L as the steel bar at 15°C. At this stage, they are rigidly connected together at both the ends. The length of composite bar is also L. When the temperature is raised to 315°C, the length of the bar increase by 1.5 mm. Determine the original length end, find the stresses in the bars.
Take $E_S = 2.1 \times 10^5$ N/mm^2, $E_C = 1 \times 10^5$ N/mm^2,
$\alpha_S = 0.000012$ per °C, $\alpha_C = 0.0000175$ per °C. **(10 Marks)**

3 The state of stress in a two dimensionally stressed body is shown in Fig.Q3. Determine the principal planes, principal stresses, maximum shear stress and their planes. Also draw the Mohr's circle to verify the results obtained analytically. Indicate all the above planes by a sketch.

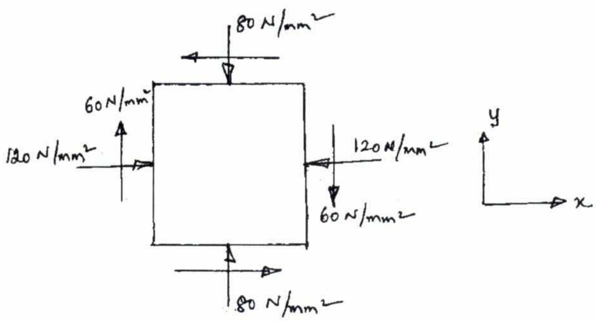


Fig.Q3 **(20 Marks)**

4 a. A simply supposed beam of span L carries a point load W at mid-span. Find the strain energy stored by the beam. **(05 Marks)**

b. Derive an expression for circumferential stress for thin cylinder. **(05 Marks)**

c. A cylindrical pressure vessel has inner and outer redii of 200 mm and 250 mm respectively. The material of the cylinder has an allowable normal stress of 75 MN/m^2. Determine the maximum internal pressure that can be applied and draw a sketch of radial pressure and circumferential stress distribution. **(10 Marks)**

PART – B

5 a. A cantilever of length 2.0 m carries a uniformly distributed load of 1 kN/m run over a length of 1.5 m from the free end. Draw the shear force and bending moment diagram for the cantilever. **(06 Marks)**

b. Draw the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 2 kN/m over the entire length and a point load of 2 kN as shown in Fig.Q5(b). Locate the point of contra flexure. **(14 Marks)**

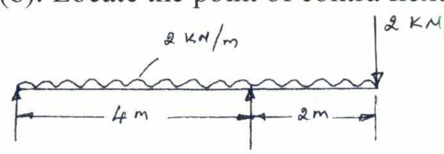
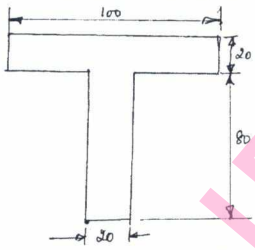


Fig.Q5(b)

6 a. A cast iron beam is of T-section as shown in Fig.Q6(a). The beam is simply supported on a span of 8m. The beam carries a uniformly distributed load of 1.5 kN/m length on the entire span. Determine the maximum tensile and maximum compressive stresses. **(10 Marks)**



All dimensions are in mm

Fig.Q6(a)

b. A beam of rectangular section of width 'b' and depth 'd' is subjected to shear force. Draw the figure showing the shear stress variation across the section. Also show that the maximum shear stress is 1.5 times the average shear stress. **(10 Marks)**

7 a. A cantilever of length 2.5 m carries a uniformly distributed load of 16.4 kN/m over the entire length. If the moment of inertia of the beam is 7.95×10^7 mm^4 and the value of $E = 2 \times 10^5$ N/mm^2, determine the deflection at the free end. Derive the equation used. **(10 Marks)**

b. A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Find: i) Deflection under each load, ii) Maximum deflection and iii) The point at which maximum deflection occurs. Take $E = 2 \times 10^5$ N/mm^2 and $I = 85 \times 10^6$ mm^4. **(10 Marks)**

8 a. Determine the diameter of a solid steel shaft which will transmit 90 KW at 160 rpm. Also determine the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm^2. Take the value of modulus of rigidity as 8×10^4 N/mm^2. **10 Marks)**

b. State the assumptions made in the derivation of Euler's expression. Derive the Euler's expression for a column subjected to an axial compressive load. Consider both ends of the column as Hinged. **(10 Marks)**

* * * * *

USN | | | | | | | | | | | **10ME/AU/TL35**

Third Semester B.E. Degree Examination, January 2013

Manufacturing Process - I

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. What is manufacturing? Discuss the factors to be considered in the selection of a process for production. **(05 Marks)**
b. Briefly discuss the steps involved in making a casting. **(05 Marks)**
c. What are the different allowances given on a pattern? Sketch and explain match plate pattern. **(05 Marks)**
d. Write a note on binders and additives used in moulding. **(05 Marks)**

2 a. What are the desirable properties of a moulding sand? **(05 Marks)**
b. Define core. List different types of core. Sketch and explain blanced core. **(05 Marks)**
c. Draw a neat sketch of a gating system showing all the elements. **(05 Marks)**
d. Explain with a sketch, the working of sand slinger. **(05 Marks)**

