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06MAT31

Third Semester B.E. Degree Examination, June / July 08
Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Expand the function $f(x) = x \sin x$ as a Fourier series in the interval $-\pi \le x \le \pi$. **(07 Marks)**

b. Obtain a half range cosine for **(07 Marks)**

$$f(x) = \begin{cases} k\,x & \text{for } 0 \le x \le l/2 \\ k(l-x) & \text{for } l/2 \le x \le l. \end{cases}$$

c. Obtain the constant term and the coefficients of the first sine and cosine terms in the Fourier expansion of y as given in the following table. **(06 Marks)**

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

2 a. Find the Fourier transform of

$$f(x) = \begin{cases} 1 - x^2 & \text{if } |x| \le 1 \\ 0 & \text{if } |x| > 1 \end{cases}$$

and use it to evaluate $\int_0^\infty \left(\frac{x \cos x - \sin x}{x^3} \right) \cos \frac{x}{2} dx$.

(07 Marks)

b. Find the Fourier Cosine transform of e^{-x^2}. **(07 Marks)**

c. Using convolution theorem, find the inverse Fourier transform of $H(\alpha) = \frac{1}{(1+\alpha^2)^2}$. **(06 Marks)**

3 a. Form the partial differential equation by eliminating the arbitrary functions $F(x+2y) + G(x-3y) = 0$. **(07 Marks)**

b. Use the separation of variable technique to solve $3U_x + 2U_y = 0$. Given $U(x, 0) = 4e^{-x}$. **(07 Marks)**

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

4 a. Derive the one dimensional wave equation in the standard form. **(06 Marks)**

b. Obtain the various solutions of the Laplace's equation $Uxx + Uyy = 0$ by the method of separation of variables. **(07 Marks)**

c. A tightly stretched string of length l with fixed ends is initially in equilibrium position. It is set to vibrate by giving each point a velocity $V_0 \sin^3 \frac{\pi x}{l}$. Find the displacement $y(x, t)$. **(07 Marks)**

PART – B

5 a. Compute the real root of the equation $x \log_{10} x - 1.2 = 0$ correct to five decimal places using Regula Falsi method. **(07 Marks)**

b. Solve the following system of equations by Gauss – Seidel iteration method.
$27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$. **(07 Marks)**

c. Find the largest Eigen value and the corresponding Eigen vector of the following matrix by using power method : $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$. Take $(1\ 0\ 0)^T$ as the initial Eigen vector. Carry out 4 iterations. **(06 Marks)**

6 a. Use Newton's divided difference formula to find f(8) given. **(07 Marks)**

x :	4	5	7	10	11	13
f(x) :	48	100	294	900	1210	2028

b. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.05 given **(07 Marks)**

x : 1	1.05	1.1	1.15	1.2	1.25	1.3
f(x) : 1	1.0247	1.04881	1.07238	1.09544	1.11803	1.14017

c. By Dividing the range into 6 equal parts, find the approximate value of $\int_0^{\pi} e^{\sin x}\, dx$ using simpsons $1/3^{rd}$ rule. **(06 Marks)**

7 a. Derive Euler's equation in the form $\frac{d}{dx}\left(f - y' \frac{\partial f}{\partial y'}\right) - \frac{\partial f}{\partial x} = 0$. **(07 Marks)**

b. Find the extremal of the function $\int_0^{\pi/2} (y'^2 - y^2 + 4y \cos x)\, dx$ given $y(0) = 0$, $y(\pi/2) = 0$. **(06 Marks)**

c. 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)**

8 a. Find the Z – transform of i) n^2 ii) $\cos n\theta$. **(07 Marks)**

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

c. Solve the difference equation $Y_{n+2} + 2Y_{n+1} + Y_n = n$ with $Y_0 = Y_1 = 0$, using Z – transforms. **(06 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June/July 08
Advanced Mathematics I

