

Maharashtra Institute of Technology, Aurangabad

(An Autonomous Institute)

END SEMESTER EXAMINATION

MARKING SCHEME

Second Year B.Tech (PPE) – Feb/Mar-2023

Course Code: PPE202

Course Name: Polymer Testing

Duration: 2 Hrs

Max. Marks: 50

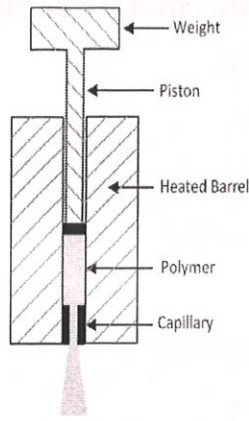
Date:

Instructions:

- i) All questions are compulsory
 ii) Assume suitable data wherever necessary and clearly state it
 iii) Figures to right indicate full marks

Q. 1	Answer any five(Marks:10)	Marks
a)	<p>Define stress and tensile strength. (1 mark each)</p> <p>Stress:The force applied to produce deformation in a unit area of test specimen. (1)</p> <p>Tensile Strength:Tensile strength is a measurement of the ability of a material to withstand forces that tend to pull it apart and to determine to what extent the material stretches before breaking. (1)</p>	2
b)	<p>What is destructive and non-destructive testing?</p> <ul style="list-style-type: none"> In order to make measurements or to study certain characteristics of a part, it becomes necessary to destroy the integrity of the part. (1) Tests or measurements carried out without harming or altering the properties of the part to determine flaws, imperfections, and nonuniformities without destroying the part. (1) 	2
c)	<p>Give the ASTM nos for compression strength, VST, Dielectric strength and RI tests. (0.5 mark each)</p> <p>Compression strength – ASTM D 695</p> <p>VST – ASTM D 1525</p> <p>Dielectric strength – ASTM D 149</p> <p>RI –ASTM D 542</p>	2
d)	<p>Define HDT and VST. (1 mark each)</p> <ul style="list-style-type: none"> Defined as the temperature at which a standard test bar (5 x ½ x ¼ in) deflects 0.010 inch under a stated load of either 66 or 264 psi.(1) Temperature at which a round, flat-ended needle of 1 mm square cross section penetrates by 1 mm, the surface of a plastic test specimen under a predefined load, and the temperature is raised at a uniform rate. (1) 	2

e)	<p>Give the complete formula of specific gravity used for both powder and solid sample specimen.(I mark each)</p> <p>For Solid samples</p> <p>Specific gravity = $a / (a+w) - b$</p> <p>Where;</p> <p>a = weight of specimen in air;</p> <p>b = weight of specimen (sinker, if used) and wire in water,</p> <p>w = weight of totally immersed sinker (if used) and partially immersed wire.</p> <p>For powder form</p> <p>Specific gravity = $a / (b + a - m)$</p> <p>a = weight of the specimen;</p> <p>b = weight of the pycnometer filled with water;</p> <p>m = weight of the pycnometer containing the specimen and filled with water.s</p>	2
f)	<p>What is creep?</p> <p>Behavior of plastics under long-term load and varying temperatures.</p> <p>When a plastic material is subjected to a constant load, it deforms quickly to a strain roughly predicted by its stress–strain modulus, and then continues to deform slowly with time indefinitely or until rupture or yielding causes failure. This phenomenon of deformation under load with time is called creep.</p>	2
g)	<p>What is the test sample size for tensile and CharpyImpact test? (1mark each)</p> <p>Tensile sample = (150 * 20 * 4) mm</p> <p>Charpy impact sample = (12.7 x 6.4 x 127.0) mm</p>	2
h)	<p>What is test sample conditioning?</p> <p>Test sample conditioning is to expose the sample to specific conditions of temperature and humidity for certain time period in order to bring down the sample into uniform equilibrium condition and to remove the environmental effect before testing.</p>	2
Q.2	<p>What is MFI? Explain the complete construction and working of MFI tester with neat sketch.</p>	8



(2)

The rate of extrusion of a thermoplastic material through an orifice of specific length and diameter under prescribed conditions of temperature and load. (1)

Construction: Explanation of; (5)

- Barrel
- Die
- Load
- Heaters
- Cutter
- Timer

Working:

- Preheat material (granules)
- Set the temperature.
- Load the material in cylinder.
- Apply specific load on piston.
- Material will start to flow from the die.
- Discard starting material.
- Cut the material coming out at every specific time interval.
- Report the result in gms per 10 mins.

