Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS
VII SEMESTER B.TECH. MECHATRONICS
END SEMESTER EXAMINATIONS, NOVEMBER 2022
SUBJECT: ENGINEERING MATERIALS [MTE 4071]
(Date: 21/11/2022)

Time: 3 Hours **MAX. MARKS: 50**

Instructions for the Candidates:
- ❖ Answer **ALL** questions.
- ❖ Data did not provide any, may be suitably assumed.

Q. No		M	CO	PO	LO	BL
1A.	Consider a parallel-plate capacitor having an area of 6.45×10^{-4} m^2 and plate separation of 2×10^{-3} m across which a potential of 10 V is applied. If a material having a dielectric constant of 6.0 is positioned within the region between the plates, compute: **(a)** The capacitance. **(b)** The magnitude of the charge stored on each plate. **(c)** The dielectric displacement D. **(d)** The polarization.	**04**	**5**	**1**	**1**	**3**
1B.	In what way edge dislocation is analogous to the motion of a caterpillar?	**03**	**3**	**4**	**4**	**2**
1C.	Explain the role of a piezoelectric element in an engine knock sensor.	**03**	**5**	**4**	**4**	**2**
2A.	A coil of wire 0.25 m long and having 400 turns carries a current of 15 A. **(a)** What is the magnitude of the magnetic field strength H? **(b)** Compute the flux density B if the coil is in a vacuum. **(c)** Compute the flux density inside a bar of chromium that is positioned within the coil. The susceptibility for chromium is 3.13×10^{-4}. Permeability of vacuum = 1.257×10^{-6} **(d)** Compute the magnitude of the magnetization M.	**04**	**5**	**1**	**1**	**3**
2B.	For α – iron, compute the interplanar spacings for the (111) and (211) sets of planes. (α – iron is BCC structure, atomic radius = 0.1241 nm)	**03**	**3**	**1**	**3**	**3**
2C.	In what way does a shape memory alloy assists in the rehabilitation of broken bones?	**03**	**4**	**4**	**4**	**2**
3A.	The raw form of carbon has been processed into carbon products like raw graphite, carbon graphite, and copper graphite and is used as filamentary and brush material. Explain the steps involved in the process and mention the applications of carbon materials.	**05**	**5**	**4**	**4**	**2**
3B.	For the below-mentioned dielectric materials, mention their applications: i. Flexible micanite ii. Cotton and cotton tapes iii. Glass and glass tapes	**03**	**5**	**4**	**4**	**2**
3C.	State the reason why piezoelectric pressure sensors are preferred over conventional electromechanical pressure sensors.	**02**	**4**	**4**	**4**	**2**

4A.	Explain the characteristics of low-resistivity materials for electrical applications.	**05**	**5**	**1**	**4**	**2**
4B.	Electrical Co. has been given the contract to install low-voltage power cables for an electrical system. The company found copper as a suitable material to solve the problem. Amongst annealed and hard-drawn copper, suggest a suitable copper type and mention its features.	**03**	**5**	**4**	**4**	**2**
4C.	Consider a parallel-plate capacitor having an area of 3225 m^2 a plate separation of 1 mm and a material having a dielectric constant of 3.5 positioned between the plates. Determine: **(a)** Capacitance of this capacitor. **(b)** Electric field that must be applied for 2×10^{-8} C to be stored on each plate. The relative permittivity of vacuum = 8.85×10^{-12} F/m	**02**	**5**	**1**	**1**	**3**
5A.	Copper and Aluminum are widely used in the manufacturing of cables, strands, and conductors as they are ductile in nature. On a cost basis, aluminum is cheaper than copper, but copper is preferred for high-temperature conditions and for making transformer windings, and motor windings. Analyze the above statement and explain the reason for the same.	**05**	**5**	**4**	**4**	**4**
5B.	Explain the function of fusible metal in an automatic fire sprinkler application.	**03**	**5**	**4**	**4**	**2**
5C.	In the case of fusible material selection, why is tungsten the preferred material in comparison to carbon even though carbon has a higher melting point?	**02**	**5**	**4**	**4**	**2**