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Roll No.

SECOND SEMESTER

B.E. (ME)

MID SEM EXAMINATION

March

2007

**ME-114 ENGG. MATERIALS AND
THERMODYNAMICS**

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions from Part B.
Answer question **ONE** & any one from the rest of **Part A**.
Use separate answer sheets for **Part-A&B**.
Assume suitable missing data, if any.
For air $C_p = 1.005 \text{ kJ/kg} \cdot \text{K}$ and $\gamma = 1.4$.

PART-A

- 1[a] Write the chemical reactions involved in lime-soda process. 3
[b] Give the steps involved in manufacture of refractories. 2
- 2[a] What are the limitations of zeolite process? 2
[b] What is priming? How it can be minimised? 3
- 3[a] Define refractoriness. Explain the method of determination of softening temperature of refractories. 3
[b] What is caustic embrittlement? How it can be prevented? 2

PART-B

- 1[a] A closed mass undergoes a reversible three process cycle. The working substance is air. The initial pressure and temperature are 0.2 MPa, 325 °C air is first compressed isothermally to 0.65 MPa. It is then heated at constant pressure. Finally, it is brought to the initial state by an adiabatic expansion process. Draw the P-V diagram of cycle and determine the heat and work transfer for each individual process. Verify that cycle integral of heat is equal to cycle integral of work. 2.5
- [b] An engine operates on the Carnot cycle using a perfect gas as the working fluid. The ratio of the greatest to least volume is fixed and equal to n . The lower temperature of the cycle is also fixed but the

volume compression ratio r of the reversible adiabatic process is variable. The ratio of specific heat is γ .

show that if the work done in the cycle is minimum, then

$$(\gamma - 1) \ln \frac{n}{r} + \frac{1}{r^{\gamma-1}} - 1 = 0 \quad 2.5$$

- 2[a] A gas enters an insulated steady flow system at 200 KPa, 27° C, with an enthalpy of 214.4 kJ/kg and a velocity of 70 m/se , at a rate of 0.00230 kg/sec. With in the system, the gas stream is separated into two systems and the measurements shows that one stream leaves at 100 KPa with an enthalpy of 206.0 KJ/kg and a very low velocity at a rate of 0.00090 kg/sec. The other leaving stream also have a very low velocity. What is its enthalpy? 2.5

- [b] Develop the following expression for the change of entropy

$$m \left[a \log e \frac{T_2}{T_1} + K [T_2 - T_1] - (a - b) \log e \frac{P_2}{P_1} \right]$$

where $C_v = b + KT$ and $C_p = a + KT$

Using the above expression, determine the overall pressure ratio and the average value of γ during the adiabatic compression from 560 K to 840 K. Compare the value of γ with that obtained from average value of specific heats over the particular temperature range.

Take $a = 1 \text{ kJ/kg-K}$, $b = 0.71 \text{ kJ/kg-K}$. 2.5

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SECOND SEMESTER

B.E. (ME/PE)

MID SEM EXAMINATION

March 2007

**ME/PE-111 ENGINEERING ECONOMICS &
ACCOUNTANCY**

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.

Assume suitable missing data, if any.

- 1 Fill up the blanks:
 - [a] Sand near river is acommodity.
 - [b] Land gets.....for its contribution in production.
 - [c] In....., there is only one producer.
 - [d] Cost of producing additional unit is called as.....cost.
 - [e] Journal and ledger refer to.....document in double entry system of book keeping.
 - [f] Reserve bank of India is.....bank. 3
- 2 Differentiate between
 - [a] Monopolistic completion and Perfect competition
 - [b] Price elasticity of demand and Cross elasticity of demand.
 - [c] Tax and Subsidy 9
- 3 Discuss credit creation by bank. 2
- 4 What do you mean by accountancy? 2
- 5 What is production function? 2
- 6 What is inflation? 2

SECOND SEMESTER

B.E. (ME/PE)

MID SEM EXAMINATION

March

2007

ME/PE-112 MATHEMATICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions, selecting any **TWO** parts from each question.

Assume suitable missing data, if any.