3 a. With a neat sketch, briefly explain the different steps involved in shell moulding process and mention its advantages and disadvantages. **(10 Marks)**
b. With a neat sketch, explain continuous casting process and mention its advantages and disadvantages. **(10 Marks)**

4 a. Explain the construction and working principle of cupola furnace, with a sketch. **(12 Marks)**
b. Describe with a neat sketch, the coreless induction furnace. **(08 Marks)**

PART - B

5 a. What is welding process? What are the advantages of welding over the manufacturing process? List the industrial applications of welding. **(08 Marks)**
b. Explain the following welding process, with necessary sketches and their field of applications : i) Tungsten inert gas welding ii) Submerged Arc welding. **(12 Marks)**

6 a. With a neat sketch, explain Thermilt welding and what are the advantages and disadvantages of Thermilt welding process. **(10 Marks)**
b. With a sketch, explain the laser beam welding process. Mention advantages and limitations of laser welding, also give application. **(10 Marks)**

7 a. Sketch and explain structure of welds. **(06 Marks)**
b. Explain the different welding defects and also give causes and remedies. **(10 Marks)**
c. Write a note on residual stress in welding. **(04 Marks)**

8 a. Compare the soldering and brazing process. Mention their advantages and disadvantages and applications for same. **(10 Marks)**
b. Explain with neat sketches, advantages and disadvantages of radiography inspection. **(10 Marks)**

*****

USN | | | | | | | | | | MATDIP301

Third Semester B.E. Degree Examination, December 2012

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions.***

1 a. Find the modulus and amplitude of the complex number $1-\cos\alpha + i\sin\alpha$. **(05 Marks)**

b. If z_1 and z_2 are two complex numbers, show that $|z_1+z_2|^2+|z_1-z_2|^2 = 2\{|z_1|^2+|z_2|^2\}$. **(05 Marks)**

c. Find the fourth roots of $-1+i\sqrt{3}$. **(05 Marks)**

d. If $2\cos\theta = x+\frac{1}{x}$, prove that $2\cos r\theta = x^r+\frac{1}{x^r}$. **(05 Marks)**

2 a. Find the n^{th} derivative of $e^{2x}\cos^3 x$. **(07 Marks)**

b. Find the n^{th} derivative of $\frac{x}{x^2-5x+6}$. **(06 Marks)**

c. If $y = e^{a\sin^{-1}x}$, prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-(n^2+a^2)y_n = 0$. **(07 Marks)**

3 a. Find the angle between the pair of curves $r = 6\cos\theta$, $r = 2(1+\cos\theta)$. **(07 Marks)**

b. Find the pedal equation of the curve $r^2 = a^2\sin 2\theta$. **(06 Marks)**

c. Obtain the Maclaurin's series expansion of the function $\sqrt{1+\sin 2x}$. **(07 Marks)**

4 a. If $u = x^2y+y^2z+z^2x$, prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z} = (x+y+z)^2$. **(05 Marks)**

b. If $u = \tan^{-1}\left(\frac{x^3y^3}{x^3+y^3}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = \frac{3}{2}\sin 2u$. **(05 Marks)**

c. If $u = x+y+z$, $v = y+z$, $z = uvw$, find Jacobian of x, y, z with respect to u, v, w. **(05 Marks)**

d. If $z = f(x, y)$ and $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$, prove that $\frac{\partial z}{\partial u}-\frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x}-y\frac{\partial z}{\partial y}$. **(05 Marks)**

5 a. Obtain the reduction formula for $\int_0^{\pi/2}\cos^n x\,dx$ and hence evaluate $\int_0^{\pi/2}\cos^6 x\,dx$ and $\int_0^{\pi/2}\cos^9 x\,dx$. **(07 Marks)**

b. Evaluate $\int_0^1\int_{x^2}^{\sqrt{x}} xy(x+y)\,dy\,dx$. **(06 Marks)**

c. Evaluate $\int_0^a\int_0^x\int_0^{x+y} e^{x+y+z}\,dz\,dy\,dx$. **(07 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

6 a. Define Gamma and Beta functions. Show that $\beta(m,n) = 2\int_0^{\pi/2} \sin^{2m-1}\theta \cos^{2n-1}\theta \, d\theta$. **(07 Marks)**

b. Prove that $\int_0^{\infty} x^2 e^{-x^4} dx \times \int_0^{\infty} e^{-x^4} dx = \frac{\pi}{8\sqrt{2}}$. **(07 Marks)**

c. Evaluate $\int_0^1 (\log x)^6 dx$. **(06 Marks)**

7 a. Solve the equation $\frac{dy}{dx} + x\tan(y-x) = 1$. **(06 Marks)**

b. Solve $x^2 y dx - (x^3 + y^3) dy = 0$. **(07 Marks)**

c. Solve $(e^y + y\cos xy)dx + (xe^y + x\cos xy)dy = 0$. **(07 Marks)**

8 a. Solve the equation $(D^3 + 1)y = 0$, where $D = \frac{d}{dx}$. **(06 Marks)**

b. Solve the equation $(D^2 - 2D + 1)y = xe^x$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{2x} - \cos^2 x$. **(07 Marks)**

* * * * *