

College of Engineering, Pune
End Semester Exam – May 2012

T. Y. B. Tech.

Polymer Technology (ILOE)

Day & Date: Friday, 4th May, 2012

Time: 2:00 – 5:00 pm

Maximum Marks: 50

Duration: 3hrs

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- Instructions:
- 1 Solve both sections in separate answerbook
 - 2 Solve all the questions
 - 2 Figures to right indicates full marks
 - 3 Do not keep mobile phones with you; the handsets will be retained permanently by exam cell
 - 4 Draw suitable figures where ever necessary
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SECTION-A

- Q.1** Suggest most suitable polymer/ plastic with proper justification for your choices from the list below. (Any Five) [10]
- (a) Computer peripherals
 - (b) Automobile body and headlight systems
 - (c) Contact lenses
 - (d) Fiber optic cables
 - (e) Fishing net
 - (f) Tyre of heavy duty vehicles
 - (g) Handles for pan, non stick cookware
- Q.2** Write a detail note on methods of processing of plastics, fibers, and elastomers [10]
- Q.3** Define and explain Any two: polymer tacticity, Glass transition temperature, copolymerization, compounding of plastics [5]

SECTION-B

- Q.4 (a)** The benzene ring in polystyrene absorbs strongly at about 195 nm. Butadiene has no absorption at this wavelength. A series of styrene-butadiene copolymers, with the styrene contents of 5%, 10%, 15%, 20%, 25%, show the absorbance values of 0.103, 0.205, 0.308, 0.410, 0.513, respectively, at 195 nm. Find out the composition of the unknown styrene-butadiene copolymer, which shows absorbance value of 0.349 at 195 nm under the same experimental conditions. [5]
- (b)** You are monitoring the synthesis of a dimethylpolyene, in terms of its growing chain, by the UV-Visible spectroscopy. Sketch schematically with proper labeling, and discuss with suitable reasoning all the possible observable changes in the $\pi \rightarrow \pi^*$ transition band in the UV-Visible spectrum, with the increasing length of the given polymer. [5]

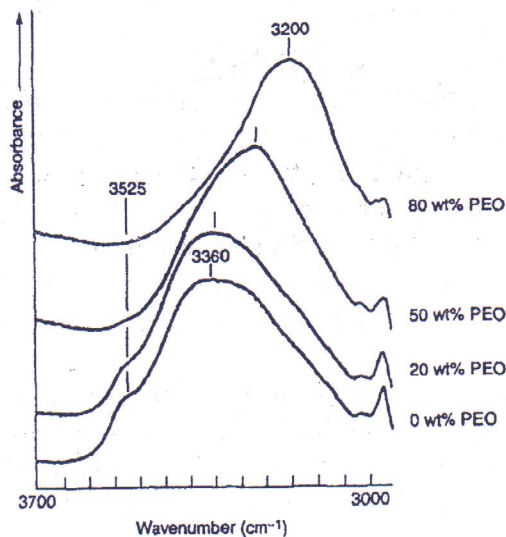
OR

You are monitoring the synthesis of a dimethylpolyene, in terms of its growing chain, by the IR spectroscopy. Sketch schematically with proper labeling, and discuss with suitable reasoning all the possible observable changes in the C=C stretching band in the IR spectrum, with the increasing length of the given polymer.

- (c) Discuss at least four important factors that would strongly affect the tensile strength and elasticity of a polymer sample. [3]
- Q5 (a) The number average molecular weight of a polystyrene is 10^5 g/mol. If the weight average degree of polymerization of the same polymer is 1200, calculate the width of the molecular weight distribution (Polydispersity index) for the given sample. [5]
- (b) Miscibility study of a 40/60 (weight %) blend of a polybenzimidazole (with $T_g = 698$ K), and a polycarbonate (with $T_g = 423$ K) was carried out by thermal melting analysis. The signals from the blend at various temperatures were monitored in terms of % Transmittance values due to the C=O stretch of the polycarbonate (at 1751 cm^{-1}). The measurements showed almost a constant value of 55 % for %T in between 0 to 502 K temperature, and a break at 502 K with a continuous increase in %T after 502 K. Discuss the miscibility of the two polymers with respect to the nature of the interactions between the component polymers. [7]

OR

IR spectroscopy has been used to investigate the miscibility of, poly(vinyl phenol) (PVPh) blended with poly(ethylene oxide). Figure below shows the O-H stretching regions of the infrared spectra of the blends for a number of compositions. Discuss the miscibility of the two polymers with respect to the nature of the interactions between the component polymers.



