UNIVERSITY OF PUNE
[4364]-741
B. E. (POLYMER) Examination - 2013
POLYMER
COMPOUNDING
(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages 2:]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

(1) Answer question number 1 or 2, 3 or 4, ***5 is compalsory section I.*** *Answer question number 6 or 7, 8 or 9 and 10 or 11 from section II*

(2) Answers to the ***two sections*** *should be written in* ***separate answer-books****.*

(3) Figures to the right indicate full marks.

(4) Draw neat sketches wherever necessary.

(5) Use of calculator, graph paper is allowed.

(6) Assume suitable data, if necessary.

SECTION 1

1a. Write a note on various mixing indices. [6]

1b. Explain constructional features and working of ribbon blenders. [6]

1c. Explain mechanism of solid-solid mixing. [6]

OR

2a. Explain distributive mixing. [6]

2b. Explain in details about mixing mechanisms. [6]

2c. Explain the mechanism used for cross-mixing in tumbler blenders. [6]

3a. Write a note on nana clay composites. [5]

3b. Write short note on: [6]

1) Polymer alloys
2) Incompatible blends

3c. Write a note on mechanisms of surface modification of fillers. [5]

OR

4a. List various types of fillers used. Explain the compounding lines used for particulate fillers. [8]
4b. Explain exfoliation and intercalation techniques used for melt compounding of melt mixing of nanacomposites. [8]

5a. List various flame retardants used. Explain their mechanism. [8]
5b. Explain the mechanism of coupling agent and processing aids. [8]

SECTION II

6a. State the advantages of reactive extrusion. [8]
6b. Write short note on compounding of EPDM and SBR. [8]

OR

7a. Write short note on modular elements used in twin screw extruders with respect to construction and mixing action. [8]
7b. Write a note on compounding of natural rubber and butyl rubber. [8]

8a. Explain constructional features of Buss ko Kneader with a schematic figure. [9]
8b. Explain any one dispersive mixing section used in single screw extruders. [5]
8c. State requirements of dispersive mixing sections. [4]

OR

9a. Write a note on variable depth mixing sections. [6]
9b. Explain any one pin mixing section with neat figure. [6]
9c. Explain working principal of fluted mixing sections. [6]

10a. Explain the mechanisms used to achieve cross mixing in 2 roll mill [7]
10b. Explain construction and working of counter rotating twin screw extruder [9]

OR

11a. Explain constructional and working of an internal mixer with a neat sketch.[9]
11b. Explain working principle of conjugated co-rotating twin screw extruder. [9]

[Total No. of Questions: *12*] **[Total No. of Printed Pages: 6]**

UNIVERSITY OF PUNE

[4364]-751

B. E. (*Polymer*) Examination - 2013

Mold & Die Design- II (2008 Course)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1 ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from Section I and Q7 or Q8, Q9 or Q10, Q11 or Q12 from Section II***

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Figures to the right indicate full marks.*

4 *Draw neat sketches wherever required.*

5 *Use of calculator, graph paper is allowed.*

SECTION -I

Q.1 A Explain with neat sketches, the type of products for which the following unscrewing mechanisms are suitable 5

i) Axially fixed rotating
ii) Rotating withdrawing.

B Explain with neat sketches the mechanism of rotating core with extractor plate for unscrewing of threaded components. 8

	C	Draw neat sketches to indicate progressive collapse of collapsible cores to relive internal undercut	5

OR

Q.2	A	The sun and planet gear system used in unscrewing mechanism of a plastic product has a pitch of 60mm with module of 3mm. the velocity ratio of 2 is to be maintained between sun and planet gear. Give all the relevant calculations for the gear drive.	8
	B	Explain with neat sketches, fixed threaded core design for striping internally threaded component.	6
	C	Explain with neat sketches product design consideration for internally threaded components.	4
Q. 3	A	List the various systems used for heating hot runner manifolds. Explain with a neat sketch construction of cartridge heaters.	8
	B	The centre distance between nozzles in a hot runner manifold is 300mm in X direction and 100mm in the Y direction. The length of a nozzle is 80mm. calculate expansion of the manifold using the following data Coefficient of thermal expansion of steel: $13x10^{-6}$ mm/mm)°C Room temperature 27°C Processing Temperature: 225°C	8

OR

Q. 4	A	With the help of neat sketches, explain the concept of semi-hot runner and complete hot runner mold. State the advantages and disadvantages of each	6
	B	Explain design feature of hot runner system	4

	C	The centre distance between hot runner nozzles for square manifold A is 500mm and that for square manifold B is 25mm. what type of hot runner nozzle will be suitable for manifold A and manifold B. draw relevant sketches of the nozzles and the manifolds.	6
Q. 5	A	Write a note on design of thermoforming molds.	8
	B	A profile die has shape as shown in figure 3. The polymer obeys power law $\tau = 1{,}50{,}000\gamma^{0.5}$. the output of the die is 75g/sec and melt density 0.78g/cc. find pressure drop across the die	8

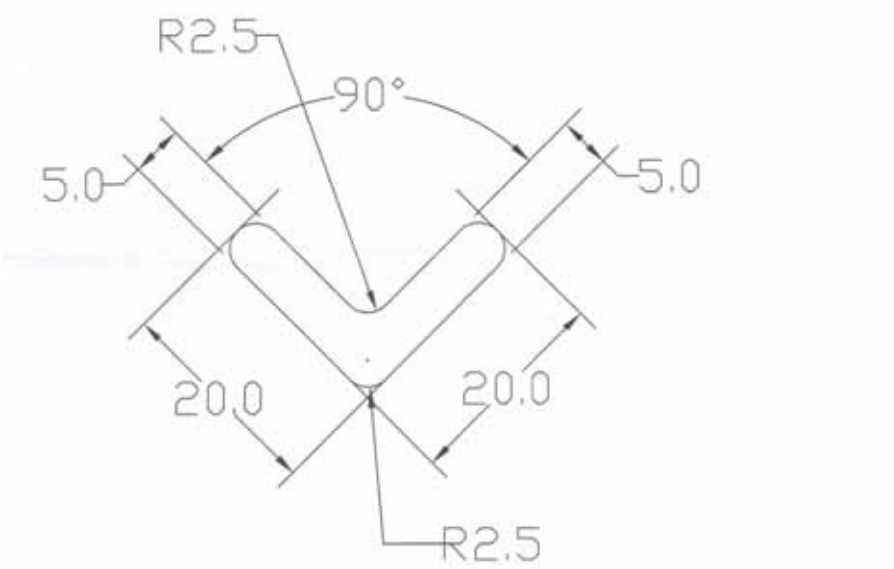

Fig.3

All dimensions are in mm.

OR

Q. 6	A	List the types of compression molds. Explain with neat sketch any one in details	8
	B	Write a note on design of transfer molds	8

SECTION II

Q. 7 Design a 2 cavity mold for the component shown in figure 1. Draw at least 2 views with one sectional view to bring out the details of the feed, cooling and ejection system. Illustrate the relevant design calculations 30

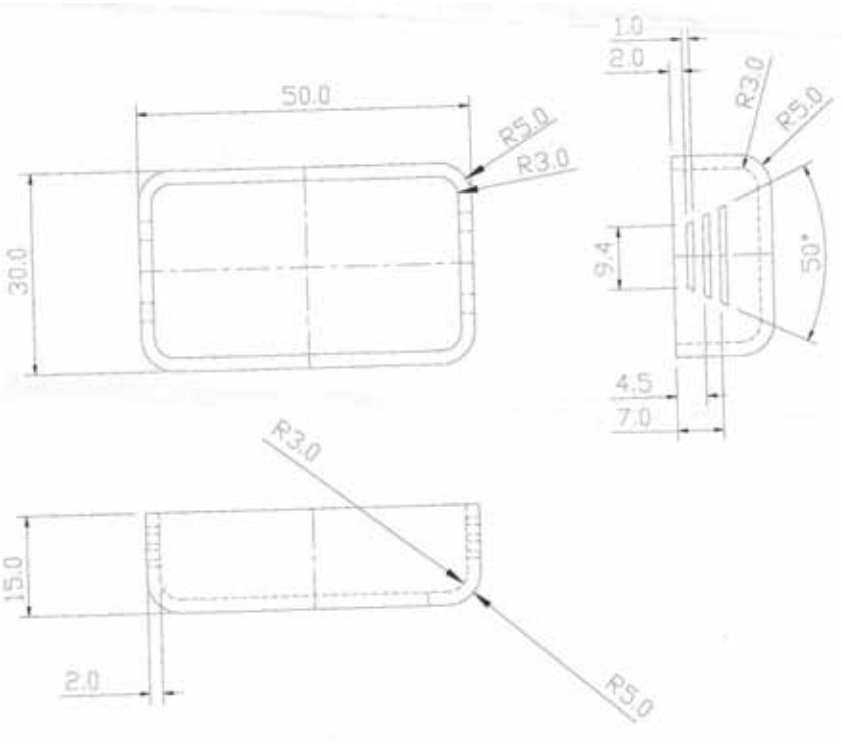

Fig. 1
Material: ABS
Shrinkage: 0.5%
Wall thickness: 2mm
Assume suitable draft
All dimensions are in mm
Cavity pressure: 400Kg/cm^2

OR

Q. 8 Design a 2 cavity mold for the component shown in figure 2. Draw at least 2 views with one sectional view to bring out the details of the feed, cooling and ejection system. Illustrate the relevant design calculations 30

