| Hall Ticket Number : | | | | | | | | | | |
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**R-15**

**Code: 5GC31**

II B.Tech. I Semester Supplementary Examinations March/April 2023

# Engineering Mathematics-III

(Common to CE & ME)

Max. Marks: 70 Time: 3 Hours

Answer *any five full questions* by choosing one question from each unit (5x14 = 70 Marks )

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Marks

## UNIT–I

1. Find the values of k for which the system of equations (3k-8)x+3y+3z=0; 3x+(3k-8)y+3z; 3x+3y+(3k-8)z=0 has a non-trivial solution. 14M

**OR**

2. a) Determine the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ 7M

   b) Find the Eigen values and eigenvectors of $A=\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ 7M

## UNIT–II

3. a) Find the Cubic polynomial which takes the values. $y(0)=1$, $y(1)=0$, $y(2)=1$ and $y(3)=10$ 7M

   b) Find the real root of the equation $x\log_{10} x=1.2$ by Regula-falsi method correct to four decimal places. 7M

**OR**

4. From the following table, estimate the number of students who obtained marks between 40 and 45 using Newton's interpolation formula

| Marks | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
|---|---|---|---|---|---|
| No. of Students | 31 | 42 | 51 | 35 | 31 |

14M

## UNIT–III

5. Employ Taylor's method to obtain approximate value of y at $x=0.2$ for the differential equation $\frac{dy}{dx}=2x+3e^x$ $y(0)=0$. Compare the numerical solution obtained with the exact solution 14M

**OR**

6. Apply Milne's method to find a solution of the equation $y'=x-y^2$ in the range $0\le x\le 1$ for the boundary conditions y=0 at x=0. 14M

## UNIT–IV

7. a) Find the half range cosine series for the function $f(x)=x$, when $0<x<®$ hence show that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots=\frac{®^2}{8}$ 8M

   b) Form a partial differential equation by eliminating the arbitrary function $f$ from $z=f\left(x^2+y^2\right)$. 6M

**OR**

8. Using the method of separation of variables, solve

$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x,0) = 6e^{-3x}$ 14M

**UNIT–V**

9. a) If $u = x^2 + y^2$, find harmonic conjugate $v(x,y)$ and write the corresponding complex potential $f(z) = u + iv$ 7M

b) Show that the polar form of Cauchy's Riemann equations are $\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = \frac{1}{r}\frac{\partial u}{\partial \theta}$ 7M

**OR**

10. Show that the function $f(z) = \sqrt{|xy|}$ is not analytic at the origin even though C-R equations are satisfied. 14M

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| Hall Ticket Number : | | | | | | | | | | |
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**R-15**

**Code: 5G532**

II B.Tech. I Semester Supplementary Examinations March/April 2023

# Mettalurgy and Material Science

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *any five full questions* by choosing one question from each unit (5x14 = 70 Marks )

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| | | | Marks |
|---|---|---|---|
| | | **UNIT–I** | |
| 1. | | Classify bonds and explain them with examples | 14M |
| | | **OR** | |
| 2. | a) | Define alloy. Explain its necessity. | 7M |
| | b) | Discuss about Schottky defect and Frankel defect. | 7M |
| | | **UNIT–II** | |
| 3. | a) | Briefly explain the methods used for construction of Equilibrium diagrams. | 7M |
| | b) | Draw the phase diagram for an Isomorphous system. | 7M |
| | | **OR** | |
| 4. | | Draw a neat sketch of Iron-Iron Carbide (Fe-$Fe_3C$) diagram and label all important points, lines and phases in it. | 14M |
| | | **UNIT–III** | |
| 5. | | Discuss briefly the properties and applications of Titanium and its alloys | 14M |
| | | **OR** | |
| 6. | a) | Briefly explain the characteristics of cast irons | 7M |
| | b) | Classify Cast Irons Explain any one of them | 7M |
| | | **UNIT–IV** | |
| 7. | | Describe the steps involved in construction of TTT diagram | 14M |
| | | **OR** | |
| 8. | a) | What is Normalizing? Explain its purpose | 7M |
| | b) | Compare hardening and Tempering processes | 7M |
| | | **UNIT–V** | |
| 9. | | Classify composites. Explain about fiber reinforced composites | 14M |
| | | **OR** | |
| 10. | | Briefly explain metal matrix composites and Carbon-Carbon composites | 14M |

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| Hall Ticket Number : | | | | | | | | | | |
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**R-15**

**Code: 5G531**

II B.Tech. I Semester Supplementary Examinations March/April 2023

# Mechanics of Solids

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *any five full questions* by choosing one question from each unit (5x14 = 70 Marks )

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Marks

## UNIT–I

1. A tensile test was conducted on a mild steel bar. The following data was obtained from the test:
   (i) Diameter of the steel bar = 3 cm
   (ii) Gauge length of the bar = 20cm
   (iii) Load at elastic limit=250kN
   (iv) Extension at a load of 150kN=0.21mm
   (v) Maximum load = 380 kN
   (vi) Total extension = 60 mm
   (vii) Diameter of rod at failure = 2.25 cm
   Determine:
   (a) The Young's modulus (b) The stress at elastic limit
   (c) The percentage of elongation (d) The percentage decrease in area. 14M

**OR**

2. a) Prove that the maximum stress induced in a body due to suddenly applied load is twice the stress induced when the same load is applied gradually. 7M

   b) Define the term 'composite bar'. How will you find the stresses and load carried by each member of a composite bar? 7M