COLLEGE OF ENGINEERING, PUNE – 5.

End Semester Examination

Robotics (Institute Level Elective)

Programme : **TYB Tech**

Specialisation : Institute Level Elective

Year : 20011 – 12

Date : 04th May 2012

Max. Marks : 50

Duration : 03 Hrs

- Instructions :-**
- 1) Solve **Any Two** from **Q. 1, 2, and 3.**
 - 2) Solve **Any One** from **Q.4 and Q. 5**
 - 3) Figures to the right indicate full marks
 - 4) Draw neat figures wherever required

Q.1 a) What is a Programmable Automation ? Justify its effective use for small batch size on a production line over a Fixed Automation ? Justify with available statistics or related graph. [08]

OR

a) Explain the term “Redundancy and Dexterity” in relation with DOF of Robot ? Also explain the RCC devices for better grasping ? (Suitable sketch is necessary) [08]

b) Justify “the use of the terms ‘Resolution , Repeatability and Accuracy ’ by the manufacturers to define the positioning capabilities of their manipulators”. [07]

OR

b) Explain the principles of working of Stepper Motors which is able to assume only discrete stationery angular positions ? [07]

Q.2 a) Explain the principal of working, speed torque characteristics and peculiar feature of any two types of electric drives which are to be used for small capacity Industrial Robot. [08]

b) What is a role played by a PID controller in the robot control systems ? Describe the working principal of system with the help of circuit diagram & performance characteristic curve. [07]

Q.3 a) What are the different robot programming methods used till to date, for an Industrial Robots? Comment on the proven effective method from the existing types, in concern with the specific advantages of that method, over the rest of the methods. [08]

b) Discuss the working principal of Rotary Optical Encoder Disc. Also explain the types of such disc. Draw a sketch of disc that can provide i) 4 - bit binary code & ii) 4 – bit gray code. [07]

OR

b) Explain the term “Generations of the Languages”. List and explain the developments of robot programming languages. [07]

Q.4 a) A Robot System has the Link parameter table as given below,

Link	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	5	0	90°
2	90°	0	4	0
3	0	6	0	45°

Obtain the transform matrices as given below

1) $[{}^1_2 T]$, $[{}^2_3 T]$ and $[{}^1_3 T]$

2) Find the corresponding joint variables using the Forward Kinematics Approach, when the coordinates of the tip of the tool mounting plate for the performance of certain task are (4 , -2 , 5) [12]

b) Elaborate the term “ Inverse Kinematics ” for Robotic Manipulators in brief and explain the possibilities of arrival of alternative solutions for inverse kinematics. [08]

OR

b) With the help of suitable sketch derive and explain the following equation of Link Transformation Matrix as given below.

$$[{}^{i-1} T_i] = \text{Rot} (X_{i-1}, \alpha_{i-1}) \cdot \text{Trans} (X_{i-1}, a_{i-1}) \cdot \text{Rot} (Z_i, \theta_i) \cdot \text{Trans} (Z_i, d_i)$$

Also give the homogeneous transformation matrix for above equation. [08]

Q.5 Write a short note with elaborations, examples and the figures (if any). (any four) [20]

- i) Artificial Intelligence - Various AI Techniques & its relevance in the Robotics.
- ii) Application of Vision Systems for complex task such as mass inspection.
- iii) Classification of Robotic gripper and details of the forces of each type of gripper.
- iv) Image Processing Techniques.
- v) Lagrangian Principal for Dynamics of Robots.
- vi) Socio Economic effects of robotization in the developing countries.
- vii) Safety Aspects for the Robots for device and the operator.

End Semester Examination
IS 302-2: Composite Materials
Semester – II

Year: T. Y. B. Tech
Academic Year: 2011-2012
Duration: (2:00 – 5:00 pm) 3 hr

Institutional Elective
Date: 04-05-12
Max. Marks 50

Instructions

- All questions are compulsory and each of 10 marks.
 - Mobile phones are strictly not allowed in Examination Halls. Any student found with the same will be debarred from the examinations.
 - Neat diagrams must be drawn wherever necessary
-

Q1. State true or false and justify.

