P1216   **[3564]-293**

B.E. (Polymer)
POLYMER PROCESSING OPERATIONS - I
(2003 Course)

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

Instructions to the candidates:

    1)   *Answers to the two sections should be written in separate books.*

    2)   *Neat diagrams must be drawn wherever necessary.*

    3)   *Figures to the right indicate full marks.*

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

    5)   *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Explain in brief the complete extrusion line used for pipe extrusion with neat figures. **[8]**

     b) Explain constructional features of flat film die. **[8]**

<div align="center">OR</div>

Q2) a) Write a short note on (any one) **[8]**
        i)   Caterpillar haul off system.
        ii)   Internal and external calibrators for pipe.

     b) Explain constructional features of a blown film die with a neat sketch. **[8]**

Q3) a) Explain melt fracture and shark skin effect in blow molding. **[6]**

     b) Explain die shaping used in extrusion blow molding. **[6]**

     c) Compare the single stage and two stage injection stretch blow molding process. **[6]**

<div align="center">OR</div>

Q4) Write short notes on: **[18]**

     a) Effect of die smell in blow molding.

     b) Pleating and parison sag.

     c) Effect of molecular weight and molecular weight distribution in blow molding.

Q5) a) Explain the process of drape forming and pressure forming with a neat sketch. **[8]**

     b) Explain the causes and remedies for wrinkling and whitening of sheets during thermoforming. **[8]**

<div align="right">*P.T.O.*</div>

Q6) Write short notes on: **[16]**
    a) Plug assist vacuum forming.
    b) Matched mold forming.
    c) Biot number.
    d) Diaphragm forming.

SECTION - II

Q7) a) Describe the design of screw and barrel used in thermoset injection molding with neat sketches. **[8]**
    b) Explain the process of Reaction Injection molding. **[4]**
    c) Write a short note on breathing techniques used in injection molding of thermosets. **[6]**

OR

Q8) a) Draw a cycle time bar chart for two color/two component injection molding. **[8]**
    b) Discuss advantages and disadvantages of gas assisted injection molding over normal injection molding. **[5]**
    c) Discuss in brief, the process of sandwich molding. **[5]**

Q9) a) Explain with neat sketch, features of semipositive mold used for compression molding. **[4]**
    b) Compare the processing parameters of melamine formaldehyde and phenol formaldehyde with respect to injection molding, compression molding and transfer molding. **[7]**
    c) Discuss the effect of variation in bulk factor on shot weight consistency in compression molding. **[5]**

OR

Q10) a) Describe the process of compression molding in details. **[10]**
    b) Discuss design features of compression molds used for DMC. **[6]**

Q11) a) Discuss various defects observed in transfer molding. Suggest remedies for the same. **[8]**
    b) Discuss the separate pot method in transfer molding. **[8]**

OR

Q12) a) Derive an expression for power dissipated per unit volume of dielectric for high frequency dielectric welding. **[6]**
    b) Draw a cycle time bar chart for transfer molding. **[6]**
    c) Discuss flow cure relationship for different material grades used in transfer molding. **[4]**

P1310

[3564] - 295
B.E. (Polymer)
MOLD AND DIE DESIGN
(2003 Course)

Time : 4 Hours]   *[Max. Marks:100*

Instructions to the candidates:
    1)   *Figures to right indicate full marks.*
    2)   *Use of logarithmic tables, pocket calculators is allowed.*
    3)   *Assume suitable data, if necessary.*
    4)   *Answer any three questions from section I and any three from section II.*

SECTION - I

Q1)   Design a two cavity two plate mold for the component in fig 1. Draw at least two views with one sectional view to bring out all the details of feed system, ejection and cooling system.   **[35]**

       Material : ABS
       Cavity pressure : 300kg /cm^2
       Total heat content : 72 cal/g.

OR

Q2)   Design a two cavity three plate mold for the component in fig 2. Draw at least two views one sectional view to bring out the details of feed, ejection and cooling system. Material : PP; Cavity pressure : 250 kg/cm^2; Total heat content : 130 cal/g.   **[35]**

Q3)   Calculate the size of guide pillar for mold designed in Q1 or Q2.   **[5]**

OR

Q4)   Calculate the size of cooling channel for the mold designed in Q1 or Q2.**[5]**

Q5)   a)   Write a short note on various systems used for split safety.   **[5]**

       b)   Explain the cam track method of split actuation with a neat figure. **[5]**

OR

Q6)   a)   Explain finger can actuation method for splits.   **[5]**

       b)   Write a note on split guiding mechanisms.   **[5]**

SECTION - II

Q7) a) Discuss advantages and disadvantages of hot runner mold systems over underfed mold systems. **[9]**

b) With a neat sketch, explain barbed nozzle design. **[7]**

OR

Q8) a) Explain the construction of any two secondary nozzles with neat sketches. **[6]**

b) Explain constructional features of rectangular hot runner manifeld. **[6]**

c) Explain any one valve system used with secondary nozzles. **[4]**

Q9) a) Write a process sheet for manufacturing of sprue bush and guide pillar for mold designed in Q1 or Q2. **[8]**

b) Write a short note on electro discharge machining. **[8]**

OR

Q10) a) Write a process sheet for manufacturing ejector plate and retainer plate. **[8]**

b) Write a short note on types of steels used in making of injection molds. **[8]**

Q11) a) Draw a neat sketch of an in line pipe die. **[10]**

b) Calculate pressure drop through a rod die using following data;
Q = 40 kg/hr ; diameter of extender ; 55 mm diameter of rod ; 12 mm ; t_o = 20 sec^{-1} melt density : 0.76g/cm^3 ; K = 33,000 NS^n / m^2; λ = 85,000 N – S /m^2. **[8]**

