OJEE M Tech Plastic Sample Paper 03

A) Mode and Time: The exam is a Computer Based Test (CBT) lasting 120 minutes.
B) Total Questions: The exam contains 90 questions.
C) Marking Scheme & Rules:

- +4 for correct answers and -1 for incorrect responses.

Q1. The rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ is:

A. 1

B. 2

C. 3

D. 0

Q2. The eigenvalues of a 3×3 identity matrix are:

A. 1, 1, 1

B. 0, 0, 0

C. 1, 0, 0

D. 3, 3, 3

Q3. The value of the definite integral $\int_0^1 xe^x dx$ is:

A. 0

B. 1

C. e

D. e-1

Q4. The local maximum value of $f(x) = -x^2 + 2x + 5$ is:

A. 5

B. 6

C. 7

D. 4

Q5. The gradient of the scalar field $\phi(x, y, z) = x^2 + y^2 + z^2$ at $(1, 1, 1)$ is:

A. 2i+2j+2k

B. i+j+k

C. 4i+4j+4k

D. 0

Q6. A function $f(z) = u + iv$ is analytic if it satisfies the:

A. Laplace equations

B. Cauchy-Riemann equations

C. Euler equations

D. Bernoulli equations

Q7. The solution to $\frac{dy}{dx} = y$ with $y(0) = 1$ is:

A. $y = x$

B. $y = e^x$

C. $y = \ln x$

D. $y = x^2$

Q8. The Laplace transform of a constant k is:

A. k/s

B. k/s^2

C. s/k

D. k

Q9. The convergence of Newton-Raphson method is:

A. Linear

B. Quadratic

C. Cubic

D. None

Q10. The number of ways to arrange the letters of "PLASTIC" is:

A. 7!

B. 5!

C. 6!

D. 7

Q11. Which of the following polymers is transparent?

A. LDPE

B. HDPE

C. PMMA

D. PP

Q12. The monomer of Teflon is:

A. Ethylene

B. Vinyl Chloride

C. Tetrafluoroethylene

D. Styrene

Q13. Which plastic is used for high-temperature applications?

A. PEEK

B. PE

C. PP

D. PVC

Q14. What is the function of a 'Nucleating agent'?

A. Improve flow

B. Increase crystallization rate

C. Lower T_g

D. Change color

Q15. Which process is best for making thin plastic films?

A. Blown film extrusion

B. Injection molding

C. Compression molding

D. Thermoforming

Q16. The main raw material for Polycarbonate is:

A. Bisphenol A

B. Ethylene

C. Propylene

D. Styrene

Q17. What is the effect of plasticizers on T_g?

A. Increases T_g

B. Decreases T_g

C. No effect

D. Increases T_m

Q18. Which polymer is used for bulletproof vests (fiber form)?

A. Kevlar

B. Nylon

C. PE

D. PP

Q19. The unit of MFI is:

A. g/10 min

B. g/min

C. kg/s

D. g/s

Q20. Which is a thermoset resin?

A. Epoxy

B. PE

C. PS

D. PP

Q21. Complete the sequence: 2, 4, 8, 16, ...

A. 32

B. 64

C. 24

D. 20

Q22. If "PLASTIC" is 7, "MOLD" is 4, then "DIE" is:

A. 3

B. 4

C. 2

D. 1

Q23. If A is taller than B and C is taller than A, who is the tallest?

A. A

B. B

C. C

D. None

Q24. The average of 5 numbers is 10. If one number is removed, the average becomes 8. What is the removed number?

A. 18

B. 20

C. 15

D. 12

Q25. Find the odd one:

A. Iron

B. Copper

C. Bakelite

D. Aluminum

Q26. Which is a biodegradable plastic?

A. PLA

B. PE

C. PS

D. PVC

Q27. What does 'FRP' stand for?

A. Fiber Reinforced Plastic

B. Film Reinforced Plastic

C. Flow Reinforced Plastic

D. Fiber Resin Plastic

Q28. What is the monomer of Nylon 6?

A. Caprolactam

B. Adipic acid

C. Hexamethylenediamine

D. Styrene

Q29. The process of adding sulfur to rubber is called:

A. Vulcanization

B. Polymerization

C. Condensation

D. Curing

Q30. Which plastic is widely used for electrical switches?