- a. At low stresses, the modulus of elasticity is given by the rule of mixtures but not at higher stresses.
- b. Creep curves of continuous ceramic fiber reinforced metals are different than that of pure metals.
- c. Aluminium-SiC composites have higher coefficient of thermal expansion compared to unreinforced aluminium.
- d. There is only limited interest in toughening ceramics by the incorporations of reinforcements of materials such as ductile metals
- e. In many composites, individual plies or layers of fabric are joined. Bonding between these layers must also be good.

Q.2

- a. How are composites classified?
- b. Why is concrete mainly used in compression in engineering designs? What is reinforced concrete (explain with diagram)? What is the main advantage of prestressed concrete?
- c. Draw a figure showing the effect of fiber orientation on the tensile strength of E-glass fiber-reinforced epoxy composites?
- d. Discuss one process of how ceramic matrix composites are manufactured?
- e. Write a short note on resin transfer molding process (RTM).

Q.3 Write a short note on: (Any 2)

- a. Open mold processes for fiber reinforced plastics (any 3)
- b. Electromagnetic interference shielding and mechanisms of shielding
- c. Composite materials for lightning arrestor

Q.4

- a. Show the diagrammatic representation (with all labeling) for the following MMC fabrication processes.
 - i. Diffusion bonding
 - ii. Squeeze casting
- b. Describe in detail, what are the fiber and matrix factors which contribute to the mechanical performance of composites? Other than the fiber and the matrix, what other factors influence mechanical performance of a composite?

Q.5

Q.5.

- a. What are metal matrix composites? What are the advantages and drawbacks of MMCs over PMCs? Are there any properties which degrade when metals are reinforced with fibers? Draw the schematic diagram of the production of multifilament superconducting composite by the bronze route.
- b. What do you mean by laminar composites? Describe various techniques for producing laminar composites.

PIET's COLLEGE OF ENGINEERING, PUNE
(An Autonomous Institute of Government of Maharashtra)
Test: End Semester Exam
Institute Level Open Elective
Subject: (PE314) Operations Efficiency

Year: 2011-12
Duration: 1 ½ hrs
Date: 4th May 2012

Sixth Semester
Max. Marks: 25

Instructions:

1. Attempt all questions.
 2. All questions carry equal marks.
 3. Draw neat figures wherever required.
 4. Assume suitable data wherever required.
 5. Make use of any or all of the OE phases to justify your answers.
 6. Wherever possible, sketch skeletal P&L layout and pie-charts to showcase OE impact area.
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- Q.1 a) Based on your understanding of "Operations Efficiency" please conceptualize 2 tools that can measure the performance of an organization.
- b) Sketch a standard P&L layout and showcase the impact areas of "Operations Efficiency". Also, state the sub-items that are included in the impact areas.
- Q.2 One of the pioneers in retail in India, Shubiksha had shop to 200+ stores with a pan-India foot print in a short time. Consumers flocked to its Stores for the low prices and fresh stock availability. From being a very successful start-up its downfall started in 2008 followed by massive store closures in 2009.
What could be some possible reasons for its failure?
- Q.3 a) This widely successful watch company comes from the Tata stable. This organization started in 80's with practically no background in the watches market and a tight Indian economy.
What could be some possible reasons for its phenomenal growth?
- b) Started from a small outhouse by college drop-outs in the 80's this multi-national software giant is the envy of all CEOs and inspiration for all budding entrepreneurs.
What could be some possible reasons for Microsoft Corporation's phenomenal growth?

COLLEGE OF ENGINEERING, PUNE

T.Y.B. Tech. Institute Level Elective-II (ISO 2-4)

Finite Elements in Engineering

End-semester Examination

Year : 2011-12

Max. Marks: 40

Semester : II

Time: Three hour

Instruction: ALL Questions are compulsory.

Q.1 Multiple Choice Questions [8]

1.1 Identify the wrong statement

(a) Finite element analysis is a method for the numerical solution of a differential equation.