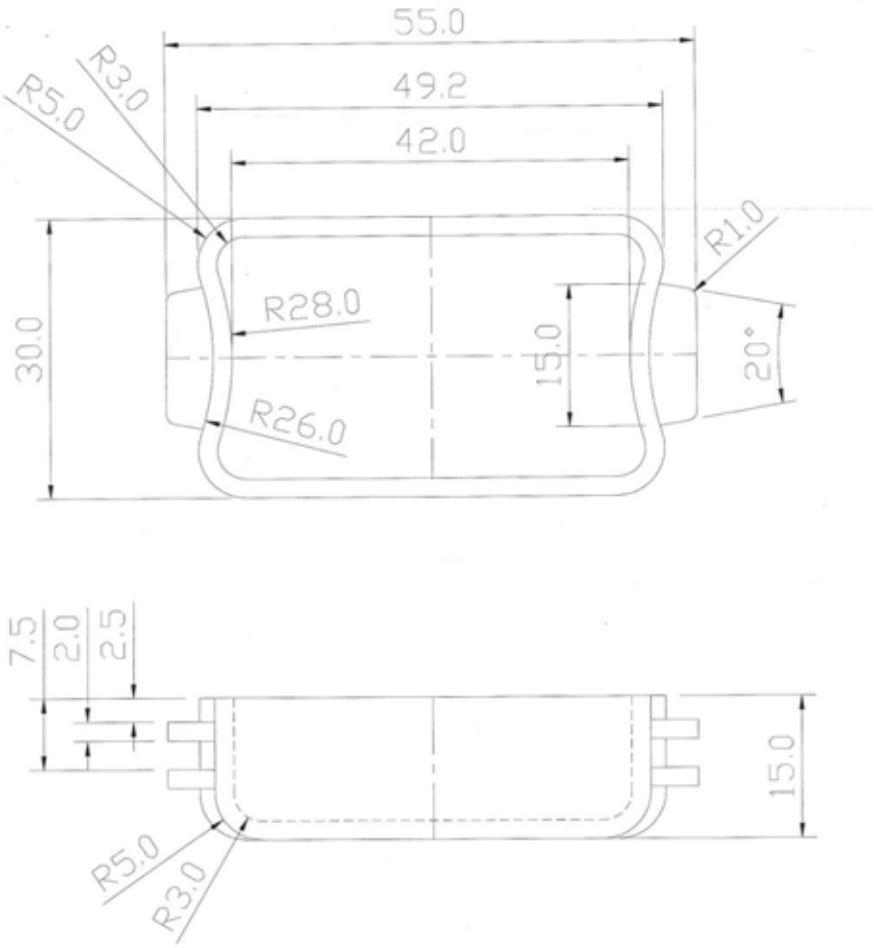

Fig. 2
Material: PP
Shrinkage: 1.8%
Wall thickness: 2mm
Assume suitable draft
All dimensions are in mm
Cavity pressure: 300Kg/cm^2

Q. 9 Write down the steps followed in designing a coat hanger sheet die. List all the design formulae 10

OR

Q. 10 A With a neat sketch, explain the constructional features of a manifold T die. With neat sketches, explain the different shapes of manifold used. 10

Q. 11 Discuss the following viscosity models. 10

1) Cross model
2) Meter model
3) Carreau model

OR

Q. 12 Obtain model constants for Ellis model for the shear stress-shear arte data below: 10

Shear rate (s^{-1})	Shear stress (Pa)
2	6640
4.12	9970
11.2	16,700
24.3	24,700
51	34,000
133	50,800
271	68,000
548	90,000
1360	127,000
2710	164,000
5230	201,000

[Total No. of Questions : 12] **[Total No. of Printed Pages :4]**

(4364)-745

B.E.(Polymer)

Examination - 2013

Mechanics of Composites

(2008 Pattern)

[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

(1) Use of logarithmic tables slide rule, Mollier charts, Electronic packet calculator and steam tables is allowed.

(2) Answers to the 02 section should be written in separate answer books.

(3) Figures to the right indicate full marks.

(4)Neat diagrams must be drawn whenever necessary.

(5) Answer 3 Question from Section I and 3 Question from Section II.

Section I

Q1. a) For an orthotropic lamina, the engineering constants are E_{11}=504Pa, E_{22}=154Pa, V_{12}=0.25. Calculate shear modulus in 1-2 plane if 45° off axis elastic modulus is Ex=25GPa. [6]

b) Define & explain the coefficient of mutual influence of the first kind and second kind. [6]

c) Prove the conditions of symmetry for Poisson's ratio in case of specially orthotropic material. [6]

$$\frac{V_{12}}{E_{11}} = \frac{V_{21}}{E_{22}}$$

OR

Q2. a) Give tensor notation system for stresses and Strains and also give transformation equations for stresses &strains for orthotropic lamina under plane stress condition. [8]

b) Write compliance matrix for orthotropic lamina under plane stress and explain also how will you find out. [6]

S_{13}, S_{23}, and ϵ_3.

c) The unidirectional fiber reinforced lamina with fibers at θ=60°, the strains in principal material direction are

$$\begin{pmatrix} t_{11} \\ t_{22} \\ r_{12} \end{pmatrix} = \begin{pmatrix} 0.005 \\ 0.001 \\ -0.05 \end{pmatrix}$$

Find Єx, Єy, rxy [4]

Q3. a) Explain how one can find out 4th order strength tenser defined in Ţsai-Wu biennials failure theory. [6]

b) Prove that the unidirectional off axis lamina under plane stress & stressed in direction 'X' at an angle θ to direction 1, Tsai-Hill criteria reduces to

$$\frac{\cos^4\theta}{x^2} + \left(\frac{1}{s^2} - \frac{1}{X^2}\right)\cos^2\theta \sin^2\theta + \frac{\sin^4\theta}{Y^2} = \frac{1}{6X^2}$$

Where X and Y are tensile failure strengths in 1&2 direction and S is shear strength in1-2 plane. [6]

c) Write a note on maximum strain theory. [4]

Q4. a) Determine the coefficients of thermal expansion $\propto_1$ & $\propto_2$ of a unidirectional glass/ epoxy lamina with following properties

Ef=100GPa; Vm=0.35, Em = 54Pa, Vf = 0.2, αf = $4.5*10^{-6}$/C

∝m=90×10^{6}/°C; Vf=0.2, ∝f=Volume fraction of fiber =0.6 [8]

b) If Engineering constants of an unidirectional orthotropic lamina with an angle of orientation 60° are E_{11}=200GPa, E_{22}=100GPa, G_{12}=20GPa, V_{12}=0.2, calculate reduced transformed stiffness matrix, reduced transformed compliance matrix. [8]

Q5. a) Obtain expressions for the average composite strength of a lamina when short fiber length is. [9]

i) equal to critical load transfer

ii) more than critical load transfer

iii) less than critical load transfer.

b) Prove the rule of mixtures for ratio for V_{12} in terms of Poisson's ratio for fiber and Poisson's ratio for matrix using mechanics of materials approach. [7]

OR

Q6 a) Write in short about. [9]

i) mechanics of materials approach.

ii) Elasticity approach to stiffness.

b) State the Haplin tsai equations and analyse them for limited values of ξ= reinforcement geometry factor & X= factor depending on constituent material properties. [7]

Section II

Q7. a) Explain with a neat sketch three rail shear tests. [6]

b) Explain the test method used to determine tensile strength & tensile modulus of flat composite laminates. [6]

c) Explain ultrasonic non-destructive evaluation technique for damage evaluation. [6]

OR

Q8 a) Explain IITRI test method for determining compressive properties of composites with neat figure. [6]

b) Explain ±45 shear test to determine in – plane shear properties. [6]

c) Explain laser shearography non-destructive technique. [6]

Q9. a) For a$[0/45/90]_s$ symmetric laminate calculate [A], [B] and [D] matrix if engineering properties of the lamina are E_1=140GPa; E_2=10GPa; G_{12}=54GPa , V_{12}=0.25. [10]

b) Give stacking sequence for the following laminates:

i) $[45/0/90]_s$

ii) $[0/45/90]_s$ [6]

OR

Define and explain force and moment resultant equations for the following types of laminates. Comment on the elements of [A], [B], & [D] matrix.

i) Regular symmetric cross ply laminate

ii) Ant symmetric laminates

iii) Symmetric laminates with multiple isotropic layers. [12]

b) Explain transurealy isotropic laminates with an example. [4]

Q11. a) Give failure mode for mechanically fastened joints and also mention merits and demerits of the mechanically fastened joints. [8]

b) A hybrid beam of 20mm consists of 3 layers of boron epoxy and 2 layers of S-glass- epoxy to replace a steel beam of bending stiffness 20KNm². Fibers in the beams are parallel to the beam axis. Assuming that each glass fiber is 0.1mm thick, determine the number of plies required for each fiber type. Determine the thickness of the beam.

Ebeam= 210 GPa. Eg =43GPa. [8]

OR

Q12.a) Write a short note on adhesicaly bonded joints for composites, [6]

b) List all the design formula for a simply supported beam carrying a distributed load. Write step wise design procedure for the same. [10]

UNIVERSITY OF PUNE
[4364]-746
B. E. Examination - 2013
POLYMER REACTION ENGINEERING
(June 2008 Pattern)

Total No. of Questions: 12 **[Total No. Of Printed Pages: 3]**
[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

*(1) Answers to the **two sections** should be written in **separate books**.*
(2) Draw neat diagrams wherever necessary.
(3) Numbers to the right indicate full marks.
(4) Assume suitable data, if necessary.
(5) Use of logarithmic tables, slide rule, Molliercharts, electronic pocket calculator and steam tables is allowed.

