

Code - 2021

G. S. Mandal's

**Maharashtra Institute of Technology, Aurangabad**

(An Autonomous Institute)

END SEMESTER EXAMINATION

**Second Year B.Tech (Plastic and Polymer Engineering) – Feb/Mar-2023**

Course Code: PPE 203

Course Name: Physical Chemistry of Polymers

Duration: 2 Hrs

Max. Marks: 50

Date: 08/02/2023

Instructions:

- i) All questions are compulsory
- ii) Assume suitable data wherever necessary and clearly state it
- iii) Figures to right indicate full marks
- iv) Use graph papers for doing problems (wherever required)

Q.1 Answer any five (Marks:10)

	Mark s	CO	BL	PI
a) Define Good, bad and theta solvents	2	1	1	1.2
b) Mention the steps of process of polymer dissolution	2	1	1	1.2
c) Define Conformation. Write <i>three</i> points about Conformation.	2	1	1	1.2
d) Methylene dichloride is a good solvent and tetrahydrofuran a poor solvent for the polycarbonate the reverse is true for PVC, yet all four materials have similar solubility parameters.	2	1	1	1.2
e) How is solubility parameter related to the energy of vaporisation and the latent heat of vaporisation?	2	1	1	1.2
f) Derive the relation between Surface Tension and Contact Angle (Young's Equation)	2	1	1	1.2
g) What is Gibbs phase rule?	2	1	1	1.2
h) What do you know about adhesive and cohesive energy?	2	1	1	1.2
Q.2 Sight down the C-2--C-3 bond, and draw Newman projection formulae for the	8	2	2	1.4
(a) Most stable conformation of 2,2-dimethylbutane,				
(b) Two most stable conformations of 2-methylbutane				

OR

Discuss conformation of Butane in brief with potential energy diagram

Q.3 How dissolution of small molecular weight compound is

	8	3	2	1.4
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different from that of dissolution of polymer?

OR

Discuss the Factors that Influence and Control Swelling and Solubility of Polymers.

- Q.4** Define Contact Angle. How contact angle determines different degrees of wetting. 8 4 2 1.2

OR

- a. Which forces are responsible for the cohesion of solids?  
b. Mention the factors affecting adhesion.

- Q.5** The following table contains osmotic pressure data at three different temperatures for a cellulose derivative called 'cellulose tricorporate' dissolved in dimethylformamide at a number of concentrations. 8 5 3 1.3  
1.4

Concentration C (g/L)	Osmotic pressure $\Pi$ at 30°C - (atm)
2.7	0.00046
12.5	0.00210
17	0.00265
22	0.00323

Calculate  $\Pi/c$  for the above data sets. Plot  $\Pi/c$  versus  $c$  and determine the best-fit line for the data set. Determine a value for the molecular weight ( $M_n$ ) of the polymer. (Use graph paper)

OR

How is molecular weight of polymers determined by Membrane Osmometry?

- Q.6** Estimate the solubility parameters of. Low-density polyethylene (LDPE) (Data given in the next page) 8 6 3 1.1

OR

Estimate the solubility parameters of polypropylene (PP) (Data given in the next page)

Note:- All course outcomes shall be addressed.

Date for Q no 2.  
Molar attraction constants at 25°C

<i>Group</i>	<i>Molar attraction constant G</i>
—CH <sub>3</sub>	214
—CH <sub>2</sub> —(single bonded)	133
—CH<	28
\C/	-93
CH <sub>2</sub> ==	190
—CH== (double bonded)	111
>C==	19
CH≡C—	285
—C≡C—	222
Phenyl	735
Phenylene ( <i>o,m,p</i> )	658
Naphthyl	1146
Ring (5-membered)	105-115
Ring (6-membered)	95-105
Conjugation	20-30
H	80-100
O (ethers)	70
CO (ketones)	275
COO (esters)	310
CN	410
Cl single	270
Cl twinned as in >CCl <sub>2</sub>	260
Cl triple as in —CCl <sub>3</sub>	250
Br single	340
I single:	425
CF <sub>2</sub> } in fluorocarbons only	150
CF <sub>3</sub> }	274
S sulphides	225
SH thiols	315
ONO <sub>2</sub> nitrates	~440
NO <sub>2</sub> (aliphatic)	~440
PO <sub>4</sub> (organic)	~500
†Si (in silicones)	~ 38