(b) Partial differential equations occur when both spatial and time coordinates are included in the same problem.

(c) Finite element method is not useful for solving coupled ordinary or partial differential equations.

(d) Analytical solutions for coupled partial differential equations are complicated.

1.2 Finite element analysis deals with (a) approximate numerical solutions

(b) boundary value problems (c) differential equations (d) all the above

1.3 A shape function is usually

(a) the coefficient that appears in the interpolation polynomial.

(b) written for each individual node of finite element.

(c) interchanged with the terminology interpolation polynomial.

(d) All the above.

1.4 The one dimensional problem in elasticity is given by the balance of forces in an elastic rod, in terms of normal stress σ , area A and axial body force f , as

$$(a) \frac{d[\sigma(x)A(x)]}{dx} + f(x)A(x) = 0 \quad (b) \frac{d[f(x)A(x)]}{dx} + \sigma(x)A(x) = 0$$

$$(c) \frac{d[\sigma(x)]}{dx} + f(x)A(x) = 0 \quad (d) \frac{d[\sigma(x)A(x)]}{dx} + f(x) = 0$$

1.5 Identify the wrong statement

(a) In finite element method, a continuous function can be approximated using a discrete model.

(b) A discrete model is compared of one or more interpolation polynomials.

(c) Continuous function is not divided into finite elements.

(d) The end points of the finite element are called nodes.

1.6 The commonly used two-dimensional elements are

(a) four-node quadrilateral and three-node triangular elements.

(b) three-node quadrilateral and four-node triangular elements.

(c) eight-node quadrilateral and six-node triangular elements.

(d) All the above.

1.7 The shape functions for a triangular element in a two-dimensional problem is often expressed in terms of

(a) surface co-ordinates

(b) area co-ordinates (c) volume co-ordinates (d) all the above

1.8 The Galerkin method of approximate analysis is

(a) classified as a method of weighted residuals.

(b) based upon assuming an approximate solution for a differential equation.

(c) based on both conditions (a) and (b).

(d) error free.

Q.2 Derive shape functions for 4-noded one-dimensional iso-parametric element. [4]

Q.3 Discuss the evaluation of the jacobian matrix for a four-noded two-dimensional iso-parametric finite element. [4]

Q.4 Given the differential equation [4]

$$u \frac{dC}{dx} - D \frac{d^2C}{dx^2} - m = 0 \quad \text{with } C(0) = C(L) = 0$$

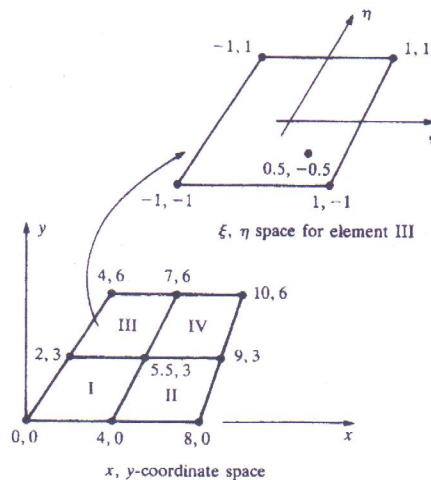
Assume a trial solution $C_R = a_2(x^2 - xL) + a_3(x^3 - xL^2)$ and obtain an approximate solution using the Galerkin method.

Q.5 A rectangular finite element with dimensions $a \times b$ is defined in an x, y coordinate system. Assume a function of the form $\phi = A + Bx + Cy + Dxy$ and derive the shape functions for rectangular element. [4]

Q.6 Derive element stiffness matrix for Three noded iso-parametric quadratic bar element. Also derive consistent nodal vector when the above element is subjected to uniformly distributed axial loading. [6]

Q.7 Derive the interpolation functions for a four-node iso-parametric element. [4]

Q.8 [6]



A four-element model of a plane area is shown in figure. Using the interpolation functions for a four-node quadrilateral element III, show that co-ordinate location $(x = 7.0, y = 6.0)$ correspond to point $(1, 1)$ in the generalized space. Also, for $\xi = 0.5$ and $\eta = 0.5$; determine the corresponding point in the global system.