SECTION-1

Q. 1. A) Explain the characteristics of chain Growth polymerization and Explain the distinctive features of polymer reaction Engineering. (12)

B) Discuss the number Average Molecular Weight, First moment of Pj' s Weight Average Molecular Weight terms used for the Characterization of mixtures of polymer molecules. (6)

OR

Q. 2. A) Discuss the number and Weight Fraction, Number Average Degree Of Polymerization, Molecular Weight Distribution terms used for the Characterization of mixtures of polymer molecules. (6)

B) Find the polydispersity index length and 380 molecules of 1 monomer Lengths.

C) Discuss the importance of molecular weight and Molecular weight Distribution of polymer. (6)

Q. 3. A) Discuss in detail all technical conclusions from free radical kinetics Studies. (6)

B) MMA is to be polymerized at 80˚C with free radical polymerization In a batch reactor. The initial concentration of monomer is 8.135 gmole/lit, and the concentration of initiator is kept constant at 0.06 (10)

gmole/lit. Assume termination takes only by combination. The rate constant are as $K_0 = 3^{*}10^{-6} sec^{-1}, k_p = 176\ lit/gmole.sec, k_c = 3.6^{*}10^{7}\ lit/gmole.sec, f = 0.6$

Find the number average molecular weight, average molecular weight and MWD for a reaction time of 200 min.

OR

Q. 4. A) Derive the necessary relationship obtained in giving molecular weight Distribution in CSTR for free radical type polymerization. (10)

B) Derive the necessary equation of the rate of initiation (ri) in terms of initiator concentration [I]. (6)

Q. 5. A) Discuss the necessary equation for the steady state population Balance equation for the particles having 'n' radicals in the Emulsion Polymerization. (12)

B) Write a note on suspension polymerization. (4)

OR

Q. 6. A) Derive the necessary equation of overall rate of polymerization in Emulsion polymerization if (16)

Case 1) Number of the free radicals per polymer particles small compared with unity.

Case 2) No transfer of polymer radicals out of the particle through diffusion and high rate of termination.

SECTION-2

Q. 7. A) Write a short note on reactor systems used for PET, PVC, High Density polyethylene polymers (18)

OR

Q. 8. A) Give technology overview for the following polymer (18)

1) SBR rubber 2) Nylon 6, 3) Polystyrene

Q. 9. A) Discuss the role of mass transfer in step growth polymerization. (8)

B) Discuss the necessary equation of the total rate of the disappearance Of the monomer M via initiation, propagation, and the termination Reaction by monomer transfer. (8)

OR

Q. 10. A) Derive the suitable model to understand the step growth kinetics at higher conversion. (16)

Q. 11. A) Write a short note on Reactor selection for carrying out (16)

Polymerization reactor.

OR

Q. 12. A) Explain the reactor design in terms of following factors (8)
Polymerization Mechanism, Stoichiometry Factors, Thermodynamics Factors and Transport Limitations.

B) Discuss the choice between batch and continuous reactor for (8)
Polymerization process.

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *3*]

UNIVERSITY OF PUNE
[4364]-756
B E. (*Polymer*) Examination - 2013
Rubber Technology
(2008 Course)(409371)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1 *Answer any 3 question from each section.*
2 *Answer 3 questions from section-I and 3 questions from section-II.*
3 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*
4 *Black figures to the right indicate full marks.*
5 *Your answer will be valued as a whole*
6 *Neat diagrams must be drawn wherever necessary.*
7 *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
8 *Assume suitable data, if necessary.*

SECTION –I

Q.1	A	With the help of a flow chart explain the various stages that occur in raw rubber technology.	6
	B	What are the molecular requirements for a material to exhibit rubbery characteristics?	6
	C	Write a short note on shortage hardening and crystallization of natural rubber	6
		OR	
Q.2	A	Discuss the thermodynamic theory of rubber elasticity.	6
	B	What is rebound resilience w. r. t rubbers? How is it measurement? Describe the teas to measure the same.	6
	C	Discuss any two rubbers w. r. t. preparation, structure, properties, compounding and applications.	6
Q. 3	A	Discuss the manufacturing method for rubber to metal assembles list applications where rubbers are assembled with metals.	8
	B	With suitable examples, discuss the following additives w. r. t. rubbers. Explain their mechanism of functioning. i. Peptisers ii. Fillers iii. Antioxidants	8
		OR	

Q. 4	A	Discuss the need of addition level of addition mechanism of functioning and examples for the following additives. i. Tacki fiers ii. Vulcanising agent and activators iii. Extender oils	8
	B	Discuss the principles of rubber compounding and design a recipe for a type tread application.	8
Q. 5	A	With the help of neat sketch explain the cure (theograph) obtained on an oscillating disc rheometes. State the significance of an oscillating disc rheometer.	8
	B	With the help of reactions explain vulcanization process using sulphur, peroxides and metal oxides as vulcanizing agents.	8
		OR	
Q. 6	A	Discuss the different techniques of vulcanization. Explain microwave curing. State the factors which affect the rate of vulcanization.	8
	B	List & differentiate between the different types of c-black. Explain the properties of c-black w. r. t. structure particle prosily physical nature of the surface chemical nature of the surface and surface area.	8

SECTION II

Q. 7	A	Discuss the compression molding technique w. r. t. rubbers. Also discuss its merits and demerits.	8
	B	What are the different types of roll arrangements in a calendar? Illustrate with the help of neat figures.	6
	C	Explain roll chambering in calendaring process.	4
		OR	
Q. 8	A	Discuss the rubber injection molding process from process parameter point of view.	8
	B	Define the term “mixing” w. r. t. rubbers and discuss the steps involved in the mixing process. Also discussion the three basic methods of mixing rubber in as internal mixer.	10
Q. 9	A	State the three main classes of cellular rubber and differential between them.	8
	B	List the various components forming a type structure and explain the function of each component. List the rubbers used in type manufacture.	8
		OR	
Q. 10	A	List the various products made from rubber latex. Discuss the straight dipping method for manufacture of rubber gloves.	8
	B	State the various applications of rubber conveyor belts. List the rubbers	8

used for the manufacturer of conveyor belts. Discuss step wire the process for manufacture of conveyor belts.

Q. 11	A	List the various tests carried out on unvalcanised rubbers.	8
		Define the term plasticity retention index of rubbers. Discuss the test to measure the sance state its significance.	
	B	State the tuber applications /products for which abrasion test is carried out. Discuss the procedure to carry out this test.	8

OR

Q. 12	A	Define “compression set” discuss the test sample dimension procedure to carry out the compression set test in compression state its significance state one application where this test needs to be done.	8
	B	Define the terms “volume resistivity” and surface restively Describe the test to measure resistivity.	8

UNIVERSITY OF PUNE

[4364-742]

B.E.(Polymer) Examination-2013

MOLD AND DIE DESIGN-I

(2008 pattern)

Time-Four hours **Maximum Marks-100**

[Total No. of Question=12] **[Total no. of printed pages= 6]**

Instructions:

(1)Answer question number 1 or 2,3 or 4, 5 or 6 from Section-I.Answer question number 7 or 8,9 or 10 and 11 or 12 from Section-II,

(2)Answers to the two sections should be written in separate answer books.

(3)Figures to the right indicate full marks.

(4)Draw neat sketches whenever required.

(5)Use of calculator and graph paper is allowed

SECTION-I

Q.1 Design a 2 cavity 2 plate mold for the component shown in figure 1.Draw at least 2 views with one sectional view to bring out the details of the feed,cooling and ejection system. Illustrate the relevant design calculations. (35)