Time: 3 hrs. Max. Marks:100

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

1 a. Find the modulus and amplitude of $\frac{(3-\sqrt{2}i)^2}{1+2i}$. **(06 Marks)**

b. Express the complex number $\frac{(1-i)(2-i)}{3-i}$ in the form of x + iy. **(07 Marks)**

c. Express the complex number $-1+i\sqrt{3}$ in the polar form. **(07 Marks)**

2 a. If $y = e^{-x}\sinh 3x\cosh 2x$, find y_n. **(06 Marks)**

b. If $y = \tan^{-1}x$, then prove that $(1+x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$. **(07 Marks)**

c. Expand $\sin x$ in ascending powers of $\left(x-\frac{\pi}{2}\right)$. **(07 Marks)**

3 a. State Maclaurins theorem and find expansion of e^x. **(06 Marks)**

b. State Taylor's theorem and find the expansion of $\sin x$ in powers of $\left(x-\frac{\pi}{2}\right)$. **(06 Marks)**

c. If $u = e^{x/t^2}$, then prove that $2x\frac{\partial u}{\partial x} + t\frac{\partial u}{\partial t} = 0$. **(08 Marks)**

4 a. If $u = \sin^{-1}\left(\frac{x^2y^2}{x+y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3\tan u$. **(06 Marks)**

b. If $u = f(y-z,\ z-x,\ x-y)$, prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. **(07 Marks)**

c. If $x = u(1+v)$, $y = v(1+u)$, show that $\frac{\partial(x,\ y)}{\partial(u,\ v)} = 1+u+v$. **(07 Marks)**

5 a. Derive the reduction formula for $\int \sin^n x\,dx$, where n is + ve integer. **(06 Marks)**

b. Evaluate $\int_0^1 x(1-x^2)^{1/2}dx$. **(07 Marks)**

c. Evaluate $\int_0^1 \int_{x^2}^{2-x^2} xy\,dx\,dy$ **(07 Marks)**

6 a. Evaluate $\int_{-1}^{1} \int_{0}^{z} \int_{x-z}^{x+z} (x+y+z)dxdydz$ **(06 Marks)**

b. Prove that $\beta(m,n) = \frac{\Gamma m\Gamma n}{\Gamma m+n}$, m, n > 0. **(08 Marks)**

c. Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\cot\theta}\,d\theta$ by expressing in terms of gamma functions. **(06 Marks)**

7 a. Solve $\frac{dy}{dx} = (4x+y+1)^2$. **(06 Marks)**

b. Solve $(x^2-y^2)dx = 2xydy$. **(07 Marks)**

c. Solve $(e^y+1)\cos x dx + e^y \sin x dy = 0$. **(07 Marks)**

8 a. Solve $x\frac{dy}{dx} + y = x^3y^6$. **(06 Marks)**

b. Solve $(D^3-1)y = 0$. **(07 Marks)**

c. Solve $(D^3-6D^2+5D)y = (5+x^2)$. **(07 Marks)**

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06ME32A

Third Semester B.E. Degree Examination, June/July 08
Material Science and Metallurgy

Time: 3 hrs. Max. Marks:100

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

Part – A

1 a. List the 14 Bravais lattices. **(05 Marks)**
b. Draw the FCC lattice and calculate its atomic packing factor. **(10 Marks)**
c. Draw a edge dislocation and explain how it moves on application of a shear stress. **(05 Marks)**

2 a. Define engineering stress and engineering strain and obtain a relationship between true strain and engineering strain. **(10 Marks)**
b. What are the slip systems in FCC and BCC crystals? **(05 Marks)**
c. Explain Brinnell hardness testing. **(05 Marks)**

3 a. Draw the S-N curve for steel and Aluminum. **(05 Marks)**
b. Draw the creep curve and label. **(05 Marks)**
c. Suppose samples of large grain size nickel and small grain size nickel are supplied to you, which sample would you choose for creep resistance and why? **(10 Marks)**