OR

Q12) a) Draw a neat sketch of side fed blown film die. **[10]**

b) Calculate the pressure drop between the points A and B for the exit region of a blown film die shown in fig 3. Using the following data
Q = 110 × 10^{-6} m^3/s; n = 0.33;
K = 32,500 N S^n/m ; λ = 0.122 × 10^5 N–S/m^2
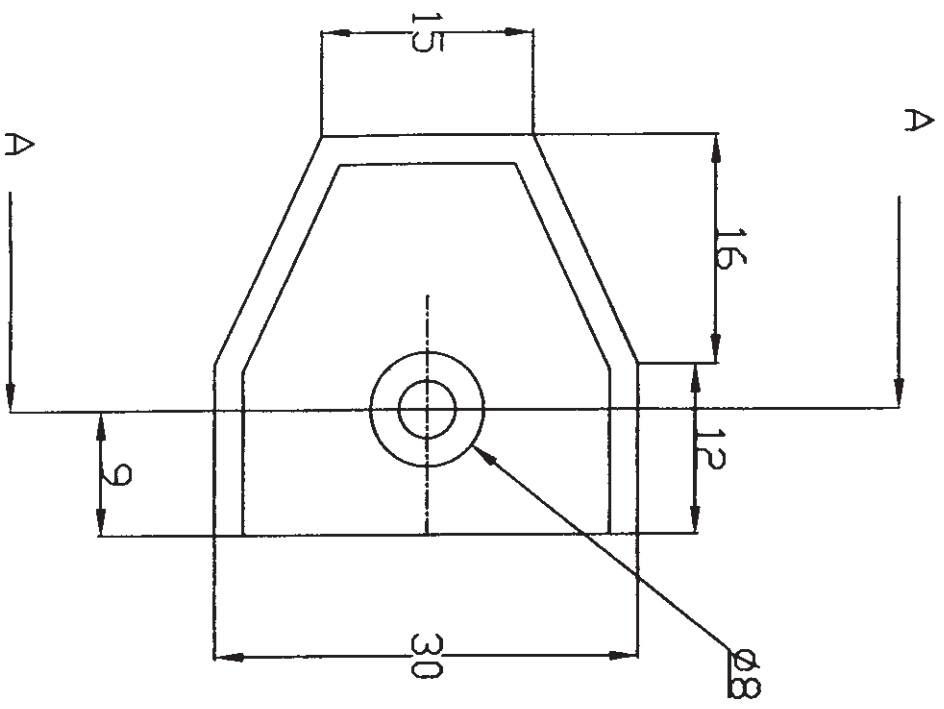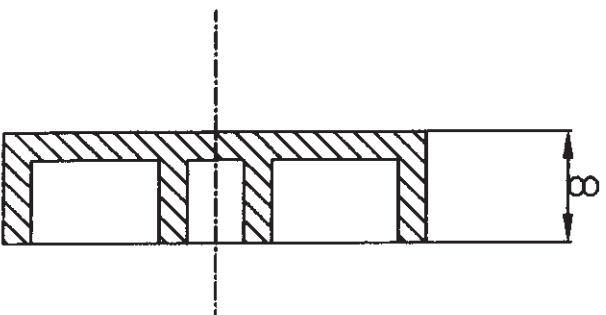melt density = 0.76g / cm^3. **[8]**
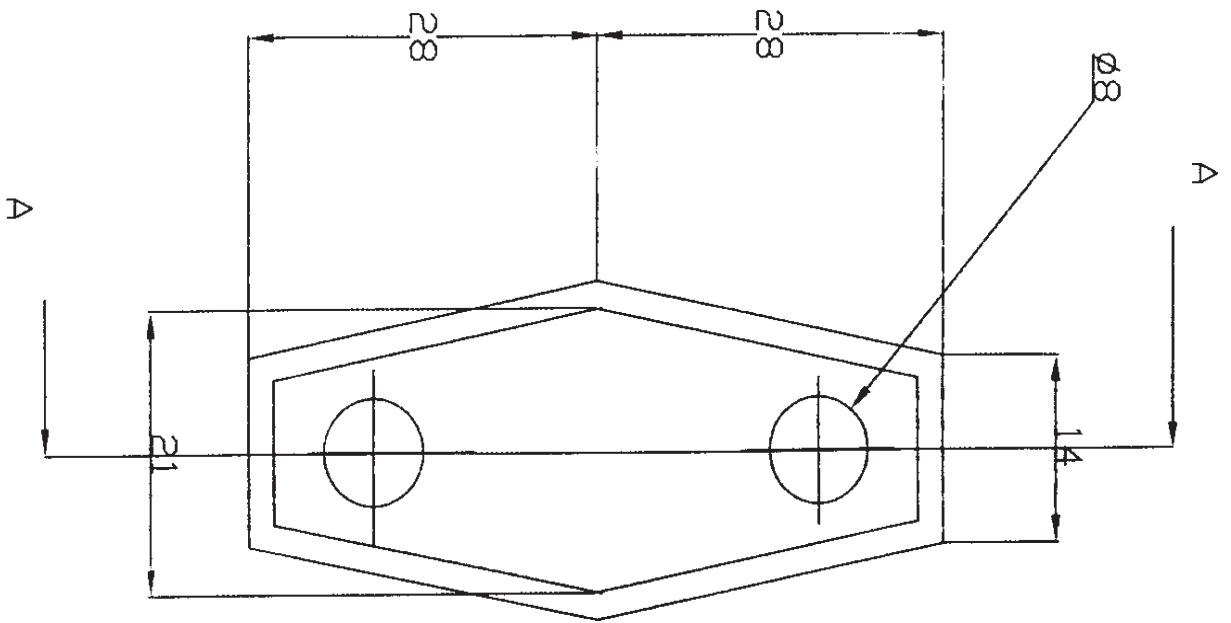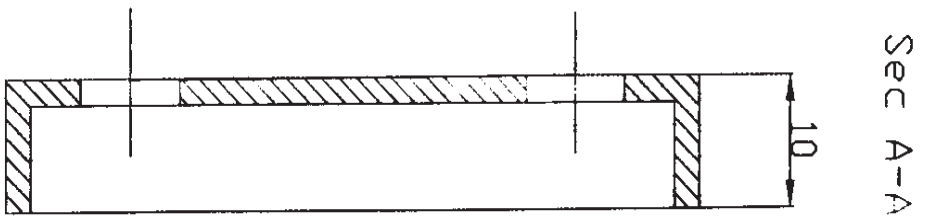
Fig.1

