| Hall Ticket Number : | | | | | | | | | | |
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**R-19**

**Code: 19A333T**

II B.Tech. I Semester Regular Examinations March 2021

# Basic Thermodynamics

( Mechanical Engineering )

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit ( 5 x 14 = 70 Marks )

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*Steam Tables, Mollier chart are permitted*

| | | | Marks | CO | Blooms Level |
|---|---|---|---|---|---|
| | | **UNIT–I** | | | |
| 1. | a) | Define the following<br>(i) internal energy (ii) Perpetual motion machine of first kind-PMM 1 | 4M | 1 | L2 |
| | b) | Steam enters a steam turbine at a pressure of 15 bar and 350°C with a velocity of 180 m/s with an enthalpy of 4 KJ/kg. The steam leaves the turbine at 1.2 bar and with a velocity of 60 m/s with an enthalpy of 2KJ/kg. Assuming the process to be reversible adiabatic, determine the work done per kg of steam flow through the turbine. Neglect the change in potential energy. | 10M | 1 | L3 |
| | | **OR** | | | |
| 2. | a) | What is positive and negative work? | 4M | 1 | L2 |
| | b) | The working fluid, in a steady flow process flows at a rate of 220 kg/min. The fluid rejects 100 kJ/s passing through the system. The conditions of the fluid at inlet and outlet are given as : C1 = 320 m/s, p1 = 6.0 bar, u1 = 2000 kJ/kg, v1=0.36 $m^3$/kg and C2 = 140 m/s, p2 = 1.2 bar, u2 = 1400 kJ/kg, v2 = 1.3 $m^3$/kg. The suffix 1 indicates the condition at inlet and 2 indicates at outlet of the system. Determine the power capacity of the system in MW. The change in potential energy may be neglected. | 10M | 1 | L3 |
| | | **UNIT–II** | | | |
| 3. | a) | Define heat engine and heat pump. | 4M | 2 | L2 |
| | b) | Prove Maxwell Equations. | 10M | 2 | L3 |
| | | **OR** | | | |
| 4. | a) | Write the following statements of second law of thermodynamics.<br>(i) Clausius statement (ii) Kelvin-Planck statement. | 4M | 2 | L2 |
| | b) | 3 kg of gas (cv = 0.81 kJ/kg K) initially at 2.5 bar and 400 K receives 600 kJ of heat from an infinite source at 1200 K. If the surrounding temperature is 290 K, find the loss in available energy due to above heat transfer. | 10M | 2 | L3 |
| | | **UNIT–III** | | | |
| 5. | a) | Define triple point and critical point for pure substance. | 4M | 3 | L2 |
| | b) | A quantity of steam at 10 bar and 0.85 dryness occupies 0.15 $m^3$. Determine the heat supplied to raise the temperature of the steam to 300°C at constant pressure and percentage of this heat which appears as external work. Take specific heat of superheated steam as 2.2kJ/kgK | 10M | 3 | L3 |
| | | **OR** | | | |

| | | | | | |
|---|---|---|---|---|---|
| 6. | a) | Explain the following terms relating to steam formation (i) Dryness fraction of steam (ii) Enthalpy of wet steam | 4M | 3 | L2 |
| | b) | Find the internal energy of 1 kg of steam at 20 bar when (i) it is superheated, its temperature being 400°C ; (ii) it is wet, its dryness being 0.9. Assume superheated steam to behave as a perfect gas from the commencement of superheating and thus obeys Charle's law. Specific heat for steam = 2.3 kJ/kg K. | 10M | 3 | L3 |