A. Bakelite

B. PE

C. PP

D. PVC

Q31. What is the primary additive in PVC to make it flexible?

A. Plasticizer

B. Filler

C. Pigment

D. Lubricant

Q32. Which polymer exhibits 'crazing'?

A. Polystyrene

B. HDPE

C. PP

D. PE

Q33. The monomer of Polystyrene is:

A. Styrene

B. Ethylene

C. Propylene

D. Vinyl Chloride

Q34. Which plastic has the lowest density?

A. PP

B. PVC

C. PS

D. PET

Q35. What is 'Die Swell' characteristic of?

A. Amorphous polymers

B. Rubbery melts

C. Crystalline solids

D. Metals

Q36. What is the function of a 'Mold Release Agent'?

A. Easy part ejection

B. Improve cooling

C. Increase flow

D. Reduce cost

Q37. Which process is used for making plastic car bumpers?

A. Injection molding

B. Extrusion

C. Thermoforming

D. Blowing

Q38. What is the monomer of PVC?

A. Vinyl Chloride

B. Ethylene

C. Propylene

D. Styrene

Q39. Which plastic is used for optical fiber coating?

A. Silicone

B. PE

C. PP

D. PVC

Q40. What is the full form of ABS?

A. Acrylonitrile Butadiene Styrene

B. Acrylonitrile Butadiene Synthetic

C. Acrylyl Butyl Styrene

D. Acid Butyl Styrene

Q41. Which process uses a rotating mold?

A. Rotational molding

B. Injection molding

C. Compression molding

D. Thermoforming

Q42. Which fiber is the strongest?

A. Carbon

B. Glass

C. Cotton

D. Wool

Q43. What does 'DSC' measure?

A. Thermal transitions

B. Molecular weight

C. Density

D. Flow

Q44. Which is a natural polymer?

A. Rubber

B. Nylon

C. Teflon

D. Bakelite

Q45. Effect of branching on polymer density:

A. Decreases

B. Increases

C. No change

D. Random

Q46. Crystallinity leads to:

A. Increased stiffness

B. Decreased stiffness

C. Increased transparency

D. Decreased density

Q47. Which polymer is used for food containers (microwaveable)?

A. PP

B. PS

C. PVC

D. PET

Q48. A 'sprue' is part of:

A. Injection mold

B. Extrusion die

C. Blow mold

D. Thermoforming

Q49. Which process uses 'parison'?

A. Blow molding

B. Extrusion

C. Compression molding

D. Injection molding

Q50. Role of 'Antioxidant':

A. Inhibit degradation

B. Increase hardness

C. Promote color

D. Lower T_g

Q51. Which is a flame retardant?

A. Antimony Trioxide

B. Carbon Black

C. Titanium Dioxide

D. Talc

Q52. Twin-screw extruder advantage:

A. Better mixing

B. Lower cost

C. Simpler design

D. Less maintenance

Q53. Which gas is used for blow molding?

A. Nitrogen

B. Oxygen

C. Hydrogen

D. Chlorine

Q54. What does DMA measure?

A. Mechanical properties

B. Chemical composition

C. Thermal conductivity

D. Electrical resistance

Q55. Which resin is used in FRP?

A. Epoxy

B. LDPE

C. HDPE

D. PP

Q56. PVC thermal degradation releases:

A. HCl

B. HF

C. HBr

D. HI

Q57. Purpose of 'Annealing'?

A. Reduce internal stress

B. Increase hardness

C. Change color

D. Improve gloss

Q58. Highest heat resistant polymer:

A. PTFE

B. PE

C. PP

D. PVC

Q59. What is 'Die Swell'?

A. Expansion

B. Contraction

C. Constant

D. Hardening

Q60. Process using 'Calender':

A. Film/Sheet production

B. Blow molding

C. Injection molding

D. Pultrusion

Q61. SI unit of viscosity:

A. Pa-s

B. Poise

C. Stoke

D. Newton

Q62. Which plastic is 'Acrylic'?

A. PMMA

B. PVC

C. PET

D. ABS

Q63. Polymerization of vinyl chloride:

A. PVC

B. PE

C. PP

D. PS

Q64. What makes 'Weld line'?