SEC A-A

All dimensions in mm
overall thk 2 mm

FIG. 2

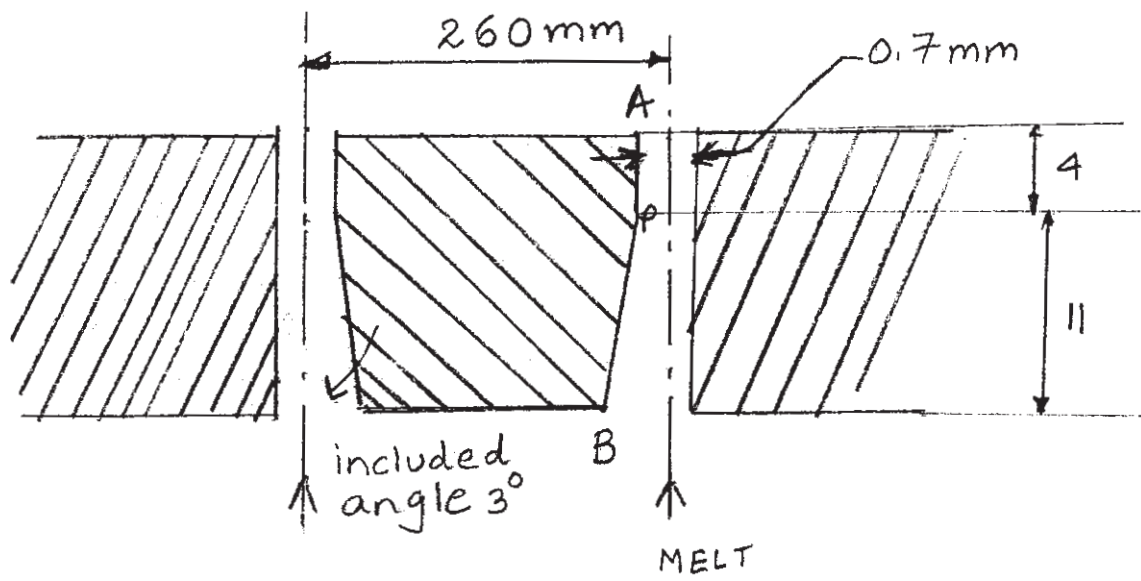Sec A-A

All dimensions in mm

overall thk 2 mm

FIG. 3

P1292   **[3564]-304**

B.E. (Polymer)
FIBER TECHNOLOGY
(2003 Course)

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

Instructions :

   1)   *All questions are compulsory.*

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

   3)   *Neat diagrams must be drawn wherever necessary.*

   4)   *Figures to the right indicate full marks.*

   5)   *Your answers will be valued as a whole.*

   6)   *Assume suitable data, if necessary.*

SECTION - I

Q1) a)   Explain the terms; yarn, filament denier, DPF, TEX, staple, texturing, fibrillation, annealing, delustring agent and twist per denier. **[10]**

     b)   Give any 3 advantages and 3 disadvantages of synthetic fibers. **[6]**

     c)   Explain the role of any 2 additives added to fiber along with its advantages. **[2]**

OR

Q2) a)   Explain the role of tire cord fabric in tyres. **[2]**

     b)   Give a short note on the history of fibers right from how they originated till date. **[7]**

     c)   What are the molecular requirements of fiber forming polymers. **[5]**

     d)   Why T_g of some polymers need to be elevated when used as a blend with natural fibers and how is it done. **[4]**

Q3) a)   How to obtain wrinkle free fabric? **[2]**

     b)   What is the method of processing Acrylic fibers. Give the diagram and method can be put as block representation? **[5]**

     c)   Explain dry-jet-wet spinning with diagram. **[5]**

     d)   Give the batch process for obtaining Nylon 6. **[4]**

OR

Q4) a) What are the functions performed by spin finish? Give the constituents and explain how does it get applied to fiber surface. **[6]**

b) What are the side reactions during PET synthesis and their drawbacks?**[3]**

c) Give the advantages of TPA over DMT along with its drawbacks. **[3]**

d) What processing method is used to obtain fibers from heat resistant thermoplastic polymers? **[4]**

Q5) a) What is Modacrylic? Give the characteristics and application. **[3]**

b) Write a short note on Kevlar and Nomex. **[4]**

c) Which fiber acts like elastic and is used generally in hosiery and sportswear? **[3]**

d) Write a short note on nanofibers and how are they obtained. **[3]**

e) What is a sportex turf and from which synthetic fibers is it made? **[3]**

OR

Q6) a) Give a chart to show the sources from where raw materials are obtained to give synthetic fibers. **[6]**

b) Give list of 4 fibers obtained from animal source. **[4]**

c) Name the fibers that can be used in space of engg. applications due to its very high strength. **[3]**

d) Write a short note on viscous rayon. **[3]**

SECTION - II

Q7) a) What are staple fibers? Explain the direct spinning process for the manufacture of staple fibers. Give its advantages and disadvantages.**[8]**

b) Explain the 3-phase model of the fiber structure. **[5]**

c) What are the different methods of identification and analysis of fibers.**[3]**

OR

Q8) a) What is crimping and why is it done? What are the different ways of crimping? Explain any one in detail. **[6]**

b) Explain disperse and Thermosol dyeing. **[5]**

c) Write a short note on "Dyeability" of synthetic fibers. **[5]**

Q9) a) What is meant by mass coloration of fibers? What are its advantages and limitations? List the different methods of mass coloration. **[8]**

b) Why is dyeing of polyester fiber difficult? Which are the 3 methods of dyeing of polyester fibers. Explain any one of them. **[8]**

OR

*Q10)*a) What is barriness? What are the 2 factors responsible for causing barriness in case of Nylons? With respect to Nylon explain how barriness is minimized. **[8]**

b) Why is it difficult to dye PP fibers? Explain the different methods to prepare modified PP fibers; and how are they dyed after modification.**[8]**

*Q11)*a) What are the reasons for preparing modified synthetic fibers? List the various types of modified polyester fibers and explain low pilling polyester. **[8]**

b) Why are acrylic fibers modified. What are bicomponent acrylic fibers? How are they prepared and what are their application. **[6]**

c) Write a short note on "flame retardant". **[4]**

OR

*Q12)*a) What are the "carrier free dyeable polyesters"? What are its advantages? Explain the 3 types of carrier free dyeable polyester fibers. **[8]**

b) What are hydrophilic acrylic fibers? How are they prepared? **[4]**

c) What are the 3 drawbacks associated with the hydrophobicity of synthetic fibers? How are they overcome? Explain how are modified synthetic fibers prepared? **[6]**

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P1217   **[3564] - 302**

B.E. (Polymer)

INDUSTRIAL MANAGEMENT AND PROCESS ECONOMICS
(409370) (2003 Course)

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

Instructions to the candidates:

  1) *In Section - I attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, In Section - II attempt Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.*
  2) *Answers to the two sections should be written in separate books.*
  3) *Neat diagrams must be drawn wherever necessary.*
  4) *Figures to the right indicate full marks.*
  5) *Use of electronic pocket calculator is allowed.*
  6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a)   What are the factors which must be taken into account before selecting a plant location? List and discuss each of them. **[8]**

   b)   The firm ABC produces and sells industrial container and packing cases. Due to competition, the company proposes to reduce the selling price. If the present level of profit is to be maintained, indicate the number of units to be sold if the proposed reduction in price is

   i)   10% and

   ii)   15%

   The following information is available :

   Present sales (30,000 units) - Rs. 6,00,000.

   Variable cost (30,000 units) - Rs. 3,60,000.

   Fixed cost - Rs. 1,40,000.