**UNIT–IV**

| | | | | | |
|---|---|---|---|---|---|
| 7. | a) | What is the difference between an ideal gas and a perfect gas? | 4M | 4 | L2 |
| | b) | One kg of $CO_2$ has a volume of 1 $m^3$ at 100 °C. Compute the pressure by (i) Van der Waal's equation and (ii) perfect gas equation. Take(a= 362850N-$m^4$/(kg-mole)$^2$ and b=0.0423$m^3$/kg-mole ) | 10M | 4 | L3 |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 8. | a) | State Boyle's Law and Charle's Law. | 4M | 4 | L2 |
| | b) | A steel flask of 0.04 $m^3$ capacity is to be used to store nitrogen at 120 bar, 20 °C. The flask is to be protected against excessive pressure by a fusible plug which will melt and allow the gas to escape if the temperature rises too high. (i) How many kg of nitrogen will the flask hold at the designed conditions? (ii) At what temperature must the fusible plug melt in order to limit the pressure of a full flask to a maximum of 150 bar? | 10M | 4 | L3 |

**UNIT–V**

| | | | | | |
|---|---|---|---|---|---|
| 9. | a) | State the following: (i) Mass fraction (ii) Mole fraction | 4M | 5 | L2 |
| | b) | A mixture of hydrogen ($H_2$) and Oxygen ($O_2$) is to be made so that the ratio of $H_2$ to $O_2$ is 2 : 1 by volume. If the pressure and temperature are 1 bar and 25 °C respectively, calculate: (i) The mass of $O_2$ required and (ii) The volume of the container. | 10M | 5 | L3 |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 10. | a) | What is the generalized compressibility chart? | 4M | 5 | L2 |
| | b) | The analysis by weight of a perfect gas mixture at 20 °C and 1.3 bar is 10% $O_2$, 70% $N_2$, 15% $CO_2$ and 5% CO. For a reference state of 0 °C and 1 bar determine: (i) Partial pressures of the constituents and (ii) Gas constant of mixture. | 10M | 5 | L3 |

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| Hall Ticket Number : | | | | | | | | | | |
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**R-19**

**Code: 19A236T**

II B.Tech. I Semester Regular Examinations March 2021

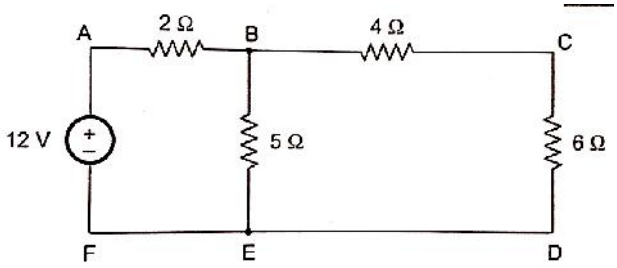
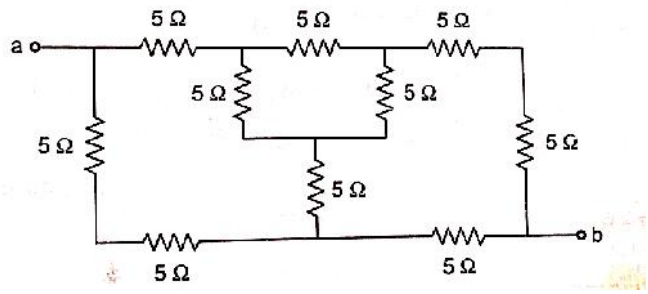
# Basic Electrical and Electronics Engineering

( Mechanical Engineering )

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit ( 5 x 14 = 70 Marks )

*********

| | | | Marks | CO | Blooms Level |
|---|---|---|---|---|---|
| | | **UNIT–I** | | | |
| 1. | a) | Explain the following terms<br>i) Potential difference ii) Ohm's law iii)Current | 7M | 1 | L1 |
| | b) | In the network shown in fig find all the branch currents and voltage drops across all resistors?<br>  | 7M | 1 | L1 |
| | | **OR** | | | |
| 2. | a) | Derive the relationship to express three delta connected resistances into three equivalent star resistance? | 7M | 1 | L1 |
| | b) | Find $R_{ab}$ across the terminals a-b of the network shown in fig?<br>  | 7M | 1 | L1 |
| | | **UNIT–II** | | | |
| 3. | a) | Derive from first principles an expression for the e.m.f. of a d.c. generator? | 7M | 2 | L1 |
| | b) | A d.c. series generator has armature resistance of 0.5Ω and series field resistance of 0.03Ω. it drives a load of 50 A. if it has 6 turns/coil and total 540 coils on the armature and is driven at 1500 r.p.m., calculate the terminal voltage at the load. Assume 4 poles, lap type winding, flux per pole as 2 mWb and total brush drop as 2 V? | 7M | 2 | L3 |
| | | **OR** | | | |
| 4. | a) | Explain the principle of working of d.c. motor? | 7M | 2 | L1 |
| | b) | A 4 pole,240 V, wave connected shunt motor gives 11.19 KW when running at 1000 r.p.m. and drawing armature and field current of 50 A and 1 A respectively. It has 540 conductors. Its resistance is 0.1Ω. Assuming a drop of 1 V per brush, calculate: (i) Total torque (ii) Useful torque (iii) Useful flux/pole (iv) Rotational losses (v) Efficiency? | 7M | 2 | L3 |

