Roll No.

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, DEC 2024

MATERIAL SCIENCE AND ENGINEERING
Semester III
CY23C02 Polymers, Biomaterials and Ceramics

(Regulation 2023)

Time: 3 hrs | Max. Marks: 100

CO1	Explain the basics concepts of general polymers and describe their composition, properties & uses.
CO2	Discuss the properties and uses of engineering and speciality polymers in various applications.
CO3	Illustrate the common polymer processing techniques and explore the use of AM methods for processing polymers, metals and ceramics.
CO4	Apply the knowledge of biomaterials for implants and other medical applications
CO5	Discuss the properties and uses of engineering ceramics and their applications in various fields.

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART - A (10 x 2 = 20 Marks)

(Answer all Questions)

Q.No	Questions	Marks	CO	BL
1	How are polymers classified based on their applications? Give examples.	2	1	1
2	Illustrate the difference between block and graft copolymers with a schematic representation. Give examples.	2	1	2
3	What are hydrogels? What are they composed of? Give two examples.	2	2	1
4	How are IPNs distinguished from polymer blends and copolymers?	2	2	2
5	Define MFI. What is its significance? What is its unit?	2	3	1
6	How electrospinning differs from conventional fiber spinning?	2	3	2
7	What are biomaterials? How are they classified?	2	4	1
8	Compare Ti and SS as orthopedic implants.	2	4	2
9	What are the properties of PSZ as biomaterials?	2	5	1
10	Cermets are ideal for active implantable medical devices. Justify.	2	5	2

PART- B (5 x 13 = 65 Marks)

Q.No	Questions	Marks	CO	BL
11 (a)	(i) Distinguish between: ✧ EPR and EPDM rubbers (5) ✧ Addition and condensation polymerizations (5) (ii) Write a note on crystallization of polymers. (3)	13	1	4
	OR			

11 (b)	(i) Distinguish between: ✧ Phenolic and cellulosic resins (5) ✧ Thermoplastic and thermoset polymers (5) (ii) Write a note on thermal transitions of polymers. (3)	**13**	1	4
12 (a)	(i) Distinguish between: ✧ Polyamides and Polyurethanes (5) ✧ Miscible and immiscible polymer blends (5) (ii) Write a note on shape memory polymers. (3)	**13**	2	5
	OR			
12 (b)	(i) Distinguish between: ✧ PUs and TPUs (5) ✧ Intrinsic and extrinsic conducting polymers (5) (ii) Write a note on LCPs. (3)	**13**	2	5
13(a)	(i) Discuss the steps involved in injection moulding process in detail with neat sketches. (10) (ii) Illustrate any three common defects found in injection moulded parts. How to rectify them? (3)	**13**	3	2 4
	OR			
13(b)	(i) Discuss the steps involved in tubular blown film process in detail with neat sketches. (10) (ii) Name any three AM processes and state its working principle in brief. (3)	**13**	3	2 4
14 (a)	(i) Establish the difference between bioinert, bioactive and bioresorbable materials. Illustrate with examples. (10) (ii) Write a brief note on hip-replacement. (3)	**13**	4	3
	OR			
14 (b)	(i) Discuss the effective use of polymeric biomaterials in any two medical applications of your choice. (10) (ii) Write a brief note on wound-dressing. (3)	**13**	4	3
15 (a)	(i) Discuss the functional properties and applications of super hard materials in medical field. (10) (ii) Write a note on SIALON. (3)	**13**	5	3
	OR			
15 (b)	(i) Discuss the functional properties and applications of glass ceramics. (10) (ii) Write a note on Ti6Al4V. (3)	**13**	5	3

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

<table>
<tr><th>Q.No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th></tr>
<tr><td>16
(i)</td><td>Match the plastics recycling codes as per SPI. Also name the polymer and state one property and use in each case.

<table><tr><th>Plastics Recycling Code</th><th>Polymer</th></tr><tr><td>1</td><td>PP</td></tr><tr><td>2</td><td>LDPE</td></tr><tr><td>3</td><td>PVC</td></tr><tr><td>4</td><td>HDPE</td></tr><tr><td>5</td><td>PET</td></tr></table></td><td>5</td><td>1</td><td>6</td></tr>
<tr><td>(ii)</td><td>Calculate the number average and weight average molecular weights and the polydispersity index with the given data.

<table><tr><th>No. of molecules</th><th>Molecular Weight (g/mole)</th></tr><tr><td>10</td><td>5,000</td></tr><tr><td>50</td><td>10,000</td></tr><tr><td>50</td><td>15,000</td></tr><tr><td>10</td><td>20,000</td></tr></table></td><td>5</td><td>1</td><td>6</td></tr>
<tr><td>(iii)</td><td>Distinguish between:
(i) HAP and TCP
(ii) Alumina and Zirconia
(iii) SiC and WC
(iv) Polyolefins and Polyamides
(v) Fluoro and Acrylic polymers</td><td>5</td><td>4, 5</td><td>6</td></tr>
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