1[a] Verify Euler's theorem for the function

$$u = \sin^{-1} \frac{x}{y} + \tan^{-1} \frac{y}{x}$$

[b] If $u = u\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$, show that

$$x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} + z^2 \frac{\partial u}{\partial z} = 0$$

[c] Obtain Taylor's series of the function $f(x, y) = \tan^{-1}\left(\frac{y}{x}\right)$ in powers of $(x-1)$ and $(y-1)$ upto second degree terms. Also, compute $f(1.1, 0.9)$ approximately upto three places of decimal.

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2[a] The radius of the base and the altitude of a can in the shape of a right circular cone are measured correct to 1%. Find the maximum possible percentage error in the volume of the cone.

[b] Evaluate $\iint_R y^2 dx dy$, where R is the area outside the circle $x^2 + y^2 = ax$ and inside the circle $x^2 + y^2 = 2ax$

[c] Evaluate

$$\int_0^{2a} \int_{x^2/4a}^{3a-x} (x^2 + y^2) dy dx$$

by changing the order of integration.

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3[a] Find the stationary values of $x^2 + y^2 + z^2$ subject to $ax^2 + by^2 + cz^2 = 1$ and $lx + my + nz = 0$.

[b] Evaluate $\iiint \frac{dx dy dz}{\sqrt{1-x^2-y^2-z^2}}$, the integral being extended to the positive octant of the sphere $x^2 + y^2 + z^2 = 1$.

[c] Find the volume under the plane $z = x+y$ and above the area cut from the first quadrant of the ellipse $4x^2 + 9y^2 = 36$.

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SECOND SEMESTER

B.E. (ME/PE)

MID SEM EXAMINATION

March

2007

ME/PE-113 PHYSICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

Assume suitable missing data, if any.

- 1 (i) Both U^{235} and Pu^{239} are fissionable elements but Pu^{239} is preferred in nuclear reactors. Why? **1**
- (ii) When fission occurs, several neutrons are released and the fission fragments are beta-radioactive. Why? **1**
- (iii) Why do nuclei tend to have more neutrons than protons at high mass numbers. **1**
- (iv) Calculate the minimum energy (in MeV) of a photon that will break the nucleus 7_3Li into an α -particle and a triton. **1**
- 2[a] Use the semiempirical binding energy formula to calculate the binding energy of ${}^{64}_{30}Zn$. What is the percentage discrepancy between this figure and the actual binding energy (given : $a_v = 14.1 \text{ MeV}$, $a_s = 13.0 \text{ MeV}$, $a_c = 0.595 \text{ MeV}$, $a_a = 19.0 \text{ MeV}$, $a_p = 33.5 \text{ MeV}$) **2**
- [b] A cyclotron in which the magnetic flux density is 3 weber/m² and whose dees radius is 0.5 m, is used to accelerate (i) protons (ii) α -particles. What must be the frequency of the p.d. applied across the dees in each case? Also calculate the maximum kinetic energy of the emerging particles. The mass of a proton is $1.67 \times 10^{-27} \text{ kg}$ and the charge on it is $1.6 \times 10^{-19} \text{ C}$. **2**
- [c] Explain the terms : (i) stimulated emission (ii) Metastable states (iii) population inversion (iv) pumping **2**
- 3[a] State Gauss's law and establish its differential form. Show that $\text{curl } \vec{E} = 0$ and explain its physical meaning. **3**

- [b] Suppose that the electric field in a region is $\vec{E} = kr^3\hat{r}$, in spherical coordinates (k is constant) (i) find charge density ρ (ii) find the total charge in a sphere of radius R, centered at the origin. 2

- 4[a] Define the three electric vectors \vec{D} , \vec{E} , and \vec{P} . Obtain the relation between these three electric vectors. 3

- [b] What is coefficient of self inductance. Find the self inductance of a toroidal coil with rectangular cross section (inner radius a, outer radius b, height h), which carries a total of N turns. 2

Atomic masses:

$$n = 1.008665 \text{ u}$$

$$^1\text{H} = 1.007825 \text{ u}$$

$$^3\text{H} = 3.016050 \text{ u}$$

$$^4\text{He} = 4.002603 \text{ u}$$

$$^7\text{Li} = 7.016004 \text{ u}$$

$$^{64}\text{Zn} = 63.929 \text{ u}$$