Course Name: Materials Science & Technology

Course Outcomes (CO):

At the end of this course, the students will be able to:

1. Introduction and importance of materials, concept of unit cell space lattice, imperfection and defect in solid.
2. Mechanical properties and testing, micro structural exam, phase diagram, equilibrium diagram and brief introduction to ferrous material, heat treatment.
3. Magnetic and electric properties along with introduction to ceramics, plastic and other materials are studied.

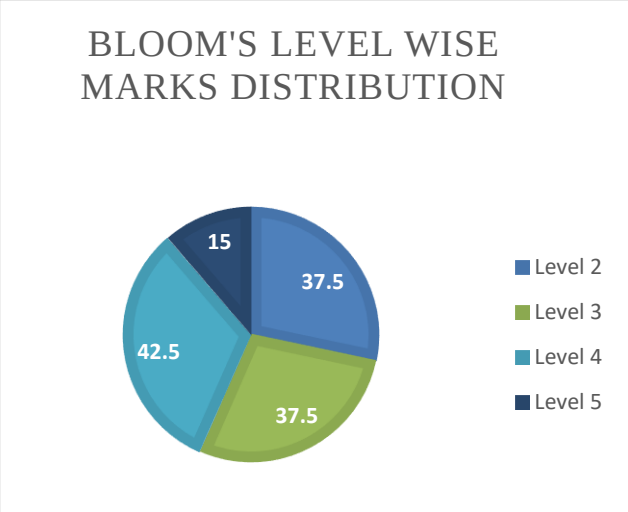
Model Question Paper
Total Duration (H:M): 3:00
Course: Materials Science & Technology
Maximum Marks :100

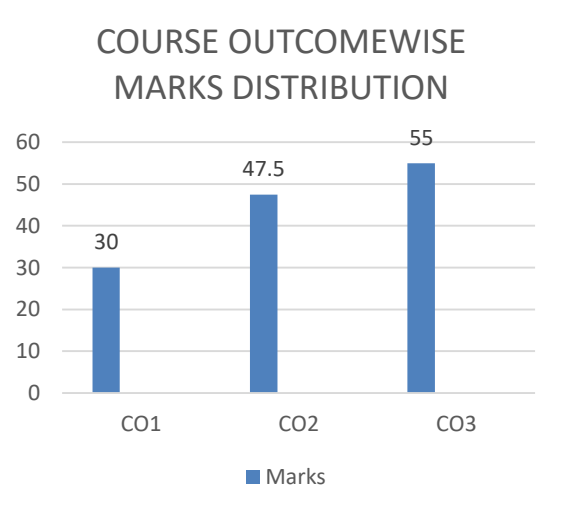
Note:(1)*From Unit- I, attempt four questions from question no. one and attempt all from question no. two. From Unit II, attempt only four questions. From Unit III& Unit IV, attempt only two questions each. From Unit-V Attempt only four questions.*

Q. No	Questions	Marks	CO	BL
	UNIT-I			
1a)	How many grams are there in one amu of material?	2.5	CO1	L2
1b)	Explain the main differences between ionic, covalent, and metallic bonding.	2.5	CO1	L2
1c)	Convert the [110] and [00$\bar{1}$] directions into the four-index Miller-Bravais scheme for hexagonal unit cell.	2.5	CO2	L3
1d)	What is the difference between atomic structure and crystal structure?	2.5	CO1	L2
1e)	For BCC iron, compute the interplanar spacing, for the (220) set of planes. The lattice parameter for Fe is 0.2866 nm. Also, assume that monochromatic radiation having a wavelength of 0.1790 nm is used, and the order of reflection is 1.	2.5	CO1	L4
2a)	Calculate the number of Schottky defects per cubic meter in potassium chloride at 500°C. The energy required to form each Schottky defect is 2.6 eV, while the density for KCI (at 500°C) is 1.955 g/cm^3.	5	CO1	L5

2b)	For an ASTM grain size of 6, approximately how many grains would there be per square inch at (a) a magnitude of 100, and (b) without any magnification?	5	CO2	L4
UNIT-II				
3a)	For a 79.65 wt% Fe, 0.35 wt% C alloy at a temperature just below the eutectoid, determine the following: (a) The fractions of total ferrite and cementite phases (b) The fractions of the proeutectoid ferrite and pearlite (c) The fraction of eutectoid ferrite	5	CO2	L4
3b)	Describe the phenomenon of coring and why it occurs.	5	CO2	L3
3c)	Explain why fine pearlite is harder and stronger than coarse pearlite, which in turn is harder and stronger than spheroidite.	5	CO2	L3
3d)	What is the major difference between heat treatable and non-heat-treatable alloys?	5	CO2	L2
3e)	Compute the strain-hardening exponent n in $\sigma_T = K\varepsilon_T^n$, for an alloy in which a true stress of 415 MPa produces a true strain of 0.10; assume a value of 1035 MPa for K.	5	CO1	L4
UNIT-III				
4a)	During a fatigue test a circular section beam 60 mm in diameter and 500 mm long is simply supported at its ends. A concentrated cyclic load acts on its whose value fluctuates between 20 kN and 50 kN. The material of the beam possesses ultimate strength of 650 MPa and yield strength of 520 MPa. Taking factor of safety of 1.8, calculate endurance strength of the material.	10	CO1	L5
4b)	Explain the ultrasonic method of NDT with the help of a diagram. Also describe the construction and working of its crystal probe.	10	CO2	L3
4c)	An iron silicon alloy sample has grain size of ASTM 2 and yield strength 124 MPa. Another sample of the same alloy of grain size 7 has a yield strength of 198 MPa. Determine the yield strength of a single crystal of this alloy.	10	CO2	L4
UNIT-IV				
5a)	Explain the mechanism of origin of permanent magnetic dipole. Describe all possible applications of magnetic materials. What is Cunife, and how is it different from Cunico?	10	CO3	L3
5b)	Explain how electrons and holes both conduct in a pure silicon crystal. How is conductivity influenced by mobility of electrons and holes?	10	CO3	L2
5c)	Critical magnetic field at zero kelvin and critical temperature for Pb are 65 kA/m and 7.18 K respectively. Determine the critical current density at 4.2 K in a lead wire of 1 mm diameter. Consider a	10	CO3	L4

	parabolic dependence of H_c on Temperature.			
	UNIT-V			
6a)	Discuss the importance and role of additives in polymers and polymerization, write their names and functions also.	5	CO3	L2
6b)	Sketch and explain various reinforcing pattern of fibers being used in composites.	5	CO3	L2
6c)	Describe Griffith's theory of brittle fracture. Obtain the expression for fracture stress in glass.	5	CO3	L3
6d)	Explain the factors involved in cavitation-erosion corrosion.	5	CO3	L2
6e)	The average molecular weight of a polyvinyl chloride is 9600. What is its degree of polymerization?	5	CO3	L4





BL–Bloom's Taxonomy Levels (1-Remembering, 2-Understanding, 3 –Applying,4 Analyzing, 5 –Evaluating, 6-Creating)

CO–Course Outcomes