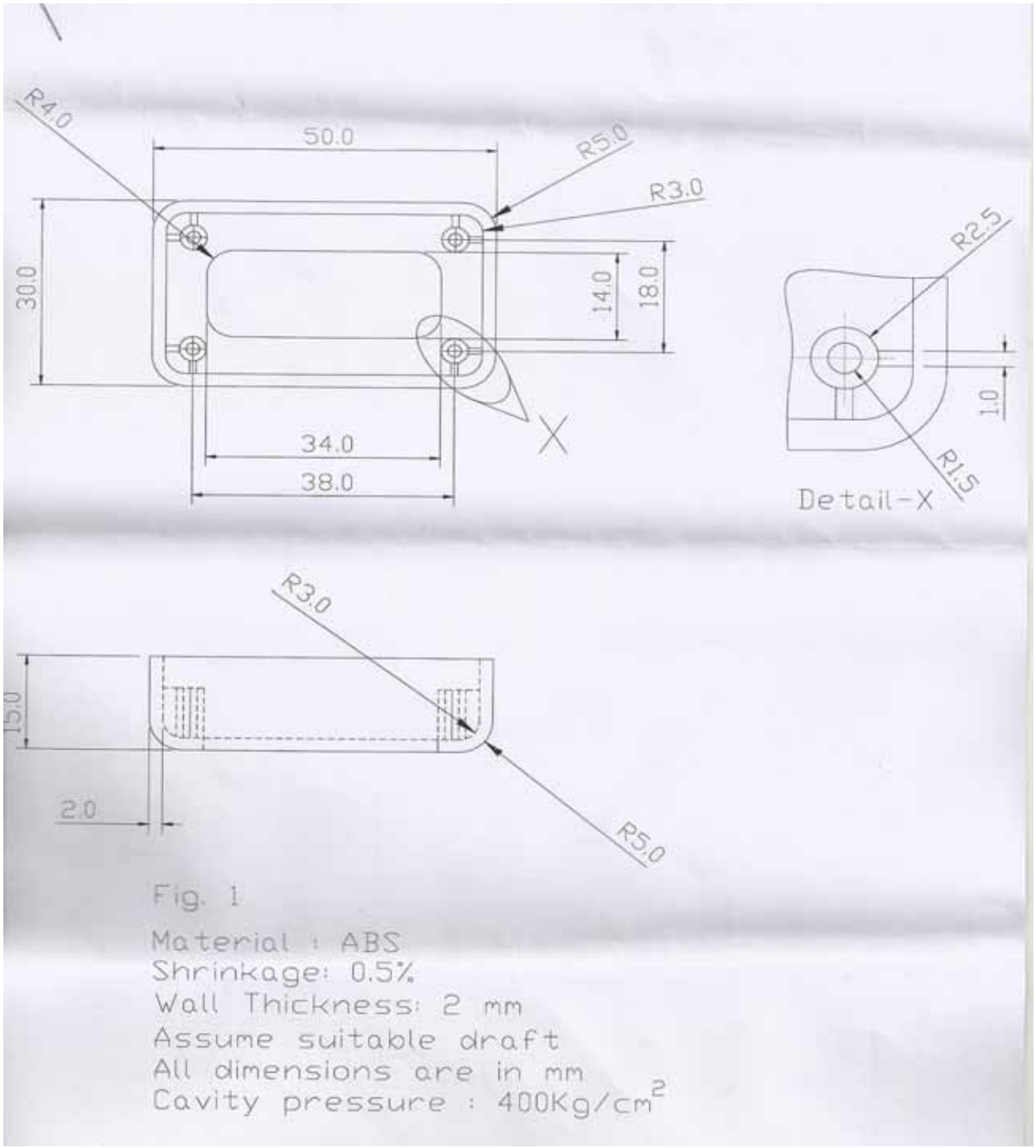

Fig. 1

OR

Q.2 Design a 2 cavity 3 plate mold for the component shown in figure 2.Draw at least 2 views with one sectional view to bring out the details of the feed, cooling and ejection system. Illustrate the relevant design calculations. (35)

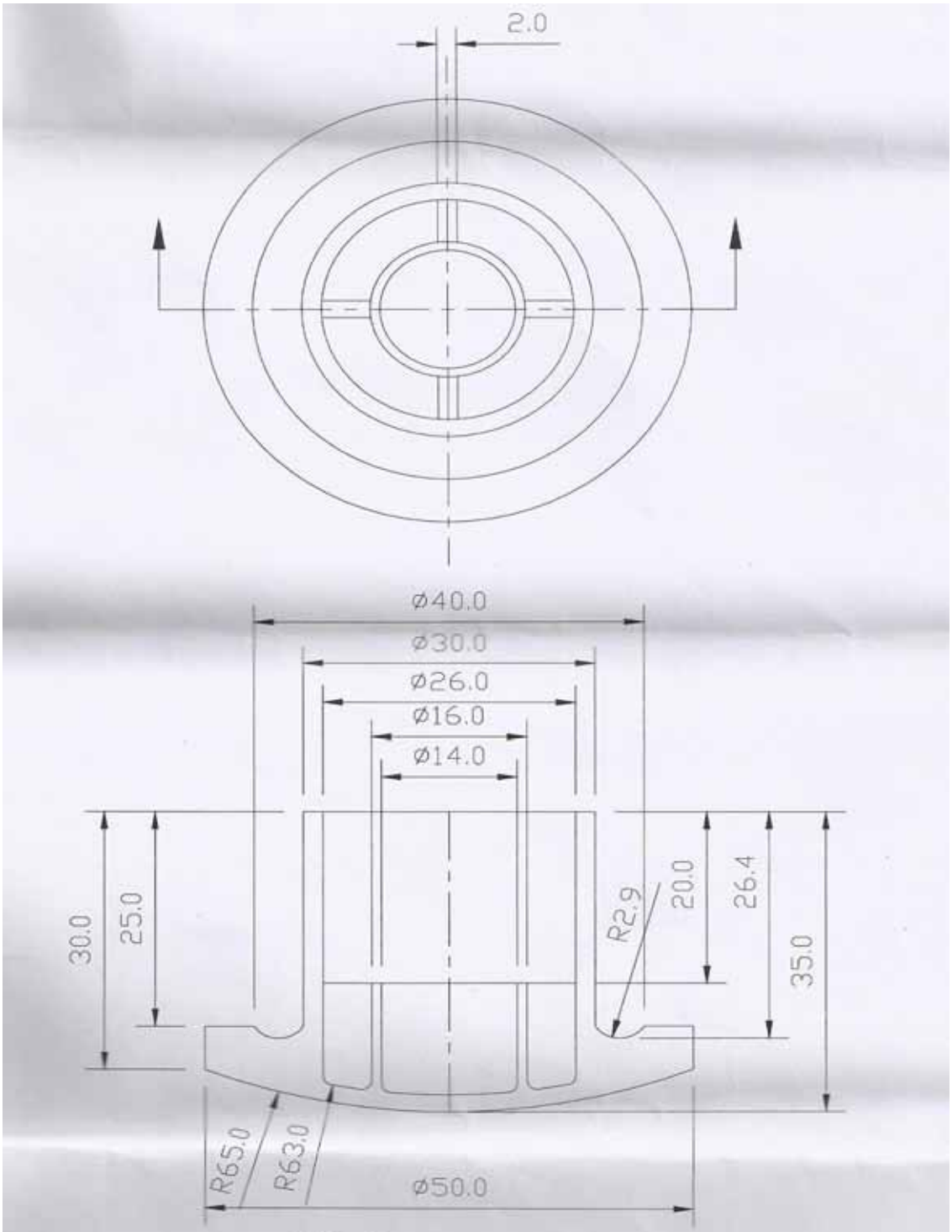

Fig. 2
Material : PP
Shrinkage : 1.8%
All dimensions are in mm.
Assume suitable draft.
Cavity pressure : 400kg/cm^2

Q.3 Explain any one method used for cooling of cavity inserts. (6)

OR

Q.4 Explain in short pin ejection method. (6)

Q.5 Explain stepwise design procedure for a blown film die. List the relevant design formulae. (9)

OR

Q.6 Draw a neat labeled sketch of blown film die. Explain it's constructional features. (9)

SECTION-II

Q.7 (a)Explain any one heat treatment process in detail. (7)

(b)Explain the effect of various alloying elements on the properties of steel.(5)

(c)How is a the grinding wheel specified? Explain significance of all the terms involved? (6)

OR

Q.8 (a)Explain in detail microstructure of steel before and after heat treatment. (6)

(b)Write a note on mold costing. (6)

(c)Write a short note on (any two) (6)

(i)Dressing of a grinding wheel

(ii)Tool signature of a single cutting tool

(iii)Honing

Q.9 (a)Explain methods to determine following geometric characteristics on the surface of a product. (6)

(i)Circularity

(ii)Parallelism

(iii)Squareness

(b)Derive an expression to determine best wire size for a ISO metric coarse thread. (5)

(c)Explain significance of unilateral and bilateral tolerancing system with typical examples. (5)

OR

Q.10 (a)Define gauges.Explain with neat sketches various production guages used in production of shafts and holes. (6)

(b)Determine the dimensions and tolerance of shaft and hole having size of 30H7/h8 fit Also,determine minimum and maximum clearance.The diameter 30 falls in range of 18mm and 30mm.The standard tolerance in microns is given by $i = 0.45\sqrt[3]{D} + 0.001\mathrm{D}$. The multiplier for grade 8 is 25i and that of 7is 16i. (10)

Q.11 (a)Explain with neat figures,constructional features of pin point gate and rectangular edge gate. (6)

(b)Explain runner balancing with a suitable example. (6)

(c)Explain with neat suitable sketch constructional features of a winkle gate.(4)

OR

Q.12 (a)Explain with neat sketch,constructional features of a sprue bush. (6)

(b)Explain the term runner efficiency. (4)

(C)Explain constructional features of a spigotted guide and guide bush. (6)

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *3*]

UNIVERSITY OF PUNE

[4364]-743

B. E. (*Polymer*) Examination - 2013

Polymer Processing Operation-II (2008 Course)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1 ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from Section I and Q7 or Q8, Q9 or Q10, Q11 or Q12 from Section II***

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Black figures to the right indicate full marks.*

4 *Your answer will be valued as a whole*

5 *Neat diagrams must be drawn wherever necessary.*

6 *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

7 *Assume suitable data, if necessary.*

SECTION –I

Q.1	A	What is parison programming? How is it done	[6]
	B	List and explain any three defects which occur in blow molding. Suggest cause remedy for the same	[6]
	C	Write short note on I. Die shaping in blow molding & II. shark effect	[6]

OR

Q.2	A	Compose single stage and two stage injection stretch blow molding	[6]
	B	Draw a neat sketch of any one type of parison die head assembly and explain the function of each part.	[6]
	C	Draw a bar chart for cycle time for single station accumulator on continuous extrusion blow molding machine. Explain all the operations in short.	[6]

