2016-17
B.E (EVENING) WINTER SEMESTER EXAMINATION
MECHANICAL ENGINEERING
PROCESS OF PLASTICS, POLYMER & CERAMIC (DE)
EME 407

Maximum Marks: 60  Credits: 04  Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.
1  (a)  Differentiate between the following:
   (i)  Addition Polymerization and Condensation Polymerization
   (ii) Degree of Polymerization (DOP) and Polymerization  [04]
1  (b)  What are polyblends? Write only types of polyblends.  [03]
1  (c)  Average molecular weight of PMMA (Poly methyl methacrylate) is 200000. Its monomer is expressed by
   \[ \text{CH}_3 \]
   \[ \text{CH}_2 = \text{C} \]
   \[ \text{COOCH}_3 \]
   Determine the DOP it has gone through. Also calculate the ratio of its molecular weight to that of polyethylene with the same DOP.  [05]
2  (a)  What are polyamides? Describe the method of preparation of Nylon 66.  [06]
2  (b)  (i) What do you mean by synthetic metal? Explain.
       (ii) What is the difference between thermoplastics and thermosetting polymers?  [03]

OR

2' (a)  List and discuss the variables affecting the solubility of polymers.  [06]
2' (b)  Explain any two:
       (i)  Nitrile Rubber (NBR)
       (ii) Chlorosulfonated Polyethylene (CSM)
       (iii) Silicon Rubber  [06]
3  (a)  What do you mean by Stereo-Lithography? Write down some applications of Stereo-Lithography.  [05]
3  (b)  Explain blown film extrusion process with neat and clean diagram.  [07]

OR

3' (a)  Write detailed notes on Calendaring.  [05]
3' (b)  Define rotation molding. With a neat sketch explain the working principle of rotation molding.  [07]
4  (a)  Briefly discuss the various plastics used in electrical applications and their properties.  [06]
4  (b)  What is Polymer Coating? Name the various materials used in Polymer coating.  [06]
5  (a)  Define glass forming process. How do we manufacture flat glass?  [05]
5  (b)  Write down the various methods of ceramic powder preparation. Explain roll crushing method in detail.  [07]
2016-17
B.E. (WINTER SEMESTER) EXAMINATION
MECHANICAL ENGINEERING
FUEL AND COMBUSTION ENGINEERING
EME420

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Attempt all questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Use of tables and charts are allowed.

Q.No.  Question                                             M.M.
1(a)   Determine the molar analysis of reactants and products respectively for methane (CH₄) burning with 200% theoretical air. Also calculate constant pressure adiabatic flame temperature of methane initially at 0.1 MPa and 298 K burning with 200% theoretical air. (Show only one iteration) [08]
1(b)   With the help of examples define: (i) Equivalence ratio (ii) constant volume adiabatic flame temperature. [04]
2(a)   Explain with the help of examples elementary reaction, global reaction and order of reaction. [06]
2(b)   Briefly discuss the chain initiating, chain propagating, chain branching and chain termination reactions. [06]

OR

2'(a)  Derive the relation between rate of reaction and equilibrium constant Kₑ. [04]
2'(b)  Following rate coefficient for the reaction NO + O → N + O₂ has been suggested
       \[ k_r = 3.80 \times 10^9 \times T^{1.0} \exp(-20,820/T) \] in cm³/gmol-s. Determine the rate coefficient for reverse reaction at 2300 K. [08]
3(a)   Differentiate between deflagration and detonation. [04]
3(b)   Explain Rankine –Hugonoit Curve with the help of diagrams. [08]
4(a)   Explain laminar premixed and diffusion flame with the help of characteristics temperature and concentration profiles. [04]
4(b)   Explain the effects of stoichiometry, pressure and temperature on laminar flame speed with the help of diagrams. [08]

OR

4'(a)  Consider a 500-μm-diameter liquid n-heptane (C₇H₁₆) droplet evaporating in hot, stagnant nitrogen at 1 atm. The N₂ temperature is 850 K. Determine the lifetime of the n-heptane droplet, assuming the droplet temperature is at its boiling point. [08]
4'(b)  Explain the terms: flammability limits and flame quenching. [04]
5(a)   Describe the explosion characteristics of H₂-O₂ system. [06]
5(b)   Discuss the procedure for calculating pressure dependent properties with respect to transfer number, B and burning rate constant, K. [06]
2016-17
B.E. (WINTER SEMESTER) EXAMINATION
MECHANICAL ENGINEERING
REFRIGERATION AND AIR CONDITIONING
EME429N

Maximum Marks: 60  Credits: 04  Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.
1.  In a R22 based refrigeration system, a liquid-to-suction heat exchanger (LSHX) with an effectiveness of 0.65 is used. The evaporating and condensing temperatures are 7.2°C and 54.4°C respectively. Assuming the compression process to be isentropic, find:
   a) Specific refrigeration effect,
   b) Volumic refrigeration effect,
   c) Specific work of compression,
   d) COP of the system,
   e) Temperature of vapour at the exit of the compressor.

OR

1'. In an air refrigerator working on the principle of Bell-Coleman cycle, the air into the compressor is at 1 atm at -10°C. It is compressed to 10 atm and cooled to 40°C at the same pressure. It is then expanded to 1 atm and discharged to take cooling load. The air circulation is 1 kg/s. The isentropic efficiency of the compressor = 80%. The isentropic efficiency of the expander = 90%.
Find the following:
   a) Refrigeration capacity of the system,
   b) C.O.P of the system
Take γ = 1.4, C_p = 1.00 kJ/kg °C

2(a) Explain selection criteria of refrigerant absorbent mixture.  [04]
2(b) Describe with sketch working of single effect ammonia- water absorption system.  [08]

OR

cond...
2'(a) Compare vapour absorption refrigeration systems and vapour compression refrigeration systems.