   Net profit - Rs. 1,00,000. **[9]**

<center>OR</center>

Q2) a)   What are the elements of costing? Explain each of them. **[8]**

   b)   The following information is obtained from the accounts of XYZ limited -

   Direct Material cost - Rs. 10,000. **[9]**

   Direct wages - Rs. 6,000.

   Direct Expenses - Rs. 200.

Factory over heads - Rs. 3,000.

Administration overheads - Rs. 1,000.

Selling and distribution over heads - Rs. 1,800.

Sales - Rs. 25,000.

i) Prepare a statement of cost and profit under absorption method showing prime cost, works cost, cost of production, total cost and profit.

ii) If factory overhead is 80% variable, administration overhead is 20% variable and selling and distribution overheads is 40% variable, prepare statement of cost and profit under marginal costing method.

Q3) a) Explain the term "Working capital" and discuss about its sources. **[6]**

b) A project requires an outlay of Rs. 1,00,000 and earns the annual cash inflows of Rs. 35,000, Rs. 40,000, Rs. 30,000 and Rs. 50,000. Calculate profitability Index, assuming the discounting rate of 15%. **[5]**

c) Explain : **[6]**

i) Preference shares.

ii) Debentures.

OR

Q4) a) What is accounting rate of return? A project involves the investment of Rs. 5,00,000 which yields profits after depreciation and tax as stated below :

Years	Profits after depreciation and taxes (Rs.)
1	25,000
2	37,500
3	62,500
4	65,000
5	40,000

At the end of 5 years, the machine in the project can be sold for Rs. 40,000. Find the Accounting Rate of Return (ARR). **[6]**

b) Explain the advantages and disadvantages of Equity Shares. **[6]**

c) A project involves cash inflows as below : **[5]**

Year	Cash Inflows (Rs.)
1	10,000
2	12,000
3	15,000
4	20,000

Assuming interest rate to be 15%, find the present value of cash inflows.

Q5) a) For depreciation, explain the difference between production unit method and production hour method. **[5]**

b) The following data is available : **[5]**

Cost of the machine - Rs. 1,00,000.

To be depreciated on time basis

Over life of the machine i.e. 10 years - Rs. 50,000.

Estimated number of units to be produced - 50

Using Joint Factor Rate method, calculate the depreciation to be charged if the machine produces 6000 units.

c) Describe the aims of budgeting. **[6]**

OR

Q6) a) The cost of a machine is Rs. 1,10,000 and its estimated scrap value is Rs. 10,000. The estimated number of units to be produced during the life of the asset is 50,000 units. If 7000 units are produced in a particular year, find the depreciation value using production unit method. **[5]**

b) Describe the types of budgets. **[6]**

c) Explain the need for depreciation accounting. **[5]**

SECTION - II

Q7) a) Use simplex technique to solve the following LP problem

Minimize $Z = x_1 - 3x_2 + 2x_3$

subject to $3x_1 - x_2 + 3x_3 \leq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$x_1, x_2, x_3 \geq 0$ **[9]**

b) Solve the following transportation problem

Deotination

		A	B	C	D	
	I	21	16	25	13	11
Source	II	17	18	14	23	13
	III	32	27	18	41	19
Requirement		6	10	12	15	43

[8]

OR

Q8) a) Solve the following assignment problem [9]

	1	2	3	4
A	10	12	19	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

b) Find the sequence that minimizes the total elapsed time required to complete the following tasks : [8]

Tasks	:	A	B	C	D	E	F	G	H	I
Time on I machine	:	2	5	4	9	6	8	7	5	4
Time on II machine	:	6	8	7	4	3	9	3	8	11

Calculate the total idle time for the machines in this period.

Q9) a) A TV dealer finds that the cost of holding a TV instock for a week is Rs. 50. Customers who cannot obtain new TVs immediately tend to go to other dealers and he estimates that for every customer who cannot get immediate delivery he loses an average of Rs. 200. For one particular model of TV, the probabilities of a demand of 0, 1, 2, 3, 4 and 5 TVs in a week are 0.05, 0.10, 0.20, 0.30, 0.20 and 0.15 respectively.

 i) How many televisions per week should the dealer order? Assume that there is no time lag between ordering and delivery.

 ii) Compute EVPI.

 iii) The dealer is thinking of spending on a small market survey to obtain additional information regarding the demand levels. How much should be willing to spend on such a survey? [9]

b) The pay off matrix of a game is given. Find the solution of the game to the player A and B.

$$
\begin{array}{c}
\hspace{3.5cm} B \\
\begin{array}{ccccc}
\quad\; I & \;\; II & III & IV & V
\end{array} \\
A \;
\begin{array}{c}
I \\ II \\ III \\ IV
\end{array}
\left[
\begin{array}{ccccc}
9 & 3 & 1 & 8 & 0 \\
6 & 5 & 4 & 6 & 7 \\
2 & 4 & 4 & 3 & 8 \\
5 & 6 & 2 & 2 & 1
\end{array}
\right]
\end{array}
$$
[8]

OR

Q10)a) A project schedule has the following characteristics :

Activity	Time
(1 - 2)	2
(1 - 4)	2
(1 - 7)	1
(2 - 3)	4
(3 - 6)	1
(4 - 5)	5
(4 - 8)	8
(5 - 6)	4
(6 - 9)	3
(7 - 8)	3
(8 - 9)	5

Construct the PERT network and find critical path and also time duration of the project. [9]

b) Raman industries Ltd., has a new product which they expect has great potential. At the moment they have two courses of action open to them : S_1 = to test the market, S_2 = to drop the product. If they test it, it will cost Rs. 50,000 and the response could be positive or negative with probabilities of 0.70 and 0.30 respectively. If it is positive, they could either market it with full scale or drop the product. If they market with full scale, then the result might be low, medium or high demand, and the respective net pay-offs would be - Rs. 1,00,000, Rs. 1,00,000 or Rs. 5,00,000. These out comes have probabilities of 0.25, 0.55 and 0.20 respectively. If the result of the test marketing is negative, they have decided to drop the product. If, at any point, they drop the product there is a net gain of Rs. 25,000 from the sale of scrap. All the financial values have been discounted to the present.
Draw a decision tree for the problem and indicate the most preferred decision. [8]

Q11) a) You have to supply your customers 100 units of a certain product every monday (and only then). You obtain the product from a local supplier at Rs. 60 per unit. The costs of ordering and transportation from the supplier are Rs. 150 per order. The cost of carrying inventory is estimated at 15% per year of the cost of the product carried.

       i)   Find the lot size which will minimize the cost of the system.

       ii)   Determine the optimal cost.   **[7]**

    b) An aircraft uses rivets at an approximately constant rate of 5,000 kg per year. The rivets cost Rs. 20 per Kg. and the company personnel estimate that it costs Rs. 200 to place an order, and the carrying cost of inventory is 10% per year.

       i)   How frequently should orders for rivets be placed, and what quantities should be ordered for?

       ii)   If the actual costs are Rs. 500 to place an order and 15% for carrying cost, the optimum policy would change. How much is the company losing per year because of imperfect cost information?   **[9]**

<div align="center">OR</div>

Q12) a) Find the optimal order quantity for a product for which the price breaks are as follows :   **[8]**

Quantity   : $0 \le q_1 < 500$ $500 \le q_2 < 750$ $750 \le q_3$

Unit cost (Rs.) :   10.00   9.25   8.75

The monthly demand for a product is 200 units, the cost of storage is 2% of the unit cost and the cost of ordering is Rs. 350.

    b) Perform ABC analysis on the following sample of items in an inventory.