College of Engineering, Pune

End Semester Exam – May 2012

T. Y. B. Tech. (ILOE)
Industrial Drives

Day & Date: Friday, 4th May 2012
Maximum Marks: 50

Time: -2.00 pm to 5.00 pm.
Duration – 3 hrs.

Instructions:

- 1. Que. 7 is compulsory.**
- 2. Answer any 4 questions from the rest.**
- 3. Assume suitable data wherever necessary and state the same.**

Q1	a)	<p>A 2600 kW, 2.2kV, 50 Hz, 735 rpm, 8 pole, 3phase squirrel cage induction motor has the following parameters referred to stator :- $r_1 = 0.075 \Omega$; $r'_2 = 0.1 \Omega$; $x_1 = 0.45 \Omega$; $x'_2 = 0.55 \Omega$. The stator is delta connected. Determine the following:- (i) Full load slip; (ii) phase current on full load; (iii) full load torque; (iv) starting current when full voltage is applied; (v) starting torque to full load torque ratio.</p>	5
	b)	<p>With a neat circuit diagram, explain static Scherbius scheme for 3-phase induction motor. Draw the speed-torque characteristics.</p>	5
Q2	a)	<p>Explain the following speed control methods for 3-phase induction motors:- (a) Static rotor resistance control; (b) Stator voltage control using SCRs.</p>	3+3
	b)	<p>A 3-phase, delta connected, 6 pole, 50 Hz, 400V, 925 rpm squirrel cage induction motor has the parameters: $r_1 = 0 \Omega$; $r'_2 = 0.3 \Omega$; $x_1 = 0.5 \Omega$; $x'_2 = 1 \Omega$. The motor is fed from a VSI and is controlled below rated speed by a constant (V/f) ratio. Calculate the torque for a frequency of 35 Hz and speed of 650 rpm.</p>	4
Q3	a)	<p>State and explain how the armature current and speed of a dc separately excited motor will be affected by each of the following operating conditions :- (i) Halving armature voltage and field current with load torque remaining constant. (ii) Halving armature voltage and field flux with the developed power remaining constant.</p>	3 3
	b)	<p>A 230 V, 960 rpm separately excited dc motor has an armature resistance of 0.02 ohm. Its rated armature current is 200A. The motor is fed by a chopper operating from a 230 V dc mains. Assuming continuous conduction (i) Calculate the duty ratio of chopper for motoring operation at rated</p>	2

		torque and 350 rpm. (ii) If the duty ratio is 0.3 at 350 rpm during braking operation, calculate the average value of armature current.	2
Q4	a)	Derive the torque speed characteristics of a separately excited dc motor fed by a single phase fully controlled converter (on the armature side) for continuous conduction of the converter. Sketch the characteristic with delay angle α as a parameter.	5
	b)	A 220V, 900 rpm, 150 A separately excited dc motor has an armature resistance of 0.05 ohm. It is fed from a three phase fully controlled converter bridge fed from a 163V, 50 Hz mains. Determine the value of α :- (i) when the motor is running at 800 rpm and rated torque. (ii) When the machine is running at - 800 rpm and twice rated torque . Assume continuous conduction and $\alpha = 0^\circ$ for rated terminal voltage.	5
Q5		Write short notes on any two of the following :- a) Single phase induction motor drives. b) Factors governing selection of an electric drive. c) Energy conservation in electric drives. d) Braking methods of 3-phase induction motor.	10
Q6	a)	Derive an expression for the torque developed by a 3-phase (cylindrical rotor) synchronous motor in terms of V , E , δ and x_s . Neglect all losses in the motor. Sketch the $T - \delta$ characteristic.	4
	b)	A 500 kW, 3.3 kV, 50 Hz, 3 phase, 4 pole, star connected synchronous motor has $r_a = 0 \Omega$; and $x_s = 15 \Omega$ the rated field current is 12 A. Calculate the armature current, speed and p.f at half the rated torque and rated field current.	6
Q7		State with reasons whether the following statements are true or false :- a) Converter fed dc motors are derated. b) Starting torque of slip ring induction motors can be varied by increasing rotor resistance. c) Power modulator of an electric drive controls power flow during steady state only. d) 3-phase squirrel cage induction motors are not superior to 3-phase slip ring induction motors . e) A motor of smaller rating can be selected for a short time duty.	2 each
