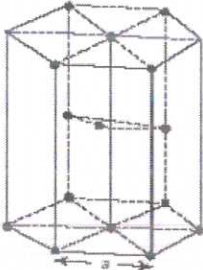


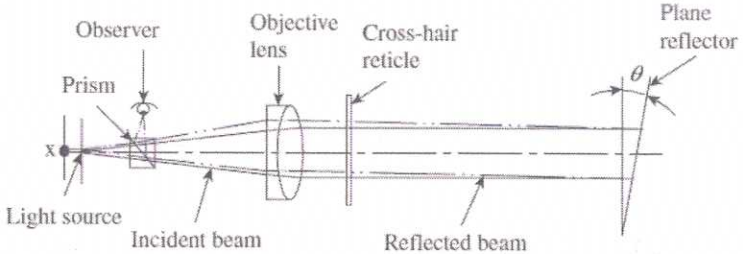
Scoring Indicators

COURSE NAME: MATERIAL SCIENCE AND METROLOGY

COURSE CODE: 3022 (21) QID: 2110220261

Q. No	Scoring Indicators	Split score	Sub Total
PART A			9
I.1	The space lattice is defined as an array of imaginary points which are so arranged in space that gives the crystal structure.	1	1
I.2	Iron containing 4.3% carbon by weight.	1	1
I.3	Magnalium, Duralumin, Hindalium (any two)	1	1
I.4	Visual inspection, magnetic particle inspection, liquid penetrant test, ultrasonic inspection and radiography. (any two)	1	1
I.5	Process of comparing the value of a parameter or feature with a known reference or standard is called measurement.	1	1
I.6	The difference between the maximum and minimum scale value.	1	1
I.7	Steel has carbon content less than 1% and Cast iron has carbon content more than 2.14% by weight.	1	1
I.8	The regular or irregular surface markings due to the manufacturing process, which tend to form a pattern on the surface.	1	1
I.9	Straightness or flatness of surfaces	1	1
PART B			24
II.1	Atoms are packed on top of each other forming a hexagonal structure. Eg: Zinc, SiO ₂ , AgCl 	Fig. 1 2	3
II.2	Phase diagram is a graphical representation of all the equilibrium phases as a function of temperature, pressure and composition.	3	3
II.3	Cyaniding, nitriding and carburizing	3	3
II.4	Creep is the property of the metal which represents the ability to deform continuously under a steady load. Creep is always considered in the designing of IC engines, boilers, turbines, etc. It occurs at high temperature objects such as rockets and nuclear reactors.	3	3
II.5	Tensile testing- tensile strength Compression testing- compressive strength Brinell, Rockwell and Vickers test- for hardness	1x3	3
II.6	Direct method The quantity to be measured is directly compared with the primary or secondary standard. Scales, vernier callipers, micrometers, bevel protractors, etc., are used in the direct method. Indirect method The value of a quantity is obtained by measuring other quantities that are functionally related to the required value.	1.5x2	3

	Measurement of the quantity is carried out directly and then the value is determined by using a mathematical relationship. Examples are angle measurement using sine bar, measurement of strain induced in a bar due to the applied force, etc.		
II.7	When a force is applied, the dimension of the strain gauge changes, leading to a change in resistance. This change in resistance or output voltage of the strain gauge gives a measure of the applied force.	3	3
II.8	Systematic or Controllable Errors- 1. Calibration errors 2. Ambient conditions 3. Deformation of workpiece 4. Avoidable errors Random Errors 1. Operator errors 2. Instrument errors	3	3
II.9	The typical geometric tests conducted for machine tools comprise tests for straightness, flatness, squareness, and parallelism. Running tests are conducted to evaluate geometric tolerances such as roundness and cylindricity.	3	3
II.10	Ring Gauge, Snap gauge, Plain plug gauge, Feeler gauge, Thread pitch gauge, Limit gauge	3	3
	PART C		42
III.1	Alloying elements are added to steel to give particular properties in the final product, such as hardness, toughness, corrosion resistance, ability to be hardened and machinability. They are also used to assist in refining, eg. for deoxidation and desulphurisation. They include: Carbon (C), Manganese (Mn), Silicon (Si), Chromium (Cr), Nickel (Ni), Cobalt (Co) etc.	7	7
III.2	Silicon steel- Si, Motors, transformers (any 3) High Speed Steel (HSS)- W, V, Cr, Co. Cutting tools Heat resisting steel- Cr, Ni, Mn. High temperature applications. Spring steel- Cr-V or Si-Mn. Springs Stainless Steel (SS)- 12% Cr with Ni, Mo. Cutlery, razor blades, surgical knives, etc.	3x2 Appln-1	7
III.3	<ul style="list-style-type: none"> • During annealing, a component is cooled in furnace whereas during normalizing, a component is cooled in still air. • In annealing, pearlite is coarse whereas in normalizing, pearlite is fine. • In annealing, internal stress is least, while internal stress is slightly high in normalizing. • Normalizing gives better strength than annealing. • Normalized steel exhibits less percentage elongation than annealed steel. • Annealed component is comparatively softer and more machinable compared to normalized steel. • Normalized component has more impact strength than annealed component of same material. • Normalizing is quicker and cheaper than annealing. 	7x1	7

III.4	Pure Metals- Ferrous and Non-ferrous, Alloys, Composites Non-metals- Ceramics, Polymers	1 1.5x4	7		
III.5	Abrupt failure without any appreciable plastic deformation and small increase in load. Cracks propagate quickly .	7	7		
III.6	Hardening or quenching is the rapid cooling of iron after heating it to high temperatures. Leads to formation of martensite on surface. Hardening increases hardness of the material. Application: cutting tools, abrasive surfaces	7	7		
III.7	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> Systematic error Not easy to detect Cannot be eliminated by repeated repeated measurements Can be assessed easily Minimization of systematic errors increases the accuracy Calibration reduce systematic errors Reproducible inaccuracies that are consistently in the same direction </td> <td style="width: 50%; vertical-align: top;"> Random error Easy to detect Can be minimized by measurements Statistical analysis required Minimization of random errors increases precision. Calibration has no effect on random errors Random in nature and can be both positive and negative </td> </tr> </table>	Systematic error Not easy to detect Cannot be eliminated by repeated repeated measurements Can be assessed easily Minimization of systematic errors increases the accuracy Calibration reduce systematic errors Reproducible inaccuracies that are consistently in the same direction	Random error Easy to detect Can be minimized by measurements Statistical analysis required Minimization of random errors increases precision. Calibration has no effect on random errors Random in nature and can be both positive and negative	7	7
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III.8	Generalised measuring system consists of transducer, transmitter and feedback control.	1 Expln.x2	7		
III. 9	Deflection of spring due to load is amplified and calibrated to a dial marked with values.	Fig-3 Expln 4	7		
III.10	Sophisticated instrument that measures orthogonal relation and coordinate values. Can be connected with computer and used for automated inspection.	Fig-4 Expln 4	7		
III.11	Any 3 comparators- working principle with figure	Name 1 Expln 3x1 Fig.- 3	7		
III.12	 <p>It is a special form of telescope that is used to measure small angles with a high degree of resolution. It is used for various applications such as precision alignment, verification of angle standards, and detection of angular movement, among others. It projects a beam of collimated light onto a reflector, which is deflected by a small angle about the vertical plane. The light reflected is magnified and focused on to an eyepiece or a photo detector. The deflection between the beam and the reflected beam is a measure of the angular tilt of the reflector.</p>	4 Fig 3	7		