Item name	Annual Consumption	Price per unit (in Rs.)
A	300	10
B	2800	15
C	30	10
D	1100	5
E	40	5
F	220	100
G	1500	5
H	800	5
I	600	15
J	80	10

[8]

<div align="center">✦✦✦✦</div>

P1291

[3564]-301

B.E. (Polymer)
POLYMER PROCESSING OPERATIONS - II
(2003 Course)

Time : 3 Hours]

[Max. Marks : 100

Instructions :

    1)   Answer three questions from each Section.

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

    3)   Neat diagrams must be drawn wherever necessary.

    4)   Figures to the right indicate full marks.

    5)   Assume suitable data, if necessary.

    6)   Use of logarithmic tables slide rule, electronic pocket calculator is allowed.

SECTION - I

Q1) a)   Draw a neat sketch of calendering plant for sheet manufacturing and discuss in short the various stages.   **[8]**

    b)   Discuss any two of the calender arrangement.   **[8]**
        i)   Superimposed calender.
        ii)   Offset calender.
        iii) Z-Type calender.

<div align="center">OR</div>

Q2) a)   Discuss various faults (problems) occur during formulation, premixing and calendering stages. Discuss also the remedies.   **[6]**

    b)   Discuss movable and fixed roll position for different types of calender.**[4]**

    c)   Write short note on (Any two):   **[6]**
        i)   Bearings used in calendering.
        ii)   Premixing equipments used prior to calendering.
        iii) Embossing on calender products.

Q3) a)   Draw neat sketch of following types of rotational molding machines and discuss merits and demerits of each.   **[9]**
        i)   Shuttle type machine
        ii)   Vertical style machine
        iii) Independent Arm machine.

    b)   Draw a typical internal mold air temperature profile in case of rotational molding and discuss various stages and the information that can be gathered from it.   **[9]**

OR

Q4) Answer the following (Any three): **[18]**

    a)   Discuss the rotational molding of different types of Nylon.

    b)   Explain the advantages of liquid polymer rotational molding and discuss flow behaviour of polymer during rotational molding process.

    c)   Explain how bubble removal can be achieved using pressure in rotational molding.

    d)   With neat sketches discuss different types of inserts and cores used in rotational moulds.

Q5) a)   Write a short note on "Slush molding process". **[6]**

    b)   Explain the process of screen printing on plastics with neat sketch. **[5]**

    c)   Discuss the process of hot stamping with neat sketch. **[5]**

OR

Q6) a)   Write a note on pretreatment on plastic films and blow molded containers. **[5]**

    b)   Discuss the process of electroplating in details. **[6]**

    c)   Discuss the process of gravure printing with neat figure. **[5]**

SECTION - II

Q7) a)   Explain the process of meet spinning with neat sketch. List the name of polymers used in meet spinning process. **[8]**

    b)   State the various process parameters of meet spinning process and explain any one process parameter. **[4]**

    c)   What is texturising? How is it carried out? **[4]**

OR

Q8) a)   Differentiate between wet spinning and dry spinning and explain wet spinning with neat sketch. **[8]**

    b)   Why is the step of drawing essential in fiber manufacture. Explain with a neat sketch the drawing process. **[5]**

    c)   Why is annealing of fiber carried out? How is it done? **[3]**

Q9) a)   What is "recycling of plastics"? What are the reasons for recycling of plastics? State different methods of recycling and explain any one method in detail. **[8]**

    b)   Describe the "SPI" resin identification coding system. **[4]**

    c)   Describe in brief Crammer feeder. **[4]**

*Q10)*a) Explain the process of "PET bottle recycling". **[6]**

b) List the different types of collection systems used for plastic waste. Explain separation method of plastic waste. **[5]**

c) Explain the "incineration process" for plastic recycling. **[5]**

*Q11)*a) List the different finishing and machining methods used for plastics? What are the points to be considered while machining plastics product?**[5]**

b) Explain with neat sketch the process of ultrasonic welding. **[6]**

c) What are the factors to be considered while selecting an adhesive for a particular application? **[3]**

d) Explain the "solvent cementing" method of polymer joining. **[4]**

OR

*Q12)*a) List different types of adhesives used in joining and explain heat sensitive adhesive. **[5]**

b) What are "self-tapping screw"? Classify them. What are the common problems associated with use of self tapping screw in plastic parts? How would you overcome these problems? **[7]**

c) What is "Post-molding insert"? List different types of past molding inserts? Explain process of "Post molding insert arrangement in plastic. **[6]**

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[3564]-300

B.E. (Polymer)

PRODUCT DESIGN AND COMPUTER APPLICATIONS

(2003 Course)

Time : 4 Hours]   *[Max. Marks : 100*

Instructions :

   1)   Answers to the two sections should be written in separate books.
   2)   Neat diagrams must be drawn wherever necessary.
   3)   Figures to the right indicate full marks.
   4)   Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
   5)   Assume suitable data, if necessary.