A. Injection molding

B. Extrusion

C. Thermoforming

D. Blowing

Q65. Atactic polymer:

A. Random structure

B. Ordered

C. Crystalline

D. Cross-linked

Q66. Non-stick coating plastic:

A. PTFE

B. LDPE

C. HDPE

D. PVC

Q67. 'Orange peel' on surface:

A. Improper flow

B. High temperature

C. Low pressure

D. Fast cooling

Q68. Mold release agent function:

A. Easy ejection

B. Increase speed

C. Cooling

D. Color

Q69. Biodegradable plastic:

A. PLA

B. PE

C. PP

D. PS

Q70. PDI meaning:

A. Polydispersity Index

B. Polymer Density Index

C. Plastic Distribution Index

D. Processing Density Index

Q71. Cross-linking effect:

A. Insolubility

B. Solubility

C. Flexibility

D. Lower T_m

Q72. Plumbing pipe plastic:

A. CPVC

B. LDPE

C. PS

D. PET

Q73. Shrinkage in molding:

A. Size reduction

B. Size increase

C. Weight loss

D. Color change

Q74. High performance thermoplastic:

A. PEEK

B. PE

C. PP

D. PVC

Q75. Crazing:

A. Micro-cracking

B. Polishing

C. Coloring

D. Heating

Q76. Additive used as filler:

A. Calcium Carbonate

B. Plasticizer

C. Dye

D. Antioxidant

Q77. Viscosity with shear rate (polymers):

A. Decreases

B. Increases

C. Constant

D. Zero

Q78. TMA stands for:

A. Thermomechanical Analysis

B. Thermal Mold Analysis

C. Total Molecular Analysis

D. Temperature Mold Analysis

Q79. Plastic with highest refractive index:

A. Polycarbonate

B. PE

C. PP

D. PVC

Q80. Check valve function in screw:

A. Prevent backflow

B. Increase pressure

C. Reduce speed

D. Change direction

Q81. Causes 'flash':

A. Worn mold

B. High heat

C. Slow injection

D. Low pressure

Q82. Carpet fiber plastic:

A. Nylon

B. PVC

C. PE

D. PS

Q83. Syngas component:

A. CO and H2

B. CO2 and H2

C. CH4 and O2

D. N2 and H2

Q84. Process for plastic films:

A. Blown film extrusion

B. Injection molding

C. Compression molding

D. Pultrusion

Q85. Cause of 'short shot':

A. Insufficient material

B. High pressure

C. Fast cooling

D. High speed

Q86. Electrical insulator plastic:

A. PE

B. PET

C. PS

D. ABS

Q87. Spherulite:

A. Crystalline structure

B. Amorphous region

C. Polymer chain

D. Additive

Q88. Phosgene-based plastic:

A. Polycarbonate

B. PVC

C. PE

D. PP

Q89. Natural rubber monomer:

A. Isoprene

B. Ethylene

C. Vinyl Chloride

D. Styrene

Q90. Plastic for lenses:

A. PMMA

B. PE

C. PP

D. PVC

Solutions

1. B
Explanation: Row 2 = 2 × Row 1; Row 3 = 3 × Row 1. Only one linearly independent row exists. Rank = 1.

2. A
Explanation: Identity matrix eigenvalues are the diagonal elements.

3. D
Explanation: $\int xe^x dx = xe^x - \int e^x dx = e^x(x-1)$. Evaluated 0 to 1: $(1-1) - (-1) = e - 1$.

4. B
Explanation: $f'(x) = -2x + 2 = 0 \implies x = 1$. Max is $f(1) = -1 + 2 + 5 = 6$.

5. A
Explanation: Gradient is $(2x, 2y, 2z)$. At $(1, 1, 1)$, it is $2i + 2j + 2k$.

6. B
Explanation: Cauchy-Riemann equations define analyticity.

7. B
Explanation: $dy/y = dx \implies \ln y = x + C \implies y = e^x$.

8. A
Explanation: $L\{k\} = k/s$.

9. B
Explanation: Newton-Raphson has quadratic convergence.

10. A
Explanation: 7 distinct letters $\implies$ 7!.

11. C
Explanation: PMMA is optical grade/transparent.

12. C
Explanation: Teflon is Polytetrafluoroethylene.

13. A
Explanation: PEEK is a high-temp resistant plastic.

14. B
Explanation: Nucleating agents speed up crystallization.

15. A
Explanation: Blown film is ideal for thin films.

16. A
Explanation: Bisphenol A is the precursor for PC.

17. B
Explanation: Plasticizers increase free volume, lowering T_g.

18. A
Explanation: Kevlar is an aramid fiber.

19. A

Explanation: MFI units are grams/10 minutes.