4 a. Explain Hume-Rothery rules for solid solution behavior. **(05 Marks)**
b. State Gibbs phase rule and lever rule in analyzing phase diagrams. **(05 Marks)**
c. Draw the phase diagrams for eutectic and eutectoid. **(05 Marks)**
d. In the above phase diagrams, show that the three phase equilibria are invariant. **(05 Marks)**

Part – B

5 a. Draw the iron-iron carbide phase diagram and label the phases. **(10 Marks)**
b. Draw the TTT diagram for a eutectoid steel and explain the different microstructures obtained at various cooling rates. **(10 Marks)**

6 a. Explain recrystallization during annealing of metals. **(05 Marks)**
b. Differentiate between austempering and martempering of steels. **(10 Marks)**
c. Explain case carburization. **(05 Marks)**

7 a. What are the different types of cast irons? **(05 Marks)**
b. Explain precipitation hardening in Al-4 wt% Cu aluminum alloy. **(10 Marks)**
c. Differentiate between brasses and bronzes. **(05 Marks)**

8 a. Define electrode potential and show its relevance in galvanic corrosion. **(05 Marks)**
b. Differentiate between activation and concentration polarization. **(05 Marks)**
c. Why are stainless steels passive? **(05 Marks)**
d. Explain stress corrosion cracking in aluminum alloy 7075. **(05 Marks)**

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06ME33

Third Semester B.E. Degree Examination, June / July 08
Basic Thermodynamics

Time: 3 hrs. Max. Marks:100

Note : ***1. Answer any FIVE full questions choosing at least TWO questions from Part A and Two questions from Part B.***
2. Use of Thermodynamic Data Hand Book is allowed.

PART – A

1 a. Differentiate between the following with suitable examples. i) System and control volume ii) Intensive and extensive properties iii) Path and point functions. **(06 Marks)**

b. Define the following : i) Thermodynamic state ii) Quasistatic process iii) Cyclic and Non – cyclic processes. **(08 Marks)**

c. The resistance of the windings in a certain motor is found to be 80 ohm at room temperature (25^0C). When operating at full load, under steady state conditions, the motor is switched off and the resistance of the windings immediately measured again, is found to be 930 ohms. The windings are made of copper whose resistance at temperature t^0C is given by $R_t = R_o [1 + 0.00393t]$, when R_o is the resistance at 0^0C. Find the temperature attained by the coil during full load. **(06 Marks)**

2 a. Show that the work and heat are path functions. **(05 Marks)**

b. A system undergoes a process in which the pressure and volume are related by an equation of the form PV^n = a constant. Derive an expression for displacement work during this process. **(05 Marks)**

c. A fluid at 0.7 bar occupying $0.09m^3$ is compressed reversibly to a pressure of 3.5 bar according to a law PV^n = constant. The fluid is then heated reversibly at constant volume until the pressure is 4 bar; the specific volume is then $0.5m^3/kg$. A reversible expansion according to a law PV^2 = constant, restores the fluid to its initial state. Sketch the cycle on a P-V diagram and calculate. i) the mass of fluid present ii) the value of 'n' in the first process iii) the net work of the cycle. **(10 Marks)**

3 a. State the first law of Thermodynamics as applied to a cycle and prove that for a non – flow process, it leads to the energy equation of the form $_1Q_2 - {}_1W_2 = U_2 - U_1$. **(06 Marks)**

b. A gas undergoes a thermodynamic cycle consisting of the following processes:
i) Process 1 – 2 : Constant pressure, P = 1.4 bar, $V_1 = 0.028m^3$, $_1W_2 = 10.5$ kJ.
ii) Process 2 – 3 : Compression with PV = constant, $U_3 = U_2$.
iii) Process 3 – 1 : Constant volume, $(U_1 - U_3) = -26.4$ kJ.
There are no significant changes in KE and PE.
1) Sketch the cycle on a P-V diagram 2) Calculate the network for the cycle in KJ.
3) Calculate the heat transfer for process 1-2. 4) Show that $\sum_{cycle} Q = \sum_{cycle} W$. **(06 Marks)**