SECTION - I

Q1) a)   Define creep and stress relaxation. Explain how creep and stress relaxation curves used in plastic product design.   **[5]**

   b)   A PP beam 120 mm long is simply supported at each end. It is subjected to a load W at its mid span. If the maximum permissible strain in the material is to be 2%, calculate the largest load which may be applied so that deflection of the beam does not exceed 5 mm in a service life of 1 year. $I = 30$ mm^4 and curves in Fig.1 should be used.   **[5]**
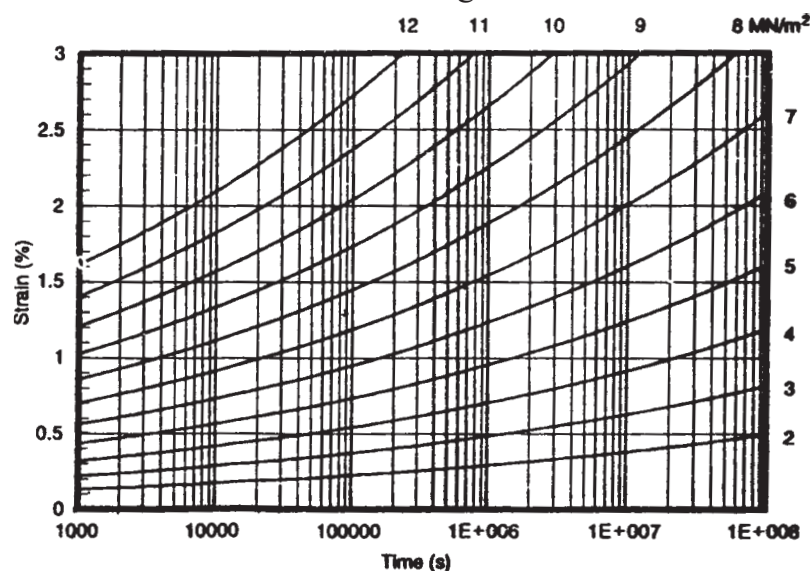

Fig.1   Creep curves for polypropylene at 20°C (density 909 kg/m³)

   c)   Derive an expression relating critical strain energy release rate to applied force and compliance.   **[6]**

Q2) a) Write short notes on **any two** : **[8]**
  i) Steps involved in plastic product design.
  ii) Parallel engineering approach in product design.
  iii) Pseudoelastic design method.

  b) Explain the standard linear solid model. Obtain expressions for creep and recovery. **[4]**

  c) The viscoelastic behaviour of a certain plastic material is represented by spring and dash pot elements having constants 1.5 GPa and 100 GNs/m² respectively. If a stress of 15 MPa is applied for 90 seconds and then completely removed, compare the values of strain predicted by the Maxwell and Voigt models after 40 seconds and 110 seconds. **[4]**

Q3) Solve **any three** : **[18]**
  a) Determine and draw the failure envelope for a general orthotropic lamina using Aziz-Isai-Hill failure theory.

  b) State the Tsai-Wu tensor failure theory. Explain how will you determine strength tensors of the second and fourth rank by carrying out uniaxial and biaxial tests.

  c) Obtain expressions for restrictions on Poisson's ratios for orthotropic material.

  d) A press fit assembly consists of metal shaft and plastic hub has following dimensions metal shaft diameter = 50 mm, hub outer diameter = 100 mm, width of joint = 25 mm.
  For an interference of 0.25 mm on radius; calculate the shrink fit stress if elastic modulus of plastic is 1 GPa and that of metal is 210 GPa. The poisson's ratio for both plastic and metal can be taken as 0.3. If the coefficient of friction between metal and plastic is 0.25. Calculate the force of separation.

OR

Q4) Solve **any two** : **[18]**
  a) A sandwich molding is made of solid skins and a central foamed plastic core. All layers can be treated as isotropic with following properties:
  Skin material:
    $E_{11} = E_{22} = 3GN/m^2$, $G_{12} = 1GN/m^2$.
  Foamed core:
    $E_{11} = E_{22} = 1GN/m^2$, $G_{12} = 0.02GN/m^2$, $\nu = 0.4$.
  Skin layers are 1 mm thick and core is 20 mm thick. Find extensional stiffness [A], coupling stiffness [B] and bending stiffness [D] matrices for above laminates.

b) Obtain expressions for elements of extensional stiffness [A], coupling stiffness [B] and bending stiffness [D] matrices in terms of engineering constants for following cases.

   i) Single isotropic layer.

   ii) Single specially orthotropic layer.

   iii) Single generally orthotropic layer.

c) Write a note with neat sketches on different types of snap fit assemblies used in plastic product design.

Q5) a) For polystyrene material, high pressure capillary viscometer data is obtained as below. **[9]**

Shear rate (1/sec)	Shear stress Pa
7.96	34,800
23.30	52,600
54.30	67,000
126.00	82,400
369.00	1,05,000
790.00	1,22,000
1620.00	1,38,000
4120.00	1,61,000
8170.00	1,79,000
16,100.00	1,96,000

Fit any one of the following viscosity model for the above data

i) Carreau

ii) Meter.

b) Discuss various types of weld lines and the causes of weld lines. **[7]**

OR

Q6) Write short notes on **any four** : **[16]**

a) Optimum gate location.

b) Flow leaders and flow restrictors.

c) Packing phase analysis.

d) Reasons for shrinkage and warpage in injection molded products.

e) Ellis viscosity model.

SECTION - II

Q7) a) Design and draw a multiimpression mold for component in Fig.2 or Fig.3. Draw at least two views including one sectional view to show details of feed, ejection and cooling system. The drawing should clearly show the way article is ejected. **[40]**

