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BSc.Eng/3rdSem.(ME)
DTE/1st Sem.

Date: 08 December 2023
Time: 9:00 am – 12:00 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Final Semester Examination

Winter Semester, A.Y. 2022-2023

Course No. ME 4325

Time : 3 hours

Course Title: Material Engineering

Full Marks : 150

There are **06 (Six)** Questions. Answer all of them. Marks in the margin indicate full marks. Do not write on this question paper. Symbols carry their usual meanings. Assume reasonable values for any missing data. Programmable calculators are not allowed.

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|---|---|--------------------------------------|
| 1 | Metals often show the crystal structure of SC, BCC or FCC. Explain with necessary sketches the structures of these three Bravais lattices. FCC is more ductile than BCC and BCC is more ductile than FCC – defend this statement. | 25
(CO3,
CO4)
(PO3,
PO4) |
| 2 | A polymer is any of a class of natural or synthetic substances composed of very large molecules, called macromolecules, which are multiples of simpler chemical units called monomers. With neat sketches explain how branch structures affect the density of a polymer. Predict the crystalline structure of a polymer if the cooling rate is very fast for a semicrystalline polymer like PANI. | 25
(CO3,
CO4)
(PO3,
PO4) |
| 3 | Primary steelmaking involves smelting iron into steel. Secondary steelmaking involves adding or removing other elements such as alloying agents and dissolved gases. Explain briefly both these routes. Defend the statement that both routes can produce the same quality of steel if the quality of scrap is high for secondary route. | 25
(CO3,
CO4)
(PO3,
PO4) |
| 4 | Draw an Iron-iron carbon diagram and label it completely; also identify the compositions for low, medium, and high carbon steel. With neat sketches, distinguish between the microstructures of low and high carbon steel. Rate these two types of steel considering their tensile strength and explain how to predict the strength from their microstructures. | 25
(CO3,
CO4)
(PO3,
PO4) |
| 5 | Martensite is a phase of steel with a tetragonal structure that is very hard and very brittle; it has microstructure of needle-like materials. Link cooling rate with formation of martensite with the help of CCT diagram. Also, explain why martensite is considered as a non-equilibrium phase. | 25
(CO3,
CO4)
(PO3,
PO4) |
| 6 | A composite material is a material which is produced from two or more constituent materials. These constituent materials have notably dissimilar chemical or physical properties. Categorize the composites based on size and shape of reinforcing agents. Deduce an equation to predict conductivity, σ for the composite in both parallel and perpendicular directions to the fiber alignment direction. | 25
(CO3,
CO4)
(PO3,
PO4) |