Q3	A	Explain the significance of Biot's number incase of thermforming of thin and thick sheets. Also discuss the different types of heating modes for thin and thick sheets.	[6]
	B	Write short notes on I. Twin sheet roll fed thermoforming II. plug assisted pressure forming	[6]
	C	What are the plugging variables in plug-assisted system in thermofoming	[4]
		OR	
Q4	A	List and discuss any three faults which occur in thermoforming giving causes and remedies for the same.	[6]
	B	Discuss the process of drape forming and pressure forming with a neat sketch	[6]
	C	Discuss mold material and design considerations for thermoforming molds	[4]
Q. 5	A	Discuss different heating systems used in calendaring	[4]
	B	Write short notes on: I. Faults observed in calendaring II. roll bending	[6]
	C	Draw a neat sketch of a calendaring plant for sheet manufacturing and discuss in short the various stages	[6]
		OR	
Q. 6	A	Derive an expression for maximum pressure through the nip of a pair of calculate rolls	[6]
	B	Write short notes on I. Hydraulic pull backs used in calendaring II. Bearings used in calendaring	[4]
	C	Discuss different methods of taking care of roll bending and roll deflection	[6]

SECTION II

Q. 7	A	Explain the theory of bubble formation in rotational moulding process. Explain different theories proposed for reduction of bubble size. Discuss also various means of ensuring a bubble free rotational moulding process.	[8]
	B	Explain in brief rotational molding of liquid polymers	[6]
	C	Discuss two defects in rotational moulded articles and give cause and remedy for the same.	[4]
		OR	
Q. 8	A	Explain in brief rotational molding of Nylons	[6]
	B	Explain how you will find out that the article is formed and is	[8]

		cooled properly from the graph of internal air temperature versus time, in case of rotational moulding	
	C	What are the advantages and limitations of rotational molding?	[4]
Q. 9	A	With the help of neat sketches explain the process of gas injection molding. What are the advantages and disadvantages of gas injection molding over conventional injection molding?	[6]
	B	Discuss the process of microcelluar injection foam molding.	[4]
	C	Write a short note on microstrucure development in slow and fast crystalizing polymers.	[6]
		OR	
Q. 10	A	Give the process outline for Sandwich injection molding list their products that can be obtained by this process.	[6]
	B	Discuss the various steps involved in a powder metal injection molding process	[6]
	C	Discuss the classification of different water injectors used in water injections molding process	[4]
Q. 11	A	Discuss electroplating of ABS	[6]
	B	Write short note on I. vacuum metallising and II. incineration	[6]
	C	List the different methods of separation of plastic waste	[4]
		OR	
Q. 12	A	Write short note on I. laser machining & II. crammer feeder	[6]
	B	Discuss the various methods of surface preparation before decorating a plastic surface.	[4]
	C	Discuss machining of polymers w.r.t tool geometry and other machining parameters	[6]

UNIVERSITY OF PUNE
[4364-744]
B.E.(Polymer) Examination 2013
Fiber Technology
(2008 pattern)

Time-Three hours **Maximum Marks-100**
[Total No. of Question=12] **[Total no. of printed pages= 3]**
Instructions:

(1)Answer 3 questions from section-I and 3 questions from section-II.
(2)Answer to the TWO sections should be written in separate answer books
(3)Neat diagrams must be drawn whenever necessary.
(4)Figures to the right indicate full marks.
(5)Your answer will be valued.
(6)Use of logarithmic tables slide rule,Mollier charts,electronic pocket calculator and steam tables is allowed.
(7)Assume suitable data whenever necessary.

SECTION-I

Q.1 (a)Define following terms. (5)
(i)Fiber (ii)Tenacity (iii)Denier (iv)Filament denier (v)Yarn
(b)Give the classification of fiber with examples. (6)
(c)Give the advantages and disadvantages of Synthetic fiber. (7)

OR

Q.2 (a)Give the molecular requirement of fiber forming polymer. (5)
(b)Give 5 commercial names of fiber and their service. Also explain mercerization process (6)
(c)Give the raw material and polymerisation technique used to obtain polyester fiber. (7)

Q.3 (a)Explain what is melt spinning .Explain with a proper diagram. (5)
(b)Explain dry-jet wet spinning & give the significance of their process with an example. (5)
(c)Compare dry to wet spinning. (5)

OR

Q.4 (a)Explain high speed spinning and its effect an morphology. (6)
(b)Explain with examples the process for dry spinning with diagram. (5)
(c)Explain why different speeds are available with godets. Also explain why many pairs of godets are required to achieve final denier. (5)
Q.5 (a)What is the composition used for spin finish.and give the role of spin finish during spinning. (6)
(b)With diagram explain the method of application of spin finish. (5)

(c)Why stretching or chewing is required. What all factors influence this process. (5)

OR

Q.6 (a)Explain false twist process & the advantage offered to fiber. (6)
(b)Explain why texturing is required .Also explain the role of stuffer box used for texturing. (6)
(c)Explain how air jet texturing is achieved. (4)

SECTION-II

Q.7 (a)Explain what is staple fiber?Why it is required.Give the steps involved in obtaining polyester staple fiber. (10)
(b)Why identification of fiber is required.Give with examples the need & method used for identification. (8)

OR

Q.8 (a)What are the structure changes that takes place during spinning. (6)
(b)What is heat setting and why is it required. (6)
(c)What is the role of TiO_2 .Also explain how and what information is given by staining test. (6)

Q.9 (a)Give the advantages of mass coloration over dyeing process. (8)
(b)Give the method used for dyeing synthetic fiber in loose fiber & yarn form. (8)

OR

Q.10 (a)Explain the process of carrier dyeing & give the advantage of this process. (8)
(b)Give the process of high temperature dyeing as well as thermorol process. (8)

Q.11 (a)Why modification is required for synthetic fiber. Give any 2 methods used for modification. (8)
(b)Write a note on bi-component fiber and the advantages offered by them. (8)

OR

Q.12 (a)What modification is required to make fiber hydrophilic as well as antistatic. (8)
(b)Write a note on recent advances in synthetic fibers with examples. (8)

[Total No. of Questions: 12] **[Total No. of Printed Pages:7]**

UNIVERSITY OF PUNE
[4364]-747
B. E. (Polymer) Examination - 2013
PRODUCTION PLANNING AND CONTROL (2008 Course)
[Time: 3 Hours] **[Max. Marks: 100]**

Instructions :

1. *Answers to the two sections should be written in separate answer-books.*
2. *Black figures to the right indicate full marks.*
3. *Assume suitable data, if necessary.*
4. *Neat diagrams must be drawn wherever necessary.*
5. *Use of calculator, graph paper, log-log graph paper is allowed.*

SECTION -I

Q.1 A) For the activity times given below- [10]

i) Find expected time for each activity,
ii) draw the PERT network, and
iii) Find variance of the network

Activity	optimistic time	pessimistic time	most likely time
1-2	2	6	4
1-3	3	8	5
1-4	5	10	7
1-6	4	8	6
2-5	3	9	6
3-7	2	4	3
4-6	0	0	0
5-7	5	10	7
6-7	0	0	0
7-8	10	20	15

B) Six jobs arrived at one time to be processed on a single machine. Assuming that no jobs arrive thereafter determine- [6]

i) Optimal sequence
ii) Completion time of the jobs
iii) Mean flow time
iv) Average in-process inventory

Job	1	2	3	4	5	6
Processing	7	6	8	4	3	5

time (min)						

OR

Q.2 A) The sequence of Parts P1 and P2 on 6 machines with manufacturing time are given below. Find optimal scheduling to minimize the total processing time for these two parts. Find also the total elapsed time. For each machine specify the jobs that should be done first. Use graphical method. [8]

Part P1	Machine sequence	C	A	E	F	D	B
	Time (hrs)	2	3	4	5	6	1
Part P2	Machine sequence	B	A	E	F	C	D
	Time (hrs)	3	2	5	3	2	3

B) The activity normal durations, normal cost, crash duration and crash cost for a project are given below: [8]

i) Draw the network and identify the critical path
ii) What is the normal duration and normal cost?
iii) Crash the project to find minimum project time and corresponding cost. the indirect cost per day is Rs. 10/-

Activity	Normal Duration	normal Cost	Crash duration	Crash cost
1-2	6	60	4	100
1-3	4	60	2	200
1-4	5	50	3	150
2-5	3	45	1	65
3-5	6	90	4	200
4-5	8	80	4	300

Q. 3 A) Following data is available for an item- [10]
Annual average demand per week = 20000
Standard deviation of demand per week = 50 units
Unit cost = Rs. 40
Average ordering cost = Rs. 200 per order
Average lead time = 8 weeks
Maximum delay = 4 weeks
Probability of delay = 0.5
Service level = 95%
Design appropriate inventory system for the above item.