c. A turbine operating under steady – flow conditions receives steam at the following state : Pressure = 13.8 bar, Specific volume = $0.143m^3/kg$, Specific internal energy = 2590 kJ/kg, Velocity = 30m/sec. The state of the steam leaving the turbine is as follows :
Pressure = 0.35 bar, Specific volume = $4.37m^3/kg$, Specific internal energy = 2360 kJ/kg, Velocity = 90m/sec. Heat is rejected to the surroundings at the rate of 0.25 kW and the rate of steam flow through the turbine is 0.38 kg/sec. Calculate the power developed by the turbine. **(08 Marks)**

4 a. Represent the Carnot Heat Engine cycle on a P – V diagram and explain briefly. **(06 Marks)**

b. State and prove Carnot's theorem. **(06 Marks)**

c. Two reversible heat engines A and B are arranged in series, A rejecting heat to B through and intermediate reservoir. Engine 'A' receives 200kJ at a temperature of 421^0C from a hot source, while Engine 'B' is in communication with a cold sink at a temperature of 4.4^0C. If the work output of A is twice that of B, find i) the intermediate temp between A and B. ii) the efficiency of each engine and iii) the heat rejected to the cold sink. **(08 Marks)**

PART – B

5 a. With usual notations, state and prove Clausius inequality. **(06 Marks)**

b. Show that entropy is a property. **(06 Marks)**

c. A heat engine receives reversibly 420 kJ/cycle of heat from a source at 327^0C and rejects heat reversibly to sink at 27^0C. There are no other heat transfers. For each of the three hypothetical amounts of heat rejected in (i), (ii) and (iii), given below, compute the cyclic integral of $\frac{\delta Q}{T}$. From these results, show which case is reversible, which is irreversible and which is impossible. i) 210 kJ / cycle is rejected ii) 105 kJ / cycle rejected iii) 315 kJ / cycle rejected. **(08 Marks)**

6 a. Explain the term availability and derive expression for availability for a non – flow steady – flow processes with usual notations. **(12 Marks)**

b. A system at 500K receives 7200 kJ/min from a source at 1000K. The temperature of atmosphere is 300K. Assuming that the temperature of the system and source remain constant during heat transfer, find out i) The net change of entropy during heat transfer ii) The decrease in available energy after heat transfer. **(08 Marks)**

7 a. Define 'Quality of Steam'. Explain any one method for determining the quality of steam with a sketch. **(06 Marks)**

b. Draw enthalpy and entropy diagram for water and indicate the following on the same. i) Saturated liquid line ii) Saturated Vapour line iii) Critical point iv) Constant pressure line v) Constant temp line vi) Constant Quality lines. **(06 Marks)**

c. A vessel of volume $0.04m^3$ contains a mixture of saturated water and saturated steam at a temperature of 250^0C. The mass of the liquid present is 9kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and the internal energy. **(08 Marks)**

8 a. With usual notations, for a ideal gas undergoing a reversible adiabatic process, the law of the process is given by $TV^{\gamma-1} = C$. **(06 Marks)**

b. Show that the entropy change of an ideal gas is given by the equation of the form $S_2 - S_1 = C_p \ ln \frac{V_2}{V_1} + C_V \ ln \frac{P_2}{P_1}$. **(06 Marks)**

c. 0.5 kg of air is compressed reversibly and adiabatically from 80 kPa, 60^0C to 0.4 Mpa and is then expanded at constant pressure to the original volume. Sketch these processes on the P-V and T-S planes. Compute the heat transfer and work transfer for the whole path. **(08 Marks)**

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06ME34

Third Semester B.E. Degree Examination, June/July 08
Mechanics of Materials

Time: 3 hrs. Max. Marks:100

Note :1. ***Answer any FIVE full questions choosing at least two questions from each section.***