**UNIT–III**

| | | | | | |
|---|---|---|---|---|---|
| 5. | a) | Explain the principle of working of a single phase transformer? | 7M | 3 | L2 |
| | b) | Explain the synchronous impedance method for calculating the regulation of a three phase alternator? | 7M | 3 | L2 |
| | | **OR** | | | |
| 6. | a) | Explain the construction of a three phase induction motor? | | 3 | L2 |
| | b) | A 20 KVA transformer has its maximum efficiency of 0.98 at 15 KVA at unity power factor. The iron loss is 350 W. calculate the efficiency at full load 0.8 power factor lagging and unity power factor? | 7M | 3 | L2 |

**UNIT–IV**

| | | | | | |
|---|---|---|---|---|---|
| 7. | a) | Explain the operation of forward biased diode along with its forward characteristics? | 7M | 4 | L1 |
| | b) | Explain the working of pnp transistor? | | 4 | L1 |
| | | **OR** | | | |
| 8. | a) | Draw and explain input and output characteristics for transistor CE configuration? | 7M | 4 | L1 |
| | b) | The four semiconductor diodes used in a bridge rectifier circuit each having a forward resistance of 0.1Ω and infinite reverse resistance, feed a d.c. current of 10 A to a resistive load from a sinusoidally varying alternating supply of 30 V (r.m.s). Determine the resistance of the load and the efficiency of the circuit. | 7M | 4 | L1 |

**UNIT–I**

| | | | | | |
|---|---|---|---|---|---|
| 9. | a) | Explain the principle of induction heating. Which are the two types of induction heating? | 7M | 5 | L2 |
| | b) | Draw the block diagram of general purpose CRO. Explain the functions of various blocks? | 7M | 5 | L2 |
| | | **OR** | | | |
| 10. | a) | Explain the theory of dielectric heating. State its advantages and industrial applications. | 7M | 5 | L2 |
| | b) | Explain the applications of induction heating | 7M | 5 | L2 |

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| Hall Ticket Number : | | | | | | | | | | |
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**R-19**

**Code: 19A334T**

II B.Tech. I Semester Regular Examinations March 2021

# Kinematics of Machinery

( Mechanical Engineering )

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit ( 5 x 14 = 70 Marks )