B) obtain an expression for economic order quantity, expression for optimum time interval and optimum average [8]

cost per unit time for a model with following assumptions.

i) Demand rate uniform,
ii) Replenishment for production rate finite,
iii) Run sizes are constant and new run will start whenever inventory is zero

OR

Q. 4 A) Obtain an expression for economic order quantity and optimum average cost per unit time for a model with following assumptions. [10]

i) Demand rate is constant
ii) Scheduling time is constant
iii) Production rate is infinite
iv) Lead time is zero
v) Shortages, if any, have to be made-up

B) Obtain an expression for a probabilistic inventory model with following assumptions. [8]

i) Continuous demand
ii) Set-up zero
iii) Continuous stock levels (stock level are not discrete)
iv) Lead time zero

Q. 5 A) Write a short note on "multiple or Sequential Sampling Plan". Explain the procedure with a suitable example of the plan. [7]

B) Injection moulding of an electrical switch suffer from the problem of black spots. For quality control 1000 switches are examined daily. Following information shows number of defective electrical switches. Draw np-chart and give your findings. [9]

Days	1	2	3	4	5	6	7	8	9	10
No. of defective switches	10	9	8	12	15	7	12	8	10	13

OR

Q. 6 A) A pipe is manufactured by extrusion process and is cut at 3 meter length. The data below gives mean length and ranges of lengths finished pipe from 10 samples each size n = 5. The specification limits for the length is 3000 ± 5 mm. [6]

Construct x chart and R- chart. Examine whether the process is under control Give your recommendation and comments. Assume for n=5, the control chart factor as A_2= 0.577, D_3 = 0, D_4 = 2.115

Sample no	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Mean - x	**3001**	**2998**	**3002**	**3000**	**3003**	**3004**	**2999**	**2996**	**2999**	**3001**
Range R	**5**	**0**	**7**	**3**	**4**	**7**	**2**	**8**	**5**	**6**

B) Discuss and explain the use of Control chart for C (Number of defects per unit) [6]

SECTION II

Q. 7 A) Solve the following traveling salesman problem to minimize the distance travelled. [10]

∞	12	24	25	15
6	∞	16	18	7
10	11	∞	18	12
14	17	22	∞	16
12	13	23	25	∞

B) Find the basic feasible solution by North-West corner rule. [8]

Plants					Supply
1	2	3	11	7	6
2	1	0	6	1	1
3	5	8	15	9	10
Requirement	7	5	3	2	17

OR

Q. 8 A) The captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are given below- [10]

Batsman	Batting Position				
	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

i) Find the assignment to positions which give the maximum number of runs.

ii) If another batsman "U" with following average runs in batting positions as given below

Batting positions	I	II	III	IV	V
Average runs	45	52	38	50	49

Is added to the team, should be he included by to play in the team? If so, who will be replaced by him.?

B) Find the basic feasible solution of the following transportation problem by Column minima method. [8]

	W_1	W_2	W_3	W_4	Available
F_1	1	2	1	4	20
F_2	3	3	2	1	40
F_3	4	2	5	9	20
F_4	5	3	6	10	20
Required	20	40	30	10	100 (total)

Q. 9 A) Trains arrive at the yard every 15 minutes and the service time is 33 minutes. If the line capacity of the yard is limited to 4 trains, find [7]

i)The probability that the yard is empty,

ii)The average number of trains in the system.

B) The goods trucks arrive at the yard with a mean of 6 trucks per hour. A crew of 20 workers can unload the truck with the help of modern equipments in 10 minutes. The trucks waiting in the queue to be unloaded are paid a waiting charge at the rate of Rs. 100 per hour. Operatives are paid wages at the rate Rs. 50 per hour. It is possible to augment the crew strength to 5 or 8 (of 20 workers per crew) when unloading will be 8 or 6 minutes per truck. Find the optimum crew size. [9]

OR

Q. 10 A) An injection moulding machine cost Rs. 60,00,000 when new. Running cost and salvage value at the end of year is given below in the table. If the interest rate is 10% per annum and running cost is assumed to have occur at mid-year find when the machine should be replaced. [10]

Year	1	2	3	4	5	6	7
Running Cost (Rs.)	200000	220000	245000	280000	320000	365000	420000
Salvage value (Rs.)	4500000	4200000	4000000	3800000	3500000	3200000	2800000

B) A packaging worker packs injection moulded TV cabinets.TV cabinets arrived at packaging stating in [6]

Poisson's fashion with mean rate of 10 per hour. The packaging time has exponential distribution. At what average rate must the packaging worker work in order to ensure a probability of 0.80 that the injection moulded TV cabinet will not have to wait more than 10 minutes.

Q.11 A) A company has 30% probability of annual sales of its 10,000 automobiles, 40% probability of 8,000 annual sales of automobiles and 30% probability of 6,000 annual sales of automobiles. If the company goes for limited production where variable costs are Rs. 10,000 per automobile and fixed costs are Rs. 8,000 annually. Alternatively they can go for full scale production where variable costs are Rs. 9000 per automobile and fixed costs are Rs. 50,000 annually. If the new automobile is sold for Rs. 11,000, should the company go for limited production or full scale production when their objective is to maximize the expected profit. [8]

B) Two players A and B without showing each other, put on a table a coin, with head of tail up. A wins Rs. 8 when both the coins show head and Rs. 1 when both are tails. B wins Rs. 3 when the coins do not match. Given the choice of being matching player (A) or non-matching player(B). which one would you choose and what would be your strategy? [8]

OR

Q. 12 A) A newspaper boy has the following probabilities of selling a magazine- [8]

No. of copies sold	Probability
10	0.10
11	0.15
12	0.20
13	0.25
14	0.30
	1.00

Cost of a copy is 30 paise and sale price is 50 paise. He cannot return unsold copies. How many copies should he order?

B Reduce the following game by dominance property and solve it.

		Player B				
		1	2	2	4	5
Player A	I	1	3	2	7	4
	II	3	4	1	5	6
	III	6	5	7	6	5
	IV	2	0	6	3	1

[Total No. of Questions: *12*] **[Total No. of Printed Pages: 2]**

UNIVERSITY OF PUNE
[4364]-748
B. E. (*Polymer*) Examination - 2013
Surface Coatings and Adhesives (Elective-II) (2008 Course)
[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

1 ***Answer 3 questions from Section I and 3 questions from Section II.***

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Black figures to the right indicate full marks.*

4 *Neat diagrams must be drawn wherever necessary.*

5 *Use of electronic pocket calculator is allowed.*

6 *Assume suitable data, if necessary.*

SECTION –I

Q.1	A	Write a short note on Various Oils used in surface coatings.Additionally ,comment on their properties and the role of each type of oil.	12
	B	Explain the significance of solvents used in surface coatings.	6
		OR	
Q.2	A	Briefly explain following additives used in surface coatings.(Any three) 1.Emulsifier 2.UV stabilizers 3.Antixidants 4.Antiforms	12
	B	What are the various steps involved in paint manufacture.	6
Q. 3	A	Comment on various Natural Resins used in surface coatings.	8
	B	Explain in detail paints based on Phenolic resins and Vinyl Resins.	8
		OR	
Q. 4	A	Write a short note following-1)Decorative Paints 2)Industrial Paints	8
	B	Explain in detail paints based on polyester Resins and Amino Resins.	8

Q. 5	A	Write a short note on general properties of paints, varnishes and lacquers.	8
	B	Explain following terms.-Spreading capacity, wet opacity, spreading time, dry hiding.	8
		OR	
Q. 6	A	With suitable example explain typical formulation of paint.	8
	B	Explain the significance of adhesion and cohesion properties as well as factors affecting these properties in case of coatings.	8

SECTION II

Q. 7	A	Explain in detail Diffusion Theory of adhesives.	10
	B	Briefly explain the concept of Chemisorption applied to adhesive field.	8
		OR	
Q. 8	A	Explain in detail Electrostatic Theory of adhesion.	9
	B	Comment on significance of surface energies and wettability in case of adhesives.	9
Q. 9	A	Write a short note on Typical formulation of adhesives used in construction applications.	8
	B	Explain in detail the concept of structural adhesives.	8
		OR	
Q. 10	A	Give various ingredients of Emulsion based adhesives and also explain their role.	8
	B	Write a short note on Elastomeric modified adhesives.	8
Q. 11	A	Enlist the factors on which adhesives joint design depends.	3
	B	With schematic diagrams explain various types of stresses which are important for adhesive joint.	8
	C	Briefly explain the testing method used to find out cure time in case of adhesives.	5
		OR	
Q. 12	A	Write a short note on Processing Requirements in case of Adhesive assembly.	8
	B	Explain in detail Mechanical testing of Adhesive Joint.	8

UNIVERSITY OF PUNE

[4364]-750

B. E. (*Polymer*) Examination - 2013

Product Design and Polymer Testing

(*2008* Pattern)

[Total No. of Questions: *12*] **[Total No. Of Printed Pages: *3*]**

[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

*(1) Answer **any three** questions from each section.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Black figures to the right indicate full marks.

(4) Your answer will be valued as a whole.

(5) Neat diagrams must be drawn wherever necessary.

(6) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(7) Assume suitable data, if necessary.