Explain the effect of important testing parameters on test results of **(Any two)**

a) Flexural strength test (Any four with effect = 4 marks)

- Sample preparation
- Sample thickness
- Temperature
- Humidity
- Load applied
- Straining rate
- Loading nose sensitivity
- Support sharpness

Q.3

4*2=8

	<p>b) HDT test (Any four with effect = 4 marks)</p> <ul style="list-style-type: none"> • Sample preparation • Sample thickness • Temperature rate • Conditioning of sample • Load applied • Loading nose sensitivity • Support sharpness <p>c) Solvent stress cracking resistance test (Any four with effect = 4 marks)</p> <ul style="list-style-type: none"> • Sample preparation • Sample thickness • Temperature • Humidity • Shape and size of jig • Clamping force • Solvent concentration 	
<p>Q.4</p>	<p>Discuss the steps involved before starting and after the following test; (Any two)</p> <p>a) Arc resistance test (Explanation on any four points each of before and after test steps)</p> <p>Before Test:</p> <ul style="list-style-type: none"> • Sample preparation • Conditioning of sample • Test chamber readiness • Electrodes readiness • Voltage and current supply check • Cleaning and drying of all surfaces <p>After Test:</p> <ul style="list-style-type: none"> • Switching of entire set up • Observations and subsequent result reporting • Removal of electrodes • Removal of failed specimen • Cleaning of chamber 	<p>4*2=8</p>

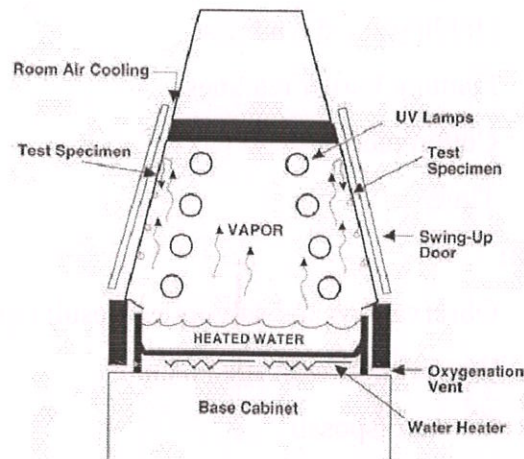
	<p>b) Flammability test for rigid solid sample (Explanation on any four points each of before and after test steps)</p> <p>Before Test:</p> <ul style="list-style-type: none"> • Sample preparation • Conditioning of sample • Sample dimension measurement • Holding stand readiness • Flaming burner readiness • Cotton piece • Timer <p>After Test:</p> <ul style="list-style-type: none"> • Observations and subsequent result reporting • Removal of burnt specimen • Cotton disposal • Burner and stand restoration • Cleaning of work place <p>c) Compression strength test (Explanation on any four points each of before and after test steps)</p> <p>Before Test:</p> <ul style="list-style-type: none"> • Sample preparation • Conditioning of sample • UTM readiness • Software readiness • Sample dimension measurement <p>After Test:</p> <ul style="list-style-type: none"> • Observations and subsequent result reporting • Removal of specimen • Removal of loading plates • Restoring the machine • Cleaning of work place 	
<p>Q.5</p>	<p>Answer any two;</p> <p>a) What is accelerated weathering test? Explain how Fluorescent UV Exposure of Plastics test is carried out?</p> <ul style="list-style-type: none"> • Accelerated weathering test methods simulate extreme weather conditions using special environmental chambers and instruments that 	<p>4*2=8</p>

speed up the weathering process. (1)

- This method simulates the deterioration caused by sunlight and dew by means of artificial ultraviolet light.