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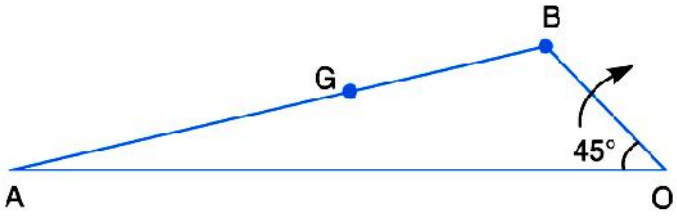
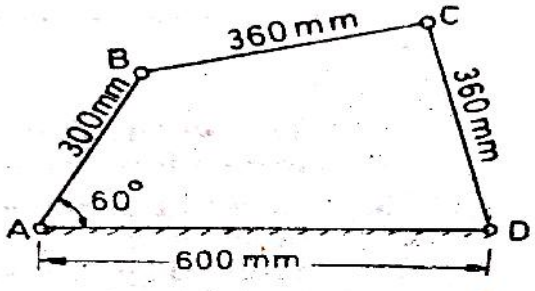
| | | | Marks | CO | Blooms Level |
|---|---|---|---|---|---|
| | | **UNIT–I** | | | |
| 1. | a) | Define the following.<br>i. Kinematic link ii. Kinematic pair iii. Kinematic chain, | 7M | 1 | L1 |
| | b) | Discuss completely constrained motion and In-completely constrained motion with suitable example. | 7M | 1 | L1 |
| | | **OR** | | | |
| 2. | a) | Discuss the inversions of quadratic cycle chain mechanism | 7M | 1 | L2 |
| | b) | Define Degree of freedom, briefly discuss the Grubler's equation to find the degrees of freedom for a plane mechanism. | 7M | 1 | L1 |
| | | **UNIT–II** | | | |
| 3. | | The engine mechanism shown in Fig has crank OB = 50 mm and length of connecting rod AB= 225 mm. The centre of gravity of the rod is at G which is 75mm from B. The engine speed is 200 r.p.m. For the position shown, in which OB is turned 45° from OA, Find 1. the velocity of G and the angular velocity of AB, and 2. the acceleration of G and angular acceleration of AB.<br>  | 14M | 2 | L3 |
| | | **OR** | | | |
| 4. | | A pin joined four bar mechanism as shown in Figure 2, has various dimensions as follows: AB= 300mm, BC=CD=360mm, and AD=600mm. The angle BAD=$60^0$. The crank AB rotates uniformly at 100 rpm. Locate all the instantaneous centres and find the angular velocity of the link BC.<br>  <br>Figure: 2 | 14M | 2 | L3 |
| | | **UNIT–III** | | | |
| 5. | | Describe with a neat sketch the Hart's straight line motion mechanism and prove that the tracing point 'P' describe a straight line path. | 14M | 3 | L2 |
| | | **OR** | | | |

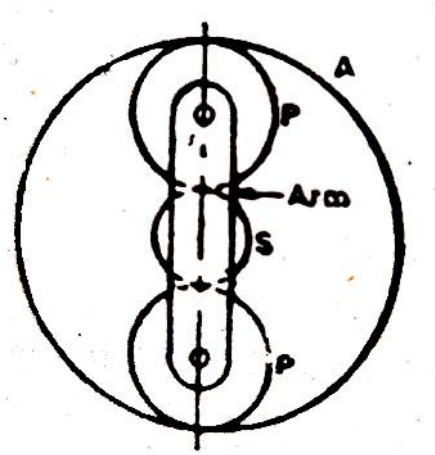
| | | | | | |
|---|---|---|---|---|---|
| 6. | a) | Discuss the condition for correct steering explain? | 7M | 3 | L2 |
| | b) | Two shafts which are inclined at an angle of 160° are connected by a Hook's joint. The driving shaft runs at a uniform speed of 1500 rpm. The driven shaft carries a flywheel of 12kg and 10cm radius of gyration. Find the maximum angular acceleration of the driven shaft and the maximum torque required. | 7M | 3 | L3 |

**UNIT–IV**

| | | | | | |
|---|---|---|---|---|---|
| 7. | a) | Discuss the phenomena of interference in toothed gearing. | 4M | 4 | L2 |
| | b) | The pitch circle radii of two involute spur gears in mesh are 51.5mm and 64.2mm. The outer circle radii are 57.5mm and 71.2mm respectively. The operating pressure angle being 20°. Determine i) Length of path of contact ii) contact ratio if the number of teeth on the gear is 20. | 10M | 4 | L5 |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 8. | | An eipicyclic gear train as shown in Figure 3 has sun wheel S of 30 teeth and two planet wheels P, P of 50 teeth. The planet wheels mesh with the internal teeth of a fixed annulus A. The driving shaft carrying the sun wheel transmits 4kW at 300 rpm. The driven shaft is connected to an arm which carries the planet wheels. | | | |




| | | | | | |
|---|---|---|---|---|---|
| | | | 14M | | |
| | | Figure: 3 | | 4 | L5 |