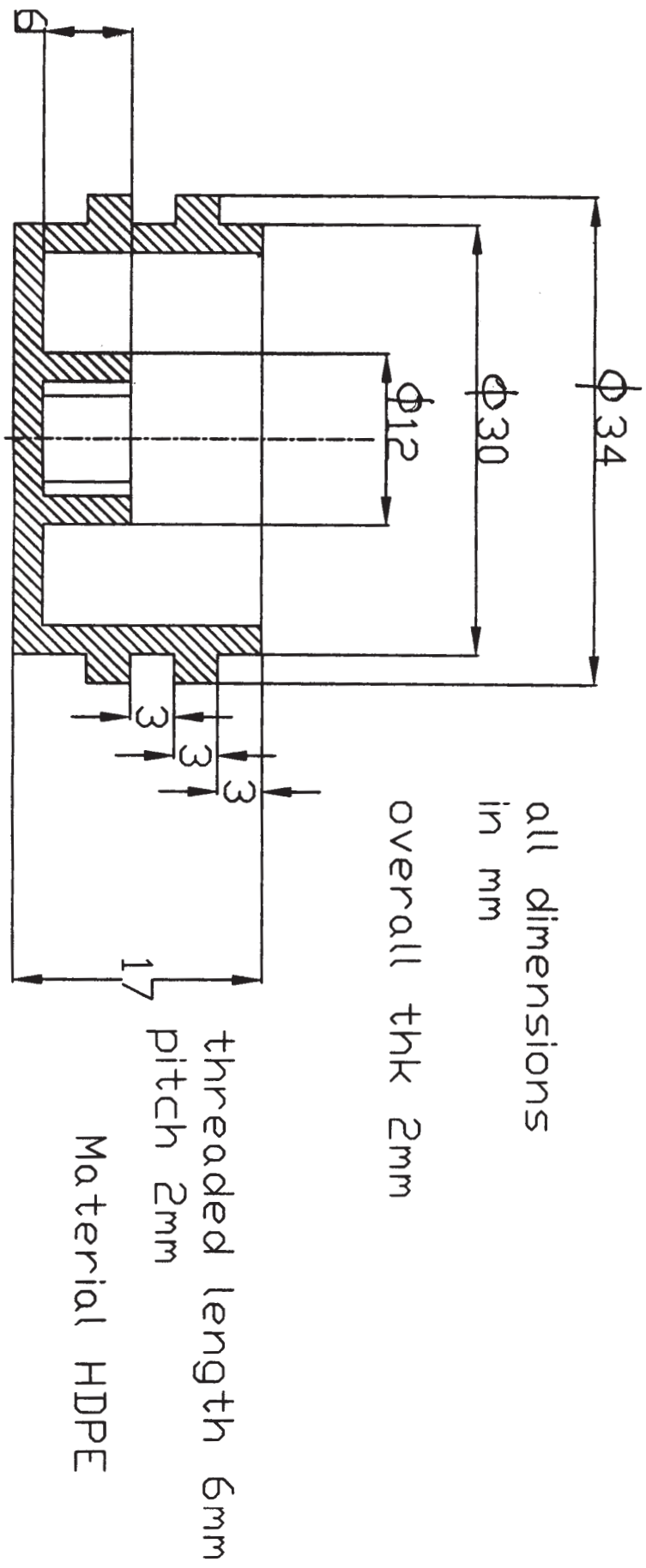b) Explain the design calculations for cams, gears if used, give overall dimensions. **[10]**
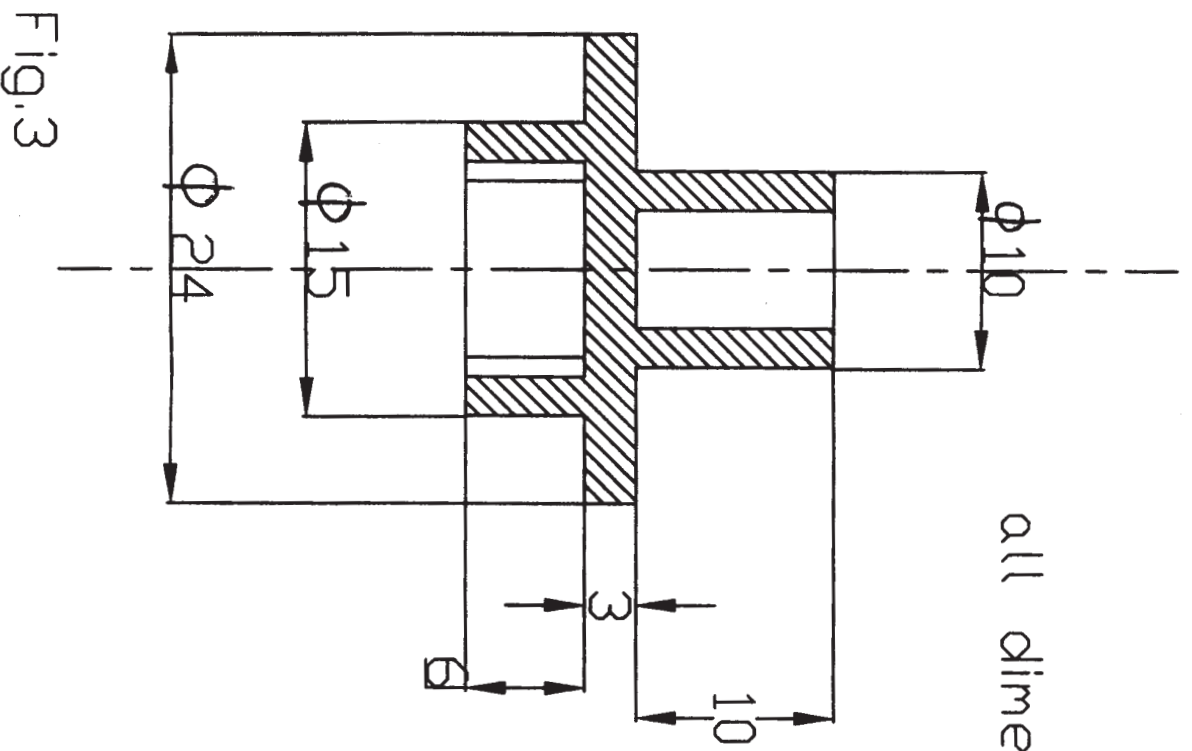
Fig.2

all dimensions in mm

overall thk 2mm

threaded length 6mm
pitch 2mm

Material HDPE

Fig.3

φ 24
φ 15
φ 10

3
6
10

all dimensions in mm

threaded length 6mm
pitch 2mm
material PP

overall thk 2mm

Total No. of Questions : 6]   [Total No. of Pages : 2

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B.E. (Polymer Engineering)
SURFACE COATING AND ADHESIVES
(2003 Course)

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

Instructions :

1)   All questions are compulsory.

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

3)   Figures to the right indicate full marks.

SECTION - I

Q1) a) Explain the various classes of paints with the contrasting features of each.   **[8]**

b) Write a note on various extenders used in paints.   **[9]**

OR

a) Explain the role of various types of oils in different types of paints. **[8]**

b) Write a on additives in paint.   **[9]**

Q2) a) Discuss industrial paints in detail.   **[8]**

b) Discuss acrylic paints with their properties and applications. **[9]**

OR

a) Based on composition how will you differentiate paints, enamels, varnishes and lacquers.   **[8]**

b) Explain the process of surface preparation for application of paints. **[9]**

Q3) a) What is weathering resistance? How will you check the performance of paint towards saline water?   **[8]**

b) Comment on health and safety aspects in paint manufacture industry.**[8]**

OR

a) Write a note on mechanical properties of paint.   **[8]**

b) Discuss the tests for coverage and adhesion of paint film. **[8]**

SECTION - II

Q4) a) Define adhesion. Explain the basic concept of adhesion. **[8]**

b) Write a note on surface energetics and wettability.   **[9]**

OR
    a)   Define adherend. What are the guidelines for good adhesion? **[8]**

    b)   Write a note on advantages and disadvantages of adhesives. **[9]**

Q5) a)   Write a note on structural adhesives. **[8]**

    b)   Explain health and safety factors involved in adhesive industry. **[9]**

OR

    a)   Differentiate between natural producer based adhesives and synthetic adhesive. **[8]**

    b)   Write a note on elastomeric modified adhesives. **[9]**

Q6) a)   Explain tack and viscosity testing of an adhesive by ASTM standard.**[8]**

    b)   Write a note on various types of joints used in adhesion bonding. **[8]**

OR

    a)   Enlist uses of adhesives. How will you decide the adhesive for particular application? **[8]**

    b)   Discuss the manufacturing of any two adhesives. **[8]**

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B.E. (Polymer)
RUBBER TECHNOLOGY
(2003 Course) (Elective)