2'(b) Compare Aqua-NH₃ with LiBr-H₂O Absorption system.

3(a) Discuss the desirable thermodynamic properties of refrigerants.

3(b) Discuss the following:
   (i) ODP    (ii) GWP    (iii) TEWI

4. Find the cooling load requirement for a hall for 50 persons (general office). The enthalpy change of air (hₑ-hᵣ) is 20 kJ/kg. Take solar heat gain = 5% of the structure heat load and ρ = 1.12 kg/m³. The hall has dimensions 20×10×5 m high. Energy release per person may be taken to be 600 kJ/h. The electrical appliances are 15 bulbs of 60 W each, one machine 1 kW and a refrigerator of 200 W. The U ΔT may be taken to be 200 kJ/h-m². If an air conditioning system is employed having COP = 3, find the energy requirement for the system. Number of air change/24 h is 2.8. ventilation per person is 0.007 m³/s, ρ = 1.12 kg/m³.

5. Explain equal friction method and static regain method for the sizing of the airducts.
2016-17
B.E. (EVENING) WINTER SEMESTER EXAMINATION
MECHANICAL ENGINEERING
NUMERICAL CONTROL OF MACHINE TOOLS (DE)
EME 453

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

<table>
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<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
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<tbody>
<tr>
<td>1 (a)</td>
<td>Define NC system. Explain the EIA and ISO standard codes for NC coding.</td>
<td>[06]</td>
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| 1 (b) | With the help of suitable figures, explain the following with reference to NC machines:  
   i) Machine origin, Program origin and part origin  
   ii) Axis identification for lathe and milling machines. | [06] |
| 2    | Attempt any TWO parts.  
   2(a) | With the help of neat sketch explain open loop and closed loop NC control system. | [06] |
| 2(b) | Explain the working of Brushed and Brushless DC Motors. | [06] |
| 2(c) | Explain the following with neat sketch:  
   i) Ball screw mechanism  
   ii) Linear encoder | [06] |
| 3    | Attempt any TWO parts.  
   3(a) | "CNC is a management control system". Discuss | [06] |
| 3(b) | Describe the principles and purposes of adaptive control. Give some examples of present applications in manufacturing. | [06] |
| 3(c) | With the help of suitable example define different format of part programming. | [06] |

contd...2
4 Write a part programme using G-M codes for the component shown in figure 1. The machining parameters are: Cutting Speed = 1500 rpm; Feed = 0.1 mm/rev. and Depth of cut = maximum of 1 mm.

![Figure 1 (All dimensions in mm)](image)

4' A profile milling operation is to be performed to generate the outline of the part in figure 2. The part is 10 mm thick. Assume all the required machining parameters. Write a part programme using G-M codes for this part.

![Figure 2 (All dimensions in mm)](image)
The outline of the job is shown in figure 3. Write the complete APT program. Assume all the machining parameters.

Figure 3 (All dimensions in mm)
The non-dimensional deflection of a beam on an elastic foundation is governed by the equation:

\[ \frac{d^4 v}{dx^4} + v - 1 = 0 \]

subject to boundary conditions

\[ v = \frac{d^2 v}{dx^2} = 0 \text{ at } x = 0 \text{ & 1} \]

Derive the approximate solution for the deflection (v) using:

i) Bubnov-Galerkin Method

ii) Least Square Method.

2 (a) Discuss in brief the steps involved in the finite element analysis of any physical system.

2 (b) Consider the differential equation

\[ \frac{d^2 T}{dx^2} + T + 2 = 0 \]

Subject to the boundary conditions:

\[ T = 0 \text{ at } x = 0 \]

\[ \frac{dT}{dx} = -1 \text{ at } x = 1 \]

i) Obtain the weak form

ii) Identify primary and secondary variables

iii) Find the solution using weak form based Galerkin Method.
3 Derive the element level governing equation for two-noded axial bar element. Assume the bar to be of uniform cross sectional area $A$, Youngs Modulus $E$ and of length $L$. The bar is subjected to an axial distributed load of intensity $q$ N per unit length.

OR

3' Consider a stepped bar as shown in Figure 1, subjected to an axial distributed load of intensity $F$ N per unit length and fixed at one end. Using two noded-bar element carry out two element analysis and obtain the assembled system of equations. Further determine the stresses and strains within the element.

4 (a) What are shape functions? Obtain the shape functions for three-noded bar element.

4 (b) Derive the element level governing equation for Euler-Bernoulli beam element and compute the stiffness matrix, and load vector for a beam carrying uniformly distributed transverse load "w" N per unit length.

OR

4' (a) Write down the assumptions of Euler Bernoulli beam theory and explain how it is different from Timoshenko Beam theory.

4' (b) Find the central deflection, reaction forces and moments for the beam shown in Figure 2.

5 (a) Explain in brief the Plane stress and plane-strain conditions. Further, derive the expressions for their constitutive matrix for linear elastic isotropic material.

5 (b) Discuss in brief the Langrangian and serendipity elements. Write down the shape functions for four-noded isoparametric element.

![Figure 1]

![Figure 2]