**UNIT–V**

| | | | | | |
|---|---|---|---|---|---|
| 9. | | A Cam rotating clockwise at a uniform speed of 1000 rpm is required to give a knife edge follower the motion defined below.<br>i. Follower to move outward through 2.5cm during 120° of cam rotation<br>ii. Follower to dwell for next 60° of cam rotation.<br>iii. Follower to return to its starting position during next 90° of cam rotation<br>iv. Follower to dwell for the rest of the cam rotation. | 14M | 5 | L6 |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 10. | | Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5mm and the least radius of the cam is 50mm. The follower is provided with a roller of 50mm diameter and the line of stroke passes through the axis of the cam. | 14M | 5 | L6 |

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| Hall Ticket Number : | | | | | | | | | | |
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**R-19**

**Code: 19AC34T**

II B.Tech. I Semester Regular Examinations March 2021

# Life Sciences for Engineers

( Common to CE, ME & CSE )

Max. Marks: 70 Time: 3 Hours

Answer *any five full* questions by choosing one question from each unit ( 5 x 14 = 70 Marks )

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| | | | Marks | CO | Blooms Level |
|---|---|---|---|---|---|
| | | **UNIT–I** | | | |
| 1. | a) | What is meant by classification and explain about living organisms based on their cellular life. | 7M | 1 | 2 |
| | b) | Differentiate between prokaryotes and eukaryotes. | 7M | 1 | 4 |
| | | **OR** | | | |
| 2. | a) | What is molecular taxonomy and how the organisms classify? | 7M | 1 | 2 |
| | b) | Explain about biological organisms comparing with manmade systems. | 7M | 1 | 2 |
| | | **UNIT–II** | | | |
| 3. | | Explain the structure and functions of proteins. | 14M | 2 | 1 |
| | | **OR** | | | |
| 4. | a) | Describe briefly about antibodies. | 7M | 2 | 2 |
| | b) | Explain the process of fermentation and its industrial applications. | 7M | 2 | 2 |
| | | **UNIT–III** | | | |
| 5. | | Explain the reactions that occur in glycolysis. | 14M | 3 | 2 |
| | | **OR** | | | |
| 6. | a) | What is synapse and describe about neuromuscular junctions? | 7M | 3 | 2 |
| | b) | Explain about electron transport system. | 7M | 3 | 2 |
| | | **UNIT–IV** | | | |
| 7. | a) | What are the characteristics of Mendal's laws and explain with suitable examples? | 7M | 4 | 2 |
| | b) | Write the differences between mitosis and meiosis? | 7M | 4 | 4 |
| | | **OR** | | | |
| 8. | a) | Describe briefly about eukaryotic DNA replication. | 7M | 4 | 2 |
| | b) | Briefly explain about central dogma of molecular biology. | 7M | 4 | 2 |
| | | **UNIT–V** | | | |
| 9. | | Describe briefly about recombinant vaccines. | 14M | 5 | 2 |
| | | **OR** | | | |
| 10. | a) | Write short notes on transgenic microbes. | 7M | 5 | 1 |
| | b) | Explain the salient features of animal cloning. | 7M | 5 | 3 |

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| Hall Ticket Number : | | | | | | | | | | |
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**R-19**

**Code: 19A331T**

II B.Tech. I Semester Regular Examinations March 2021

# Mechanics of Solids

( Mechanical Engineering )

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit ( 5 x 14 = 70 Marks )

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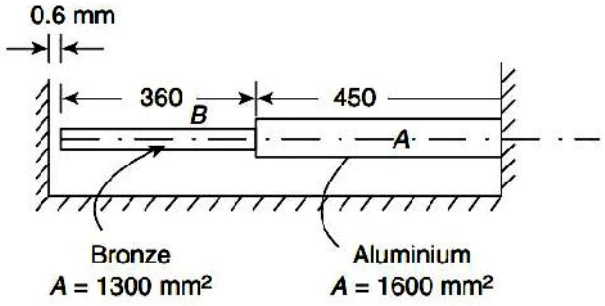
| | | Marks | CO | Blooms Level |
|---|---|---|---|---|