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

Instructions to the candidates:

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

SECTION - I

Q1) a)   What are the molecular requirements for a material to act as a rubber.**[4]**

b)   What is class 'R', class 'S' and class 'T' rubber? Explain giving suitable examples. List the characteristic properties of elastomers.   **[6]**

c)   Explain the thermodynamic theory for rubber elasticity.   **[6]**

OR

a)   How are rubbers classified? What is the basis for their classification? Discuss any two rubbers w.r.t. their synthesis, properties and applications.   **[8]**

b)   Explain a stress-strain graph for vulcanised and unvulcanised rubber.**[4]**

c)   How do the properties of elastomers change on vulcanisation. Draw a graph and explain.   **[4]**

Q2) a)   Explain the need for addition, mechanism of functioning and two examples of each of the following additives :   **[9]**

i)   Tackifiers.

ii)   Activators.

iii)   Peptizers.

b)   List the types of C-blocks and differentiate between them.   **[7]**

OR

a) Discuss the need for addition, mechanism of functioning, level of addition with examples. **[9]**

   i) Antioxidants.

   ii) Accelerators.

   iii) Vulcanising agents.

b) Explain the properties of C-block w.r.t structure, particle porosity, physical nature of the surface, chemical nature of the surface and surface area. **[7]**

Q3) a) What is Vulcanisation? State the factors which affect the rate of vulcanisation. **[7]**

b) State the different techniques of vulcanisation. Explain microwave curing. **[7]**

c) Write a short note on "Polymerio sulfur". **[4]**

OR

a) Draw & explain the rheometer cure curve. Explain its significance. **[7]**

b) What is mastication? State its significance. Discuss the mastication curve for Natural rubber. **[7]**

c) State the principles of compounding. **[4]**

SECTION - II

Q4) a) Discuss the process of injection molding of rubbers. **[8]**

b) What is "roll bending" in calendaring process? What are the remedies to overcome the same. **[8]**

OR

a) List different types of roll arrangements used in calendaring. Explain roll chambering. **[8]**

b) Explain any 3 process parameters for injection molding of rubbers. **[8]**

Q5) a) List the various components forming a tyre structure and explain the function of each component. List the rubbers used in tyre manufacture.**[8]**

b) Differentiate between the 3 main classes of cellular rubber. What tests would you carry out on rubber foams. **[8]**

OR

a) Explain the construction of a typical hose and the materials used as reinforcements in the manufacture of a hose. **[5]**

b) Explain the process for manufacture of a molded hose. **[4]**

c) Explain the process for manufacturing of dipped goods. **[7]**

Q6) a) Which tests would be carried out for the following products? Why? **[8]**

    i) Tyres.

    ii) Seals & Gaskets.

    iii) Engine mountings.

b) Explain the curve obtained on an Oscillating Disc Rheometer state its significance. **[4]**

c) Discuss the following tests **[6]**

    i) Permanent set in tension.

    ii) Abrasion resistance.

<div align="center">OR</div>

a) Define the term "resilience" and explain the test used to measure rebound resilience. **[6]**

b) Explain with neat diagrams the methods to measure volume & surface resistivity. **[8]**

c) Explain the principle and working of a Mooney's viscometer. **[4]**

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B.E. (Polymer Engineering)
POLYMER REACTION ENGINEERING (409366)
(2003 Course) (Elective - I)

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

Instructions :

    1)   Answers to the two sections should be written in separate books.

    2)   Neat diagrams must be drawn wherever necessary.

    3)   Figures to the right indicate full marks.

    4)   Assume suitable data, if necessary.

    5)   Use of logarithmic table, electronic pocket calculators is allowed.

SECTION - I

Q1) a) Explain the importance of viscosity change on the final polymer formed via polymerization reaction. **[8]**

    b) Discuss the role of polymerization reactor in deciding the molecular weight distribution of the formed polymer. **[8]**

OR

Q2) a) Discuss the importance of molecular weight and Molecular weight distribution of polymer. **[8]**
Discuss the Weight Fraction, Molecular Weight Distribution terms used for the characterization of mixtures of polymer molecules.

    b) Discuss the distinction between chain polymerization Vs Step Polymerization based on kinetics. **[8]**

Q3) a) Derive the necessary equation used for the determination of the rate of the appearance of the polymer $\left(\Sigma R_{Pn} \right)$ in Free Radical Polymerization via all termination reaction. **[10]**

    b) Discuss in detail Molecular weight distribution obtained via step growth polymerization. **[8]**

OR

Q4) a) Discuss in detail all technical conclusions from Free Radical Kinetics Studies. **[8]**

    b) Derive the necessary relationship applicable for Ionic Polymerization in batch reactor. **[10]**

Q5) a) Write a note on Ziegler Natta polymerization. **[8]**

b) Discuss in detail the three stages of Emulsion Polymerization. **[8]**

OR

Q6) Discuss the Chiu's model for the effect of diffusion on the rate constant in step growth polymerization. **[16]**

SECTION - II

Q7) a) Explain in detail polymerization of vinyl chloride with the help of the flow sheet. **[12]**

b) Explain in detail the SBR polymerization reactor. **[6]**

OR

Q8) Give technology overview for the following polymer. **[18]**

a) Styrene Polymerization, b) Nylon 66, c) PET.

Q9) a) Write a note on Trommsdroff Effect. **[8]**

b) Write a note on gel effect in step growth polymerization. **[8]**

OR

Q10) Bulk polymerization of Styrene is to be carried out in batch reactor at 60°C with the free radical initiator. For a reaction time of 5 hrs, compute the following: The percentage conversion of the styrene, overall number average degree of polymer product and the number average molecular weight of polystyrene.

The initial concentration of styrene is 8.35 gmole/lit, and the concentration of initiator is kept constant at 0.04 gmole/lit. Assume termination takes place 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 the volume of the reactor filled by the reacting system is 3760 lit. **[16]**

Q11) a) Discuss in detail the control problems associated with polymerization reactor. **[8]**

b) Explain in detail about the Batch, semi batch and continuous polymerization process and their effect on the product quality. **[8]**

OR

Q12) a) Give the review on Hazards and safety measures associated with polymerization reactors. **[8]**

b) Write a short note on the effect of various process variables on the reactor design. **[8]**

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