20. A
Explanation: Epoxy is a thermoset.

21. A
Explanation: Doubling the previous number. $16 \times 2 = 32$.

22. A
Explanation: Count letters. PLASTIC=7. DIE=3.

23. C
Explanation: C ¿ A ¿ B.

24. A
Explanation: Sum = 50. New sum = $4 \times 8 = 32$. $50 - 32 = 18$.

25. C
Explanation: Bakelite is plastic, others are metals.

26. A
Explanation: PLA is compostable.

27. A
Explanation: Fiber Reinforced Plastic.

28. A
Explanation: Caprolactam is the monomer.

29. A
Explanation: Vulcanization uses sulfur.

30. A
Explanation: Bakelite is heat resistant/insulator.

31. A
Explanation: Plasticizers impart flexibility.

32. A
Explanation: PS shows crazing.

33. A
Explanation: Styrene is the monomer.

34. A
Explanation: PP is very low density.

35. B
Explanation: Die swell is due to elastic recovery.

36. A
Explanation: Release agents help ejection.

37. A
Explanation: Car bumpers are injection molded.

38. A
Explanation: Vinyl chloride is the monomer.

39. A

Explanation: Silicone for optical fibers.

40. A
Explanation: ABS is Acrylonitrile Butadiene Styrene.

41. A
Explanation: Rotational molding uses rotating molds.

42. A
Explanation: Carbon fibers are exceptionally strong.

43. A
Explanation: DSC measures thermal transitions.

44. A
Explanation: Rubber is a natural polymer.

45. A
Explanation: Branching interferes with packing; density decreases.

46. A
Explanation: Crystallites increase stiffness.

47. A
Explanation: PP is used for microwave containers.

48. A
Explanation: Sprue feeds injection mold.

49. A
Explanation: Parison is for blow molding.

50. A
Explanation: Antioxidants stop degradation.

51. A
Explanation: Antimony Trioxide is a flame retardant.

52. A
Explanation: Twin-screw improves mixing.

53. A
Explanation: Nitrogen prevents degradation.

54. A
Explanation: DMA measures mechanical properties.

55. A
Explanation: Epoxy is used for FRP.

56. A
Explanation: PVC releases HCl.

57. A
Explanation: Annealing reduces stress.

58. A
Explanation: PTFE is heat resistant.

59. A

Explanation: Die swell is expansion.

60. A
Explanation: Calendering for film production.

61. A
Explanation: Pa-s is SI unit.

62. A
Explanation: PMMA is acrylic.

63. A
Explanation: PVC from vinyl chloride.

64. A
Explanation: Weld lines occur in injection molding.

65. A
Explanation: Atactic means random.

66. A
Explanation: PTFE is non-stick.

67. A
Explanation: Flow defects cause orange peel.

68. A
Explanation: Release agents help ejection.

69. A
Explanation: PLA is biodegradable.

70. A
Explanation: PDI is Polydispersity Index.

71. A
Explanation: Cross-linking makes polymers insoluble.

72. A
Explanation: CPVC is common for plumbing.

73. A
Explanation: Shrinkage is volume reduction.

74. A
Explanation: PEEK is high performance.

75. A
Explanation: Crazing is micro-cracking.

76. A
Explanation: Calcium Carbonate is a filler.

77. A
Explanation: Polymers are shear-thinning.

78. A
Explanation: TMA is Thermomechanical Analysis.

79. A

Explanation: PC has high RI.

80. A
Explanation: Check valve prevents backflow.

81. A
Explanation: Flash is caused by mold wear.

82. A
Explanation: Nylon is used for fibers.

83. A
Explanation: Syngas is CO and H2.

84. A
Explanation: Film production.

85. A
Explanation: Short shot lacks material.

86. A
Explanation: PE insulates.

87. A
Explanation: Spherulite is crystalline.

88. A
Explanation: PC made from Phosgene.

89. A
Explanation: Isoprene monomer.

90. A
Explanation: PMMA for lenses.