Ultraviolet light of wavelengths between 290 and 350 nm is the most efficient portion damaging to plastics.

Fluorescent UV lamps radiate between 280 and 350 nm. (3)



b) Describe both the electrical resistance test methods in detail.

- **Surface Resistance:** A standard size specimen is placed between two electrodes. For sixty seconds, a voltage is applied, and the resistance is measured. Surface or volume resistivity is calculated, and apparent value is given (60 seconds electrification time). (2)

Volume Resistance: Same procedure with electrode exposure to opposite faces of the test specimen. (2)

c) How tristimulus color evaluation is done? (Full answer = 4 marks)

- Use of spectrophotometer
- L, a, b and delta E value of standard reference sample
- Actual sample with required color shade
- Testing to fine L, a, b value of actual sample
- Comparing the L, a, b values of reference and actual sample
- Make necessary change to match the exact color.

Answer any one;

a) Explain the complete process of dilute solution viscosity determination for thermoplastics.

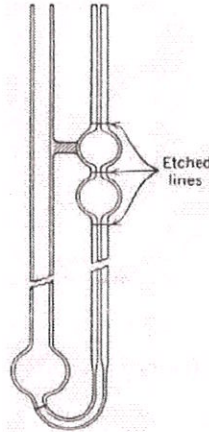
Explanation of following points;

- For all polymer solutions
- Required glass wares.

Q.6

8

- Solution preparation.
- Feeding solution and keeping in constant temp. bath.
- Bringing the level to Upper graduation mark.
- Timer starts exactly when the solution meniscus passes the upper mark and stops when passes lower mark.
- Time in secs. noted down.
- Repeat for pure Solvent too.



Then, finding out viscosities from following formula;

$$\text{Relative viscosity} = t / t_0$$

$$\text{Specific viscosity} = \text{Relative viscosity} - 1$$

$$\text{Reduced viscosity} = \text{Specific viscosity} / C$$

$$\text{Inherent viscosity} = \ln \text{Relative viscosity} / C$$

b) What is ESCR? How this test is carried out? Explain with suitable diagram.

- The ability of plastic specimen to resist slow growth of cracks in environmental like conditions is generally known as ESCR. (1)
- Procedure (4)

Sample is loaded to sample holder.

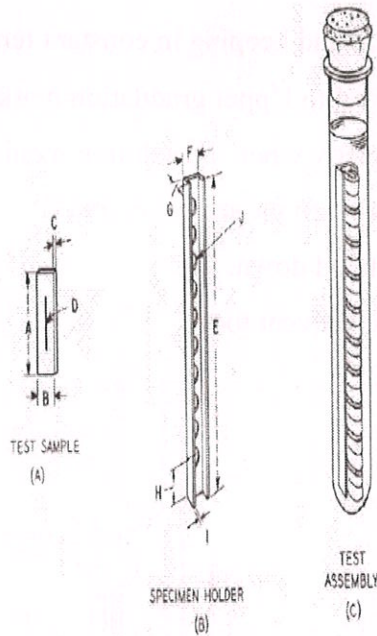
Holder is placed in test tube.

Fresh active reagent is filled in test tube.

Tube is placed in a constant-temperature bath maintained at $50 \pm 0.5^\circ\text{C}$ or $100.0 \pm 0.5^\circ\text{C}$, depending upon the conditions selected for the test.

Test specimens are removed after a specified time and observed for crazing.

- Diagram (3)



c) Define thermal conductivity. Describe VST test process with suitable sketch.

- Rate at which heat is transferred by conduction through a unit cross sectional area of a material when a temperature gradient exists perpendicular to the area. (1)

- Procedure: (4)

The test is carried out by first placing the test specimen on a specimen support and lowering the needle rod so that the needle rests on the surface of the specimen.

The temperature of the bath is raised at the rate of 50 or 120 °C/hr uniformly. The temperature at which the needle penetrates 1 mm is noted and reported as the Vicat softening temperature.

- Diagram (3)