SECTION-I

Q1	A	Write a note on designing of plastic component with hinges.	6
	B	Explain the pseudo elastic design method for plastic.	6
	C	A 100mm long plastic beam is simply supported at each end. It is subjected to a load w at its mid-span. If the maximum permissible strain should not exceed 2%, calculate the maximum load which can be applied so that the deflection does not exceed 4mm after 6 months. Moment of inertia for the beam is 30mm^4. Use the answer in fig.1.	6

OR

Q2	A	Write a note on designing of plastic bearings.	6
	B	List the various steps followed in designing of plastic products. Explain the process of understanding of end use requirement for a particular product.	6
	C	Explain the concurrent approach to plastic product design.	6
Q3	A	List the method used to conduct chemical resistance tests in plastic. Explain any 2 in detail.	6
	B	List the major environmental factors affecting the properties of plastic explain the test procedure followed to understand the effect of UV light on plastics.	6
	C	Describe the test method to determine fungi resistance to plastics.	4

OR

Q4	A	Explain the flammability test for non-rigid plastics.	5
	B	Explain the horizontal burring test.	5
	C	Explain the test procedure for ignition response test.	6
Q5	A	Explain why at least one holding jaw of the tensile testing machine has to have complete degree of freedom of rotation in all axes while testing polymeric samples.	5
	B	Explain the test variables affecting I zod and cheupy impact test.	5
	C	Define heat deflection temperature and discuss the test variable that shall affect HDT.	6

OR

Q6	A	Draw the generalized creep curve and discuss various stages. Explain how creep data can be generated for plastic product design.	6
	B	With neat sketch explain how coefficient of linear thermal expansion can be determined.	5
	C	Explain the test set up for three point bending test.	5

SECTION-II

Q7	A	Explain the detail pulse echo technique used to measure flows in plastic product under ultrasonic testing.	6
	B	How density of a plastic is determined by density gradient method.	6
	C	Explain the technique used to determine partial size and its distribution for polymeric materials.	6

OR

Q8	A	Describe any two test used for testing of PVC pipe	6
	B	Explain test method to determine permeation or barrier properties for polymers.	6
	C	Explain the importance of water absorption test for plastic and its method.	6
Q9	A	Define dialectic strength of an insulating material. Discuss the procedures to determine the same. Also state only the factors that affect this property.	7
	B	Derive the term birefringence. Explain importance of this property for plastic.	5
	C	Explain L, a, b tristimulus system as developed by CIE to describe the color	4

OR

Q10	A	Draw a schematic of a haze meter and explain its working.	6
	B	Write short note on(any two)	6
	i.	Traking across plastic surface	
	ii.	Refractive index and its measurement	
	iii.	Electrical resistance tests for plastic	
	C	Explain differences between colorimeter and spectrophotometer techniques used for identifying colors in plastic industry.	4

Q11	A	Explain with neat sketches separable and inseparable snap anomalies used for the assembly of plastic parts.	6
	B	Explain design features of BT, BF and T type of thread cutting screws wit neat sketches.	6
	C	Discuss material considerations for ultrasonic welding of plastics.	4

OR

Q12	A	Explain the process of spin welding. Discuss the various joint configuration used for this process.	6
	B	Discuss importance of molecular weight cohesive strength and viscosity of an adhesive in adhesion bonding.	5
	C	Explain what is meant by energy director in ultrasonic welding its importance for crystalline and amorphous materials.	5

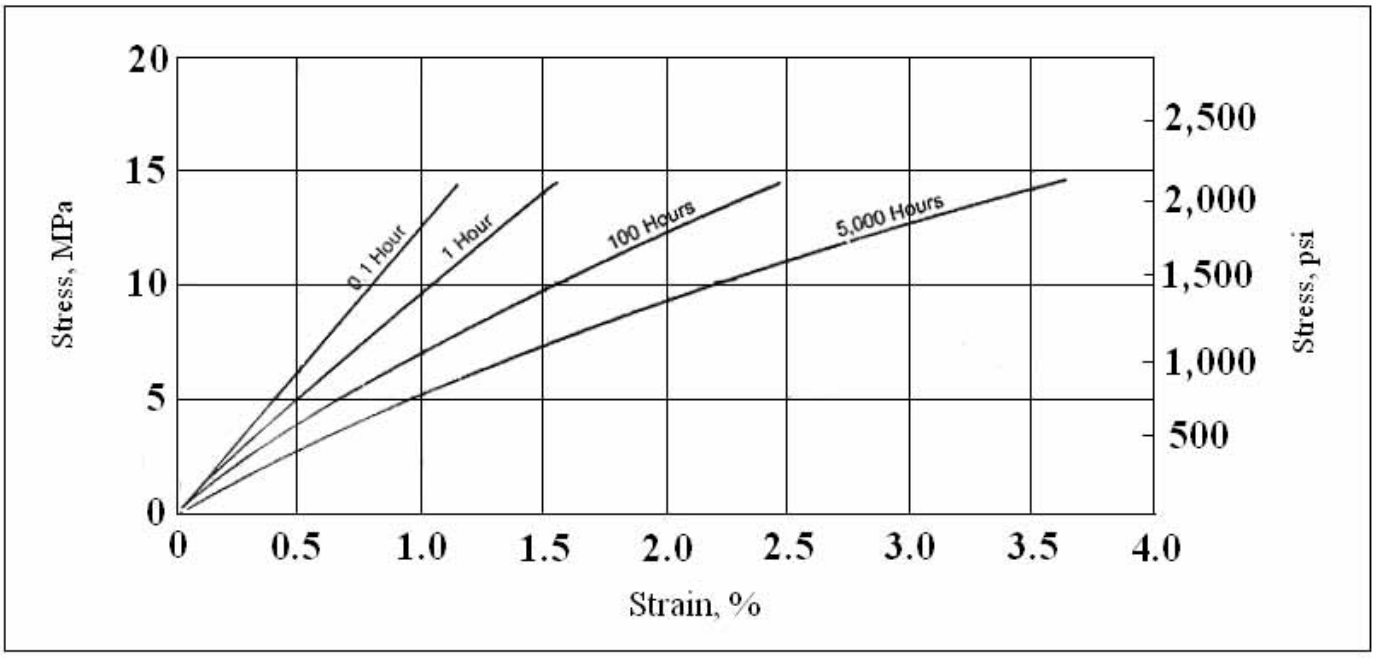

Fig. 1 Creep curves

[Total No. of Questions:12] **[Total No. of Printed Pages: 3]**

UNIVERSITY OF PUNE

[4364]-752

B. E. (Polymer) Examination - 2013

Polymer Physics and Characterizations (2008 Course)

[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

1 *Answer 3 questions from Section I and 3 questions from Section II*

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Neat diagrams must be drawn wherever necessary.*

4 *Black figures to the right indicate full marks.*

5 *Your answer will be valued as a whole*

6 *Assume suitable data, if necessary.*

SECTION -I

Q.1	A	Explain the working principle of FTIR.	4
	B	Explain the methods used for sample preparation in FTIR.	8
	C	What are the different modes of vibration in FTIR	6
		OR	
Q.2	A	Can one differentiate PE and wax using FTIR?	3
	B	If a mixture or blend is given, how to analyze each using FTIR	5
	C	How to identify vulcanized rubbers using FTIR?	4
	D	What is ATR technique and what information can be generated using ATR.	6
Q. 3	A	Give the working principle of NMR.	7
	B	Explain what information can be generated during following processes; using NMR 1) Relaxation 2) Spin-Spin interaction 3) Chemical shift	9
		OR	
Q. 4	A	Explain how NMR can be used to characterize polymer qualitatively as well as quantitatively.	10
	B	Give the methodology used while interpreting NMR spectra.	6
Q. 5	A	Give the figure explaining working of a PC.	10
	B	Explain working of HPLC and list the information given by it.	6

OR

Q. 6	A	On what principle does x-Ray diffraction work and what data can be studied us it.	10
	B	Explain what is SAXS and WAXS. What information is obtained using SAXS as well as WAXS techniques	6

SECTION II

Q. 7	A	Give the principle and advantages of electron microscope	5
	B	Explain how sample preparation is done for SEM	6
	C	Give the working of TEM and for what it is used?	6

OR

Q. 8	A	Explain working of AFM & for what it is used	6
	B	Explain how following details are studied 1) Surface energy 2) Spherulitic growth 3) Compatibility of polymers in blends	12
Q. 9	A	Explain how thermal transitions are studied in polymers.	5
	B	Explain how DTA helps in characterizing polymer blends	5
	C	What is the technique used in DTG & how is it different than DTA.	6

OR

Q. 10	A	On what principle does DSC work. Show an ideal plot generated by DSC.	5
	B	How isothermal scans are generated by DSC and what information is given by them.	6
	C	What is DMA used for and what is the working principle is.	5
Q. 11	A	What is birefringence and how is it found for polymers.	6
	B	Describe the various optical properties that need to be measured in case of polymers.	10

OR

Q. 12	A	Why electrical properties are important to be known for polymers and how are they measured.	5
	B	What are conducting polymers? Give two eg.	5
	C	Write short note on 1) Static change in polymers 2) DEA	6

[Total No. of Questions:12] [Total No. of Printed Pages: 5]

UNIVERSITY OF PUNE

[4364]-753

B. E. (Polymer) Examination - 2013

Processing of Composites (2008 Course)

[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

1 ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from Section I and Q7 or Q8, Q9 or Q10, Q11 or Q12 from Section II***

2 *Answers to the **two sections** should be written in **separate answer-books**.*

3 *Figures to the right indicate full marks.*

4 *Use of log paper, log-log paper and pocket calculator is allowed.*

5 *Assume suitable data, if necessary.*

SECTION -I

Q.1	A	Explain Griffith's formula for strength of brittle fibers in terms of critical flaw size.	3
	B	For a square arrangement of fiber packing, show that fibers having square cross section can be packed to higher fiber volume fraction than fibers with round cross-section.	5
	C	A particular composite of PVC and wood flour is made by extrusion by adding 50% by weight of wood flour. Find void fraction and composite density if following data is know- Density of wood = 0.6 gms/cm^3 Density of PVC formulation = 1.4 gms/cm^3	5
	D	Discuss various types of particulate composite with reference to shape, geometry and matrix materials. Explain the applications of particulate composites.	5

OR

Q.2	A	Write in short about- i) Polyester as matrix material in composites ii) Thermoplastic Polyimides as matrix material in composites. iii) Surface treatment for carbon and Kevlar fibers.	10
	B	Explain coupling agents used and their mechanism for surface treatment of glass fibers in thermoset composites	8
Q. 3	A	Write in short about tooling requirement, method of heat & pressure application in case of wet layup technique.	6
	B	Discuss compression moulding of sheet moulding compound with reference to process, mould requirement, applications and trouble	6

shooting of processing problems.