2. ***Assume suitable data wherever necessary.***

PART A

1 a. Define Hook's law, modulus of elasticity, elasticity and strain. **(04 Marks)**

b. Derive an expression for the total extension of the tapered circular bar cross section of diameter D and d, when it is subjected to an axial pull of load P. **(06 Marks)**

c. For the laboratory tested speciman the following data were obtained:
- i) Diameter of the speciman = 25 mm
- ii) Length of speciman = 300 mm
- iii) Extension under the load of 15 KN = 0.045 mm
- iv) Load at yield point = 127.65 KN
- v) Maximum load = 208.60 KN
- vi) Length of the speciman after failure = 375 mm
- vii) Neck diameter = 17.75 mm

Determine : i) Young's modulus ii) Yield point stress iii) Ultimate stress iv) Percentage elongation v) Percentage reduction in area. **(10 Marks)**

2 a. Derive the relationship between Young's modulus and modulus of rigidity in the form of $E = \frac{9GK}{3K+G}$. **(06 Marks)**

b. Derive an expression for extension of the bar due to its self weight only having area 'A' and length 'L' suspended from its top. **(04 Marks)**

c. A 12 mm diameter steel rod passes centrally through a copper tube 48 mm external diameter and 36 mm internal diameter and 2.50 m long. The tube is closed at each end by 24 mm thick steel plates which are secured by nuts. The nuts are tightned until the copper tube is reduced in length by 0.508 mm. The whole assembly is then raised in temperature by 60°C. Calculate the stresses in copper and steel before and after raising the temperature, assuming the thickness of the plates remain to be unchanged.

Take $\alpha_S = 1.2 \times 10^{-5}$ per °C, $\alpha_C = 1.75 \times 10^{-5}$ per °C

$E_S = 2.1 \times 10^5$ N/mm^2, $E_C = 1.05 \times 10^5$ N/mm^2 **(10 Marks)**

3 a. What are principal stresses and principal planes? **(02 Marks)**

b. Explain procedure for construction of Mohr's circle with tensile, compressive and shear stresses acting on the component. **(06 Marks)**

c. The state of stress in two dimensionally stressed body is as shown in figure Q3 (c). Determine the principal planes, principal stresses, maximum shear stress and their planes. **(12 Marks)**

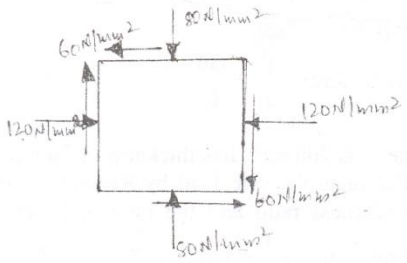

Fig. Q3 (c)

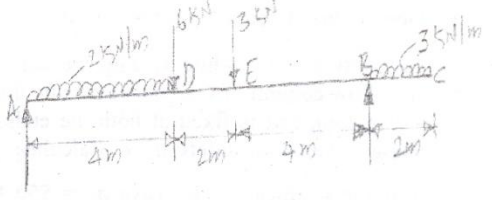

Fig. Q5 (b)

4 a. What are the differences between thin and thick cylinder? **(02 Marks)**

b. Derive Lamme's equation for thick cylinder. **(08 Marks)**

c. A thin cylindrical shell 1.2 m in diameter and 3 m long has a metal wall thickness of 12 mm. It is subjected to an internal fluid pressure of 3.2 MPa. Find the circumferential and longitudinal stress in the wall. Determine change in length, diameter and volume of the cylinder. Assume E = 210 GPa and $\mu = 0.3$ **(10 Marks)**

PART B

5 a. Define shear force, bending moment, point of contraflexture and beam. **(04 Marks)**

b. Draw shear force and bending moment diagram for beam shown in figure Q 5 (b), indicating the principal values. **(16 Marks)**

6 a. Prove that maximum shear stress in a rectangular section of width b and depth d is equal to 1.5 times of its average shear stress. **(06 Marks)**

b. Explain neutral axis and modulus of section as applied to beam. **(04 Marks)**

c. An unequal angle section shown in figure Q6 (c) is used as a simply supported beam over a span of 2 m and uniformly distributed load of 10 kN/m, inclusive of its own weight. Determine the maximum tensile and compressive stresses in the section. **(10 Marks)**

