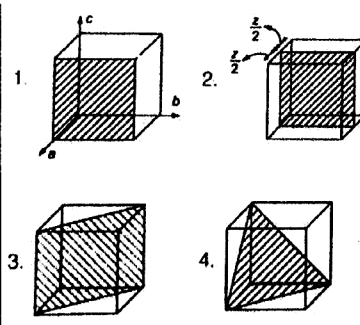


B.E. POWER ENGINEERING SECOND YEAR SECOND SEMESTER - 2025**SUBJECT: Material Sciences****Time: Three Hours****(Full Marks 100)**

Answers **MUST** be accompanied with relevant diagrams and curves
 Please make sure that answer sheets have proper border (of atleast 1") around the edge

Part I (CO1) (45 marks)**1. Answer ALL****7.5×6=45**

- Compare ionic, covalent and metallic bond, based on characteristics.
- What are the different properties that originate due to metallic bond? (write in a tabular format)
- Compare crystalline and non-crystalline solids. (write in a tabular format)
- Compare simple cubic, body-centered cubic, face centered cubic and diamond cubic crystals based on their different based on characteristics and properties.
- Determine the millers indices of the given plane.



- Compare hard and soft magnetic materials based on characteristics and properties. (write in a tabular format)

Part II (CO2) (20 marks)

- Describe the Fe-C diagram, and define eutectic, eutectoid and eutectic reactions. **(10)**

- A** – Describe the salient points of the stress strain curve in tension. Write a short note on the difference between engineering strain and actual strain. Comment on the difference between them with an example. **(3 + 7)**

Or

- B** – Comment on the elastoplastic properties of metals. Compare with proper diagrams the behaviour of metals under

- | | | |
|-----------------------|--|--------------------------------------|
| i. Linear elastic | ii. Non-linear elastic | iii. Elasto-plastic or visco elastic |
| iv. Perfectly plastic | v. Elastoplastic with strain hardening | vi. Ideal rigid |
| vii. Ideal fluid | | (3 + 7) |

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Part III (CO3) (15 Marks)

4. A – Compare the properties of
- i. hardness and toughness
 - ii. Fatigue and creep. (7.5 × 2)

OR

- B – i. Comment on the different alloying elements of carbon steel.
ii. What would be the desired properties of boiler material and cryogenic steel (7.5 × 2)

Part IV (CO4) (5 × 4 = 20 Marks) Answer any 4 (300 words each)

5. Write short notes on the alkaline electrolysis, polymer/proton membrane electrolysis and steam electrolysis for the production of hydrogen.
6. What are supercapacitors? How are they different from batteries?
7. Write a short note on the classification of batteries.
8. Write in detail the role of graphene and carbon nano-tubes for the production of hydrogen.
9. Write the difference between mono and polycrystalline solar cell. Briefly discuss their encapsulation methods.
10. Discuss the use of PCM materials as heat transfer fluids. What would be their respective advantages and disadvantages?
11. What do you mean by thermal run-aways in batteries?
12. Comment on the advantages and disadvantages of solar thermal heat transfer.