**2017-18**  
B.E. (WINTER SEMESTER) EXAMINATION  
MECHANICAL ENGINEERING – VIII SEMESTER  
PROCESSING OF PLASTICS, POLYMERS AND CERAMICS  
EME-407

Maximum Marks: 60
Duration: Two Hours

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

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
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<tbody>
<tr>
<td>1(a)</td>
<td>Using suitable examples, discuss how the basic type of polymers can be classified?</td>
<td>[06]</td>
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<td>1(b)</td>
<td>Write short notes on any two of the following:</td>
<td>[06]</td>
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<td></td>
<td>i. Liquid crystal polymer</td>
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<td>ii. Blending and alloying of polymer</td>
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<td>iii. Special purpose elastomers</td>
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<td>2(a)</td>
<td>Differentiate between thermoplastic and thermosetting polymers.</td>
<td>[06]</td>
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<td>2(b)</td>
<td>Describe the term “Plasticization”. Discuss the effects of internal and external plasticizers.</td>
<td>[06]</td>
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<tr>
<td>3(a)</td>
<td>List the various types of extrusion processes. Differentiate between Jacketing coating and Pressure coating extrusion with diagram(s).</td>
<td>[06]</td>
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<td>3(b)</td>
<td>What is injection molding? Explain the different stages of injection moulding with the help of suitable diagram.</td>
<td>[06]</td>
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**OR**

| 3'(a) | Explain the working principle of rotation molding? List the process parameters and advantages of rotation molding. | [06] |
| 3'(b) | Explain blow molding process used for plastic processing with neat sketch. Give major application of blow molding process. | [06] |
| 4(a)  | What are the applications of different type of plastic? List some properties of plastics. Discuss the disadvantages associated with using plastic as a building material. | [06] |
| 4(b)  | What is meant by Polymer Coating? Briefly discuss the various steps for professional polymer coating of large areas. | [06] |

Contd...
5(a) List the methods used to manufacture ceramic products. Explain slip casting process of ceramic manufacturing.

5(b) What are the various methods used for ceramic powder preparation? Explain in detail the roll crushing method.

OR

5'(a) Discuss the important electrical and mechanical properties of ceramics?

5'(b) Differentiate between amorphous and crystalline solid. Explain the sequential steps involved in glass forming process.
2017-18
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 is allowed.

Q.No.  Question  M.M.
1(a)  Define gravimetric analysis with suitable examples. Calculate the theoretical air fuel ratio for the combustion of octane C₈H₁₈. How can we convert this into molal analysis?  [07]
1(b)  Define adiabatic flame temperature and how can we determine it? By drawing suitable graphs discuss the effects of various parameters on adiabatic flame temperature  [08]
2(a)  Differentiate between global and elementary reactions. Define various chain and chain branching reactions with the help of examples. What do you mean by net production rate of any species?  [07]

OR

2'(a)  Derive the relation between rate coefficients and equilibrium constants.  [07]
2(b)  Explain the various mechanisms of formation of nitric oxide (NO) with the help of reactions.  [08]

3(a)  Define flammability limits. A full propane cylinder from a camp stove leaks its contents of 0.464 kg into a 3.66 m × 4.27 m × 2.44 m room at 20°C and 1 atm. After along time the fuel gas and room air are well mixed. Is the mixture in room flammable?  [05]
3(b)  Draw and explain Rankine-Hugoniot curve by mentioning governing equation.  [10]

(End)
3'(a) Define burning velocity and what are the different methods of determining it. Determine the laminar burning velocity $S_l$ by area method of stoichiometric CH$_4$-air mixture burning in a conical flame of flame height 5.1 cm in a Bunsen burner with port diameter of 10 mm if it consumes 19 litres per minute of fuel-air mixture.

3'(b) What are the assumptions in the burning of liquid fuel droplet combustion model. With the help of neat diagram show the variation of properties along radial direction for this model.

4(a) A spark ignition engine is running on a dynamometer test stand and the following measurements of the exhaust products are made: CO$_2$ = 12.47%, CO = 0.12%, O$_2$ = 2.3%, C$_6$H$_{14}$(equivalent) = 367 ppm, NO = 76 ppm. All concentrations are by volume on a dry basis. The engine is fuelled by isoctane. Determine the emission index of unburned hydrocarbon expressed as equivalent hexane and NO.

OR

4'(a) Define the various methods of quantification of emissions. In the gaseous mixture of N$_2$ and O$_2$. The N$_2$ and O$_2$ have composition of 80% and 20% by mass respectively. Calculate the critical temperature (Tc) and critical pressure (Pc) of the gaseous mixture.