## UNIT–I

1. a) A composite bar of bronze and aluminium as shown in the following Fig. The temperature of the composite bar is raised by 100°C. Determine the compressive force developed in the bars after the rise of temperature and the change in length of aluminium bar. The area of cross-section of bronze bar is 1,300 mm2 and of aluminium bar is 1,600 mm2 $E_b$ = 105 GPa, $E_a$ = 70GPa, $\alpha_b$ = 18 × 10−6 /°C, $\alpha_a$ = 23 × 10−6 /°C.




10M CO1 L3

b) A 40-mm cubical block is subjected to shear stress and it is observed that $\tau_e$ = 240 N/mm$^2$. If shear modulus G = 84 kN/mm$^2$, determine (i) the modulus of resilience, (ii) the shear strain at elastic limit and (iii) the total strain energy absorbed at elastic limit. 4M CO1 L2

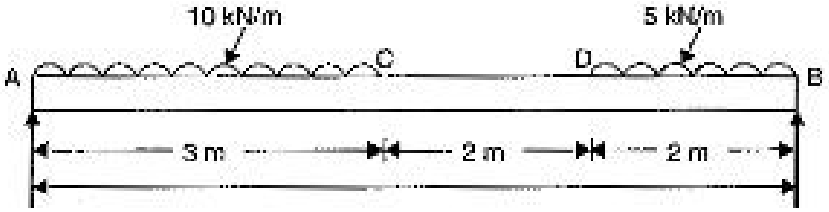
**OR**

2. a) Draw stress-strain curve for a ductile material subjected to tension and explain about the salient points on it. 5M CO1 L3

b) A tension test is conducted on a steel bar of gauge length 55 mm and diameter 10 mm.The bar during the test elongates to 80 mm.A maximum load of 80 kN may be applied onthe bar but it yields at 35 kN and finally breaks at 40 kN. Find the following parameters.(i) Yield strength; (ii) Ultimate strength; (iii) Strength at the point of failure;(iv) Actual strength at the point of failure when the diameter is reduced to 5 mm;(v) Percentage elongation; and (vi) Percentage reduction in area. 9M CO1 L3

## UNIT–II

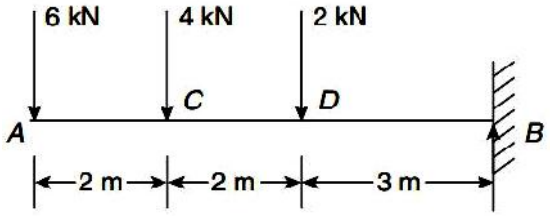
3. A simply supported beam of length 7m, carries the uniformly distributed load and two-point loads as shown in the following Fig. Draw the Shear Force and Bending Moment diagrams for the beam. Also calculate the location and magnitude of maximum bending moment.




14M CO2 L3

**OR**

4. A 7-m-long cantilever is free at end A and fixed at end B carries three loads as shown in Fig. Determine support reaction and draw SF diagram and BM diagram of the cantilever.




14M CO2 L3

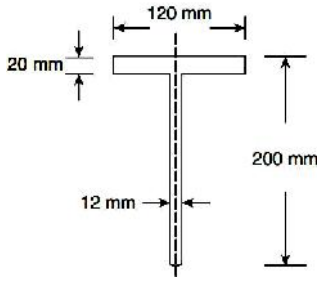
**UNIT–III**

5. Derive the expression for Shear Stress Distribution in a Rectangular Section of a Beam. 14M CO3 L3

**OR**

6. a) A beam is of circular sections of diameter D mm. At a particular section of the beam, shear force is 10 kN. Determine the diameter D if the maximum shear stress at neutral layer is not to exceed 15 N/mm$^2$ . 7M CO3 L3

   b) A T-section with dimensions, flange 120 mm × 20 mm and web 180 mm × 12 mm, is shown in Fig. It is subjected to a positive bending moment of 5 kN m. What are the stresses developed at extreme edges of the section?