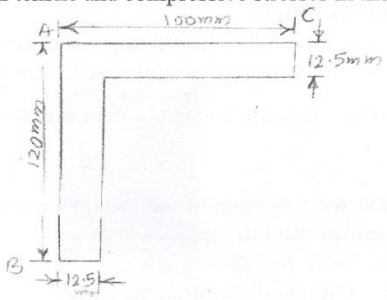

Fig. Q6 (c)

7 a. For simply supported beam with uniformly distributed load over whole length show that the maximum deflection is equal to $\frac{-5}{384}\frac{WL^4}{EI}$. **(05 Marks)**

b. A beam AB of span 6 m is simply supported at the ends and is loaded as shown in figure Q7 (b). Determine i) deflection at C ii) maximum deflection and iii) slope at the end A. Take $E = 2 \times 10^5$ N/mm^2, $I = 2 \times 10^7$ mm^4. **(15 Marks)**

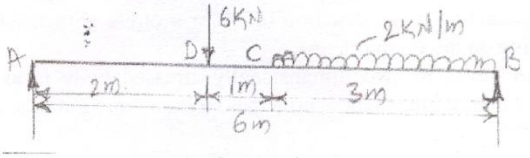

Fig. Q7 (b)

8 a. Derive the torsion formula, in the standard form $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$ and list all the assumptions made while deriving the same. **(08 Marks)**

b. A hollow column of C.I. whose outside diameter is 200 mm, has thickness of 20 mm. It is 4.5 m long and is fixed at both the ends. Calculate the safe load by Rankine's formula using a factor of safety of 4. Calculate slenderness ratio and the ratio of Euler's and Rankine's critical loads. Take σ_C = 550 N/mm^2, $\alpha = \frac{1}{1600}$ and E = 8×10^4 N/mm^2. **(12 Marks)**

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06ME35

Third Semester B.E. Degree Examination, June / July 08
Manufacturing Process – I

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions, choosing atleast two questions from each part.***

PART A

1 a. List the advantages and disadvantages of casting process. **(04 Marks)**
b. Explain the basic steps involved in a casting process. **(05 Marks)**
c. Explain with sketches i) Sweep pattern ii) Match-plate pattern. **(06 Marks)**
d. What are pattern allowances? Explain any one. **(05 Marks)**

2 a. What are the desirable properties of moulding sand? **(04 Marks)**
b. What are cores? Briefly explain their significance in sand moulding process. **(06 Marks)**
c. What are casting defects? Explain any two. **(06 Marks)**
d. Explain the working of jolt type moulding machine. **(04 Marks)**

3 a. Explain briefly the following, with sketches:
i) Shell mould ii) Investment mould. **(10 Marks)**
b. Explain the following:
i) Pressure die casting ii) Centrifugal casting. **(10 Marks)**

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

PART B

5 a. What is welding? Mention the advantages and limitations of welding process. **(08 Marks)**
b. Explain the following with neat sketch:
i) Submerged Arch Welding (SAW) ii) Oxy-Acetylene Welding. **(12 Marks)**

6 a. Explain the principle of i) Seam welding ii) Projection welding. **(08 Marks)**
b. With a sketch explain the process of laser welding process, mention advantages and limitations. **(12 Marks)**

7 a. Discuss the factors affecting weldability of metals. **(06 Marks)**
b. Explain the parameters affecting (HAZ) – Heat Affected Zone. **(06 Marks)**
c. Mention the role played by filler rods in welding process and briefly discuss the advantages. **(08 Marks)**

8 a. Compare the soldering and brazing processes. Mention their advantages and disadvantages. **(10 Marks)**
b. What is NDT? Explain with a neat sketch ultrasonic inspection procedure. **(10 Marks)**

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