4(b) What are the various types of liquid fuels? Discuss the important properties of gasoline and diesel fuel. Define surrogate fuel for gasoline and diesel fuel.
WINTER 2017-18
B.E. (AUTUMN SEMESTER) EXAMINATION
MECHANICAL ENGINEERING
REFRIGERATION AND AIR-CONDITIONING
EME-429N

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Use of Refrigeration Charts and Tables is allowed.

Q.No. Question M.M.
1(a) In an R-22 based refrigeration system, a liquid-to-suction vapor heat exchanger (LSHX) with an effectiveness of 0.65 is used. The operating evaporator and condenser temperatures are 7.2°C and 54.4°C respectively, Assuming the compression process to be isentropic, determine:
(i) Specific refrigeration effect (ii) Volumetric refrigeration effect (iii) Specific work of Compression (iv) COP of the system (v) Temperature of vapor at exit of compressor. [05]

1(b) Describe the working of a cascade refrigeration system with the help of a neat sketch and obtain the expression for optimum coupling temperature. [07]

OR

2(a) Discuss briefly the four conditions that need to be satisfied by a binary mixture so that it behaves as an ideal mixture. Also show the pressure-concentration and enthalpy-concentration characteristic curves. [04]

2(b) Show that the ideal vapour absorption refrigeration system can be considered as a combined system consisting of Carnot heat engine and a Carnot refrigerator. [03]

2(c) With the help of a schematic diagram, discuss the working principle of a thermoelectric refrigerator. [05]

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Contd...
2 (c') The operating temperatures of a single stage vapor absorption refrigeration system are: generator: 90°C; condenser and absorber: 40°C; evaporator: 0°C. The system has a refrigeration capacity of 100 kW and the heat input to the system is 160 kW. The solution pump work is negligible.

(a) Find the COP of system and the total heat rejection rate from the system.

(b) An inventor claims that by improving the design of all the components of the system he could reduce the heat input to the system to 80 kW while keeping the refrigeration capacity and operating temperatures same as before. Examine the validity of the claim.

3(a) Discuss refrigerant selection criteria based on thermodynamic, thermophysical, environmental and economic properties.

3(b) What is a thermo-static expansion valve? Explain its working with the help of a schematic diagram.

4 Discuss the various thermal indices used for evaluating indoor environment and present ASHRAE comfort chart, recommended inside design conditions.

4' A 100% outdoor summer air conditioning system has a room sensible heat load of 400 kW and a room latent heat load of 100 kW. The required inside conditions are 24°C and 50% RH, and the outdoor design conditions are 34°C and 40% RH. The air is supplied to the room at a dry bulb temperature of 14°C. Find a) the required mass flow rate of air b) moisture content of supply air, c) Sensible, latent heat loads on the coil, and d) The required cooling capacity of the coil, Coil Sensible Heat Factor and coil ADP if the by-pass factor of the coil is 0.2. Barometric pressure = 1 atm.

5(a) Describe the design procedure of air conditioning ducts using equal friction method.

5(b) State and explain the fan laws, and discuss the use of fans under off-design conditions.
2017-18
B.E. (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.

Q.No. | Question | M.M.
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1 | Attempt any **TWO** parts.
   1(a) What is numerical control (NC) machine tool? Explain NC process in detail. | [06]
   1(b) With the help of schematic diagram of an NC machine tool explain the following: i) MCU, ii) DPU and iii) CPU. | [06]
   1(c) With the help of a suitable figure explain the axis identification for lathe and milling NC/CNC machines. | [06]
2 | Attempt any **TWO** parts.
   2(a) What are various types of input media in NC machine tools? Illustrate briefly. | [06]
   2(b) Explain the construction and working of an encoder. | [06]
   2(c) What is the difference between Drives and Actuation Systems in NC machine tools? | [06]
3 | Attempt any **TWO** parts.
   3(a) What is a CNC system? What are its components? | [06]
   3(b) Define DNC. Explain briefly different types of DNC system. | [06]
   3(c) What is part programming? Explain with the help of suitable example the applications of the following codes:
   i) G03
   ii) G42
   iii) G91
4(a) Write a part programme using G-M codes for the component shown in figure 1. The turning operation machining parameters are: Cutting Speed = 1500 rpm; Feed = 250 mm/min and Depth of cut = 1 mm.
OR

4. (a) 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)

5. The outline of the job is shown in figure 3. Write the complete APT program. Assume the required machining parameters.

Figure 3 (All dimensions in mm)