7M CO3 L3

**UNIT–IV**

7. A beam, 7 m long, carries a uniformly distributed load of 20 kN/m, run throughout its length. The beam is supported over a span of 5 m with overhang of 2 m on one side. Determine the slope and deflection at the free end. If E = 200 GPa and I = 802 × 10$^4$ mm$^4$ . 14M CO4 L3

**OR**

8. A beam ABCD, 7 m long hinged at A and roller supported at D carries 7 kN load at B and 4 kN/m udl over BC = 3 m. If EI = 14,000 kN m$^2$ for the beam, determine the slope at A and deflection at point C. 14M CO4 L3

**UNIT–V**

9. a) A thin cylindrical shell made of 5-mm-thick steel plate is filled with water under pressure of 3 N/mm$^2$ . The internal diameter of the cylinder is 200 mm and its length is 1.0 m. Determine the additional volume of the water pumped inside the cylinder to develop the required pressure. Given for steel E = 208 kN/mm$^2$ and μ = 0.3, and for water K = 2,200 N/mm$^2$ . 7M CO5 L3

   b) Derive the expression for circumferential and volumetric strain for thin Cylinder Subjected to Internal Pressure p. 7M CO5 L4

**OR**

10. a) Evaluate the length of a cast iron column of 80 mm in diameter, the Euler's theory is applicable, if $\sigma_c$ = 550 N/mm$^2$ for CI and E = 102 kN/mm$^2$ , the column is hinged at both the ends 7M CO5 L3

    b) Derive Lami's equation for thick cylinders subjected to internal and external pressures. 7M CO5 L4

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| Hall Ticket Number : | | | | | | | | | | |
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**R-19**

**Code: 19A332T**

II B.Tech. I Semester Regular Examinations March 2021

# Metallurgy & Material Science

( Mechanical Engineering )

Max. Marks: 70 Time: 3 Hours

Answer any *five full* questions by choosing one question from each unit ( 5 x 14 = 70 Marks )

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| | | | Marks | CO | Blooms Level |
|---|---|---|---|---|---|
| | | **UNIT–I** | | | |
| 1. | a) | Classify bonds and explain any two types of bonds. | 7M | | L3 |
| | b) | Explain in brief the crystallization of pure metals. | 7M | | L2 |
| | | **OR** | | | |
| 2. | | Classify imperfections in solids and explain them with the help of neat diagrams. | 14M | | L3 |
| | | **UNIT–II** | | | |
| 3. | a) | Draw Fe-$Fe_3C$ phase diagram and label the phase in it. | 7M | | L4 |
| | b) | List out various reactions that occur in iron - iron carbide phase diagram and explain them with temperatures and compositions. | 7M | | L1 |
| | | **OR** | | | |
| 4. | a) | Explain the phase rule and its importance in phase diagrams | 7M | | L2 |
| | b) | Explain in detail the relationship between equilibrium diagrams and properties of alloys | 7M | | L2 |
| | | **UNIT–III** | | | |
| 5. | a) | Explain the microstructure, properties, and applications of White Cast iron, Malleable Cast iron. | 7M | | L2 |
| | b) | Classify plain carbon steels and give a brief note on various types of plain carbon steels. | 7M | | L2 |
| | | **OR** | | | |
| 6. | | Explain various types of tool and die steels and their properties and applications | 14M | | L2 |
| | | **UNIT–IV** | | | |
| 7. | a) | Define heat treatment. Explain various heat treatment parameters and heat treatment cycle. | 7M | | L1 |
| | b) | Explain at least 3 types of annealing processes with the help of a heat treatment cycle. | 7M | | L2 |
| | | **OR** | | | |
| 8. | a) | Explain in detail the effect of alloying elements on Iron – Iron carbon system, | 7M | | L2 |
| | b) | Explain the procedure to construct TTT diagram for an eutectoid steel. | 7M | | L2 |
| | | **UNIT–V** | | | |
| 9. | a) | Explain the properties and applications of cermets. | 7M | | L2 |
| | b) | Explain any two methods of component manufacture of composites. | 7M | | L2 |
| | | **OR** | | | |
| 10. | a) | Explain in brief the properties and applications of carbon-carbon composites and metal matrix composites. | 7M | | L2 |
| | b) | Discuss various steps involved in powder metallurgy process. | 7M | | L2 |