C Write in short about (any one) 4

i) Diaphram forming

ii) Hot press technique.

OR

Q. 4 A Gel time test on a resin system yielded following data. 6

Temp (°C)	Time n minutes
210	2
200	3.5
180	7
160	15
140	30
130	37
125	40

If gel time can be represented by-

$t_{gel} = A \exp\left(\frac{E}{RT}\right)$ where

E = Activation Energy

R = Universal gas constant

A = Constant

Find gel time at 220°C and 110 °C.

B Discuss at least two methods of incorporation of fibers in thermoplastic matrix material. 6

C Explain roll wrapping process in short 4

Q. 5 A Explain the use of thermomechanical model to autoclave processing. 8

B What is de-bulking with reference to autoclave processing and how does it help in compaction. 8

OR

Q. 6 A Write short notes (Any four) 16

i) Importance of process models to overcome processing problems.

ii) Application of flow submodel to autoclave process.

iii) Resin transfer moulding

iv) Resin film infusion

v) Elastic reservoir moulding

SECTION II

Q. 7 A Discuss the major parameters that govern the pulling force requirement in the process of pultrusion. 6

B Draw a neat sketch of pultrusion process and discuss major factors that govern the fiber wet out. 6

	C	What is the effect of internal pressure generated in pultrusion die?	4
		OR	
Q. 8	A	Write short notes on (any two) i) Matrix flow model ii) Application of pultrusion. iii) Design considerations for pultrusion die	8
	B	The isothermal cure rate for certain resin system is given by $\frac{d\propto_c}{dt} = k \ \propto_c{}^2 \ (1 - \propto_c)^2$ The temperature dependent constant K, is given by- k= $2\times10^6 \exp\left(\frac{-4000}{T}\right)$ Where T is in degree Kelvin Find the rate of cure, $\propto_c$, at which the rate of cure is maximum. The curing takes place at T=300 degree Kelvin	8
Q. 9	A	Explain thermomechanical model as applied to filament minding	10
	B	Write in short about machining of composites	6
		OR	
Q. 10	A	With a schematic sketch, explain tape winding process and its applications.	5
	B	Write in short about void and stress submodels	8
	C	Give at least two failure modes in adhesive joints	3
Q. 11	A	With reference to nano clay polymer composites, discuss i) Intercalated dispersion ii) Exfoliated dispersion iii) Phase separated dispersion	9
	B	Discuss various structure of carbon nano-tubes and their effects on properties of composites	9
		OR	
Q. 12	A	Discuss various methods to disperse layered silicates in polymer to make nanoclay- polymer composites	9
	B	Write in short about method of producing carbon nano-tubes	9

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *3*]

UNIVERSITY OF PUNE

[4364]-754

B. E. (*Polymer*) Examination - 2013

Specialty Polymer and Applications. (2008 Course)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1 *Solve 3 questions to Section I and Section II should be written on separate answer book.*
2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*
3 *Figures to the right indicate full marks.*
4 *Neat diagrams must be drawn wherever necessary.*
5 *Use of electronic pocket calculator is allowed.*
6 *Assume suitable data, if necessary.*

SECTION –I

Q.1	A	With appropriate schematic diagrams explain the following terms- Nematics, Smectic, Cholesteric and Discotic phases in case of liquid crystalline polymers (LCPs)	08
	B	Write short note on Thermotropic LCP. Give suitable example.	06
	C	Comment on importance of blending of LCP with engineering plastics.	04
		OR	
Q.2	A	What is Liquid Crystalline phase? State various characteristics of liquid crystalline phase.	07
	B	Write a short note on "Rheology of LCPs"	05
	C	With suitable example explain in detail Lyotropic LCP system.	06
Q. 3	A	Explain in detail "Band Theory" in case of conducting polymers.	05
	B	What do you understand by the terms Bipolaron, Soliton, Polaron?	06
	C	Comment on the significance of doping process.	05
		OR	
Q. 4	A	Discuss important properties of conducting polymers.	06
	B	Enlist various application areas of conducting polymers. Explain any one in detail.	06
	C	What are various routes to synthesize polyacetylene? Briefly explain any one route.	04
Q. 5	A	Write short note on Polyimide as Heat Resistant Polymer.	05
	B	Comment on various routes to improve thermal stability of given polymers.	08

	C	Aromatic polyamides have better thermal stability compared to aliphatic polyamides. Do you agree with the statement? Justify your answer.	03
		OR	
Q. 6	A	Write short note on "Ablative Polymers as Heat Resistant Polymers"	06
	B	Explain in detail the physical as well as chemical factors affecting thermal stability/heat resistance of polymers.	10

SECTION II

Q. 7	A	Explain in detail Types of Membranes.	06
	B	Write short on Photosensitive Polymers.	06
	C	Explain various steps involved in photolithography.	04
		OR	
Q. 8	A	Enlist various applications of membranes. Explain any one in detail.	10
	B	What are Photoresist Polymers? With suitable examples explain the terms positive and negative photoresists. Enlist various applications of photoresists.	06
Q. 9	A	What is Biocompatibility? Why is it necessary to understand the concept of biocompatibility in case of biopolymer?	05
	B	Write short note on "polymers as Biocatalysts".	06
	C	Compare between Biopolymers and conventional Polymers.	05
		OR	
Q. 10	A	Along with various applications give the examples of polymeric materials used as Biopolymers.	06
	B	Comment on the basis requirements for material to behave as Biomaterial.	06
	C	Explain in brief the use of biomaterials in drug delivery.	04
Q. 11	A	Explain in detail the following (any one): Polymers used in – 1. Cosmetic applications 2. Controlled release of agricultural chemicals 3. Telecommunication applications 4. Green Houses and Mulches.	18
		OR	
Q. 12	A	Explain the concept of Polymer concrete.	04
	B	Enlist General Characteristics and applications of polymer concrete products.	05
	C	Explain in detail the construction of polymeric optical fibers.	05
	D	Comment on usage of polymers in Food contact applications.	04

[Total No. of Questions: 12] **[Total No. of Printed Pages:** 2]

UNIVERSITY OF PUNE
[4364]-757
B. E. (Polymer Engineering) Examination - 2013
POLYMER THERMODYNAMICS AND BLENDS
(2008 Pattern)(409371-C)(Elective IV)

[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

1 *Answers to the **two sections** should be written in **separate answer-books**.*
2 *Neat diagrams must be drawn wherever necessary.*
3 *Assume suitable data, if necessary.*
4 *Use of logarithmic tables, slide electronics pocket calculator is allowed*
5 *Black figures to the right indicate full marks.*

SECTION -I

Q.1	A	Explain the following terms: i) Change in free energy, ii) Change in Heat content, iii) Change in internal energy	[6]
	B	Explain changes in enthalpy and entropy during addition polymerization and condensation polymerizations. Correlate it to the molecular weight obtained during the reaction.	[6]
	C	Describe first law of thermodynamics. Explain it with reference to reversible processes.	[6]
		OR	
Q.2	A	State the importance of entropy in the explanation of free energy change in process. Explain the isothermal process	[10]
	B	Explain thermodynamic criteria of polymeric dissolution. Describe the condition under which it is not a spontaneous process.	[8]
Q.3	A	What is ideal behavior of mixing? How do real chemicals other than polymer show deviation from ideality? Explain behavior of polymers during mixing.	[8]
	B	Describe assumptions of Hildebrand in explaining regular solutions. State its limitations of the theory.	[8]
		OR	
Q. 4	A	Describe assumptions of Gugenheim in explaining strictly regular solutions. State it limitations.	[8]
	B	Explain the importance of Molecular weight parameter with necessary diagram on the miscibility of polymer blend system.	[8]
Q. 5	A	State phase rule. Explain it with reference to various phases possible	[8]

		in polymeric melts.	
	B	Explain the terms UCST and LCST in polymeric solution. Explain the cases where UCST>LCST and LCST>UCST	[8]
		OR	
Q. 6	A	Explain behavior of LCST and UCST of polymer with variation in second viral coefficient and free energy of mixing.	[8]
	B	Explain miscibility of blend on the basis of thermodynamic principles.	[8]
		SECTION II	
Q. 7	A	Discuss in detail different methods of blending with one example each.	[10]
	B	Explain with the help of graph of property VS composition the properties of Miscible and Immiscible blends.	[8]
		OR	
Q. 8	A	To a polymer A of Tensile strength 20Mpa and polymer B with tensile strength 40Mpa was blended to get a resultant blend with tensile strength of 26Mpa find the blend composition if I) Simple additivity rule II) Logarithmic additivity Rule.	[6]
	B	Explain different polymeric Modifier used to improve the following properties such as Impact Strength, Chemical Resistance, Heat Deflection Temperature, Flame Resistance.	[6]
	C	Write a short note on Engineering Polymer Blends, Classification of PB.	[6]
Q. 9	A	Discuss any two methods of Compatibilization with suitable examples.	[10]
	B	Explain any two methods of characterizations (Thermal and Microscopic) of polymer Blends.	[6]
		OR	
Q. 10	A	Discuss with one example the role of Maleic Anhydride grafted polymers in blend Technology.	[8]
	B	Discuss Toughened Polymers via blend technology.	[8]
Q. 11	A	Explain applicable Rheological models to explain Miscible and Immiscible Polymer Blends.	[10]
	B	Explain Permeability of Blends to Gases and vapors.	[6]
		OR	
Q. 12	A	Write in detail classifications of Interpenetrating Polymer Network and Discuss in detail any two examples of PIN.	[16]