## UNIT–II

3. A beam ABC 8 m long has the support at the end A and other support at B 6 m from A. It carries a uniformly distributed load of 6 kN/m over the entire length and a point load of 10 kN at the end C. Draw the shear force and bending moment diagrams 14M

**OR**

4. A simple supported beam of length 8m rests on supports 6m apart, the right hand end is overhanging by 2 m. The beam carries a uniformly distributed load of 1500 N/m over the entire length. Draw the shear force and bending moment diagrams and find the point of contra flexure, if any? 14M

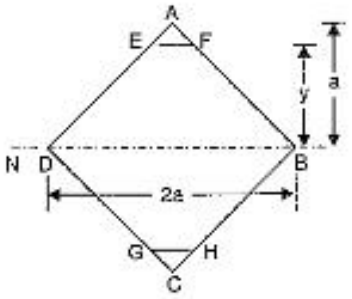
## UNIT–III

5. a) Derive the section modules for (a) rectangular section and (b) circular section 7M

   b) Prove that for a rectangular section the maximum shear stress is 1.5times the average stress. Sketch the variation of shear stress. 7M

**OR**

6. Prove that the moment of a resistance of a beam of square section, with its diagonal in the plane of bending is increased by flatting top and bottom corners as shown in figure and that moment of resistance is maximum when $y = \frac{8a}{9}$. Find the percentage increase in moment of resistance also.




14M

**UNIT–IV**

7. Define Macaulay's method? And find out Deflection of a simply supported beam with an Eccentric point load 14M

**OR**

8. A beam of length 6 m is simply supported at the 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. Compute,
   i. Slope and deflection under each load. ii. Maximum deflection
   iii. The point at which maximum deflection occurs.
   Assume E = 2 X $10^5$ N/mm$^2$ and I = 85 X $10^6$ mm$^4$. 14M

**UNIT–V**

9. A solid round bar 3 m long and 5 cm in diameter is used as a sturt. Determine the cripping load when the given sturt is used for the following conditions
   i) Both the ends are hinged
   ii) Both the ends are fixed
   iii) One end is fixed and one end is hinged and
   iv) One end is fixed and one end is free.
   Take E = 2.1 x $10^5$ N/mm$^2$. Also find safe load taking factor of safety as 4 in each case. 14M

**OR**

10. What are the stresses induced in the thin cylindrical shell subjected to internal pressure? Explain and derive them. 14M

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**R-15**

**Code: 5G533**

II B.Tech. I Semester Supplementary Examinations March/April 2023

# Basic Thermodynamics

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *any five full questions* by choosing one question from each unit (5x14 = 70 Marks )

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Marks

**UNIT–I**

1. a) What is meant by displacement work? Explain the same with reference to the Quasi-static process. 7M

   b) Classify the types of thermodynamic systems with the help of suitable example. 7M

**OR**

2. a) Derive the general steady flow energy equation and deduce SFEE for Turbine. 8M

   b) A mass of 8 kg gas expands within a flexible container so that the p–v relationship is of the form $pv^{1.2}$ = constant. The initial pressure is 1000 kPa and the initial volume is 1 $m^3$. The final pressure is 5 kPa. If specific internal energy of the gas decreases by 40 kJ/kg, find the heat transfer in magnitude and direction. 6M

**UNIT–II**

3. a) Determine the expression for the measurement of performance for reversible heat engines, heat pump and refrigerators. 10M

   b) State Carnot theorem. 4M

**OR**

4. a) Write short notes on Second law of Thermodynamics. 7M

   b) An inventor claims to develop an engine which absorbs 100KW of heat from a reservoir at 1000K produces 60 kW of work and rejects heat to a reservoir at 500 K. Will u advise investment in its development? 7M

**UNIT–III**

5. a) Write about the Mollier Chart and its use. 7M

   b) Draw and explain P-V diagram for pure substance. 7M

**OR**

6. a) A sample of steam from a boiler drum at 3 MPa is put through a throttling calorimeter in which the pressure and temperature are found to be 0.1 MPa, 120°C. Find the quality of the sample taken from the boiler. 8M

   b) Explain the concept of Triple point. 6M

**UNIT–IV**

7. a) 1.5 kg of air at pressure 6 bar occupies a volume of 0.2 $m^{3.}$ If this air is expanded to a volume of 1.1 $m^3$. Find the work done and heat absorbed or rejected by the air for each of the following methods. (i) Isothermal process (ii) Adiabatic process (iii) Polytropic process. 10M

   b) A spherical shaped balloon of 10 m diameter contains hydrogen at 33 $^0$C and 1.3 bar. Find the mass of hydrogen in the balloon. 4M

**OR**

8. a) Derive the relationship between the two principal specific heats and characteristic gas constant for a perfect gas 6M

   b) Deduce the equation $PV^Y$ = Constant for an adiabatic process 8M

**UNIT–V**

9. a) Explain Mass fraction, Mole fraction, Internal energy and specific heat of gas mixtures 8M

   b) Briefly discuss about the Volumetric Analysis. 6M

**OR**

10. The volumetric analysis of a dry flue gas in a boiler trail is given in percentage as 13% $CO_2$, 1.5% CO, 3.5% $O_2$ and 82% $N_2$. Determine the percentage gravimetric analysis also find the specific gas constant of the mixture 14M

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