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| Hall Ticket Number : | | | | | | | | | | |
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**R-19**

**Code: 19AC31T**

II B.Tech. I Semester Regular Examinations March 2021

# Partial Differential Equations and Complex Variables

( Common to CE, EEE, ME & ECE )

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit ( 5 x 14 = 70 Marks )

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| | | | Marks | CO | Blooms Level |
|---|---|---|---|---|---|
| | | **UNIT–I** | | | |
| 1. | a) | Find the Laplace Transform of $f(t)=\begin{cases}\cos t\ , 0<t<\pi \\ \sin t, \quad t>\pi\end{cases}$ | 7M | CO1 | L1 |
| | b) | Find $L\left(\frac{\cos 2t-\cos 3t}{t}\right)$ | 7M | CO1 | L1 |
| | | **OR** | | | |
| 2. | a) | Find the Laplace transform of $e^{4t}(\sin 2t \cos t)$ | 7M | CO1 | L1 |
| | b) | Find the Laplace transform of $f(t)=\begin{cases}1 & , 0\le t<1 \\ -1 & , 1\le t<2\end{cases}$ having period 2 | 7M | CO1 | L1 |
| | | **UNIT–II** | | | |
| 3. | a) | Find the inverse Laplace Transform of $\frac{1}{(s^2+1)s}$ | 7M | CO2 | L1 |
| | b) | Apply Convolution theorem to evaluate $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$ | 7M | CO2 | L3 |
| | | **OR** | | | |
| 4. | | Solve $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+2y=5\sin t$ , *if* $y(0)=y'(0)=0$ | 14M | CO2 | L3 |
| | | **UNIT–III** | | | |
| 5. | | Expand $f(x)=x-x^2$ as Fourier series in the interval $(-\pi,\pi)$ and hence obtain $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+....=\frac{\pi^2}{12}$ | 14M | CO3 | L3 |
| | | **OR** | | | |
| 6. | a) | Find a Fourier series to represent $f(x)=x\ \sin x, \quad -\pi<x<\pi$ and hence deduce that $\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-....=\frac{1}{4}(\pi-2)$ | 7M | CO3 | L1 |
| | b) | Express $f(x)=x^2$ as half –range sine series in $0<x<4$ | 7M | CO3 | L2 |
| | | **UNIT–IV** | | | |
| 7. | | If a string of length $\ell$ is initially at rest in the equilibrium position and each of its points is given , the velocity $V_0\sin^3\frac{\pi x}{\ell}$ find the displacement $y(x,t)$. | 14M | CO4 | L2 |
| | | **OR** | | | |
| 8. | | An insulated rod of length $\ell$ has its ends A and B maintained at 0°C and 100°C respectively until steady state condition prevails. If B is suddenly reduced to 0°C and maintained at 0°C, Find the temperature at a distance $x$ from A at time $t$. | 14M | CO4 | L3 |
| | | **UNIT–V** | | | |
| 9. | | Show that the function $f(z)=\begin{cases}\frac{x^3(1+i)-y^3(1-i)}{x^2+y^2} & , if \quad z\neq 0 \\ 0 & , if \quad z=0\end{cases}$ is not analytic at origin, even though C-R equations are satisfied at origin. | 14M | CO5 | L2 |
| | | **OR** | | | |
| 10. | a) | Show that the function $v(x,y)=\sin x\cosh y+2\cos x\sinh y+x^2-y^2+4xy$ satisfies Laplace equation and find the corresponding analytic function $u+iv$ | 7M | CO5 | L1 |
| | b) | Verify Cauchy's theorem for the function $f(z)=3z^2+iz-4$ taken over the boundary of the square with vertices $1\pm i$ *and* $-1\pm i$ | 7M | CO5 | L4 |

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