Subject Code: R16MTE101

M.Tech - I Semester Regular/Supplementary Examinations, DEC-2018.
OPTIMIZATION TECHNIQUES
(TE)

Time: 3 hours   Max Marks: 60

Answer any FIVE questions.
All questions carry EQUAL marks of 12.
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1. (a) What is the difference between quadratic and cubic interpolation methods?
(b) Find the minimum of the function f=(λ/log) by the following methods. (take the initial trial step
   length as 0.1)
   (i)   Quadratic interpolation method
   (ii)   Cubic interpolation method

2. By using Fletcher-Reeves Method, Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting
from the point $X_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

3. Carryout at most five iterations for the function using the method of steepest descent (ascent).
Assume that $X^0 = 0$

$$min\ f(X) = x_1 - x_2 + x_1^2 - x_1x_2$$

4. Find the maximum value of $Z = x_1^2 + 2x_2^2 + 4x_3$
   Subject to the condition

$$x_1 + 2x_2 + x_3 \leq 8$$
$$x_1, x_2, x_3 \geq 0$$

5. Consider the LPP

$$MaxZ = 2x_1 + x_2 + 4x_3 - x_4$$
   Subject to $x_1 + 2x_2 + x_3 - 3x_4 \leq 8$
                 $-x_2 + x_3 + 2x_4 \leq 0$
                 $2x_1 + 7x_2 - 5x_3 - 10x_4 \leq 21$
   And $x_1, x_2, x_3, x_4 \geq 0$
   (i)   Solve the LPP,
   (ii)   Discuss the effect of change of b_2 to 11.
   (iii)   Discuss the effect of change of b to [3 -2 4].

6. Use Branch and Bound method to solve the following:

$$Maximize\ Z = 2x_1 + 2x_2$$
$$\text{Subject to} \quad 5x_1 + 3x_2 \le 8$$
$$x_1 + 2x_2 \le 4$$

And $x_1, x_2 \ge 0\ and\ integer$

7. (a) Define Mean, Variance, Covariance, Joint density function
   (b) What is the difference between Probability density and probability distribution functions?

8. A bakery keeps stock plum cakes. Past experience shows that the daily demand of the cake has the probability distribution given below:

Daily demand	0	10	20	30	40	50
Prob	0.01	0.20	0.15	0.5	0.12	0.02

Find the mean,variance,standard devation.

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Subject Code: R16MTE102

M.Tech - I Semester Regular and Supplementary Examinations, Dec-2018.
ADVANCED THERMODYNAMICS
(TE)

Time: 3 hours   Max Marks: 60

Answer any FIVE questions.
All questions carry EQUAL marks of 12.
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1. (a) Show that the transfer of heat through a finite temperature difference and the adiabatic mixing of two fluids are irreversible.
(b) A heat engine is used to drive a heat pump. The heat transfers from the heat engine and from the heat pump are used to heat the water circulating through the radiators of a building. The efficiency of the heat engine is 27% and the COP of the heat pump is 4. Evaluate the ratio of the heat transfer to the circulating water to the heat transfer to the heat engine.   [6+6]

2. (a) State and explain the Gouy-Stodola theorem.
(b) The steam enters a steam turbine steadily at 3 Mpa and 450^0 C at a rate of 8 kg/s and exits at 0.2 Mpa and 150^0 C. The steam is losing heat to the surroundings at 100 kPa and 25^0 C at a rate of 300 kW. The changes in kinetic and potential energies are negligible. calculate i) actual power output ii) the reversible work iii) second law efficiency iv) the reversibility v) the availability of the steam at inlet conditions.   [6+6]

3. (a) What are virial coefficients? When do they become zero?
(b) Steam initially at 1.5 MPa, 300^0 C expands reversibly and adiabatically in a steam turbine to 40^0 C. Determine the ideal work output of the turbine per kg of steam.   [6+6]

4. (a) What is enthalpy of combustion? What is internal energy of combustion?
(b) Gaseous butane at 25^0 C is mixed with air at 400 K and burned with 40 % theoretical air. Determine the adiabatic flame temperature.   [6+6]

5. (a) what is cogeneration plant? What are the thermodynamic advantages of such a plant?
(b) Why is the combined gas- steam cycle more efficient than either of the cycles operated alone.
                    [6+6]

6. (a) Describe an MHD closed cycle system, with its advantages and disadvantages.
(b) What is a fuel cell? Describe the principle of working of a fuel cell with reference to H_2-O_2 cell.
                    [6+6]

7. (a) Describe the principle of working and constructional details of a thermionic generator.
(b) Write a short notes on adiabatic flame temperature.   [6+6]

8. (a) Write a short notes on the following.
     i) Joule -Thompson C-efficient   ii) Maxwell relations
(b) Establish the equivalence of Kelvin -Planck and Clausius statements.   [8+4]

Narasaraopeta Engineering College (Autonomous)
Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16MTE103

M.Tech - I Semester Regular/Supplementary Examinations, Dec - 2018.
ADVANCED HEAT & MASS TRANSFER
(TE)

Time: 3 hours   **Max Marks: 60**

Answer any FIVE questions.
All questions carry EQUAL marks of 12.
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1. (a) Briefly explain different modes of heat transfer and give the basic laws governing these modes. [4]

    (b) Derive general and 3-dimensional heat conduction equation in Cartesian coordinate system. [8]

2. (a) Briefly explain the physical significance of Nusselt, Reynolds, Prantl and Grashoff numbers used in convection heat transfer analysis. [6]

(b) Calculate the rate of heat loss from a human body which may be considered as a vertical cylinder 30 cm in diameter and 175 cm high while standing in atmosphere which is at 15^0C. The surface temperature of the human body is 35^0C. [6]

3. (a) Air at 20 C is flowing along a heated plate at 134 C at a velocity of 3m/s. The plate is 2 m long and 1.5m wide. Calculate the thickness of hydrodynamic boundary layer and the skin friction coefficient at 40cm from the leading edge of the plate. The kinematic viscosity $v = 15.06 \times 10^{-6}$ m^2/s. [6]

(b) Air at 2 bar pressure and 200°C temperature gets heated as it flows through 2.5cm dia tube with a velocity of 10 m/s. A constant heat flux condition is maintained at the wall and the wall temperature is 20°C above the air temperature all along the length of the tube. Make calculation for the heat transfer per unit length of the tube. Also determine the increase in bulk temperature over a 3m length of the tube. [6]

4. (a) Explain the phenomena of natural convection over a vertical plate with the help of temperature and velocity profiles. [6]

(b) Briefly explain the Nusselt's condensation theory on vertical plate by drawing temperature and velocity profiles. State the assumptions made. [6]

5. (a) Show that by inserting one radiation shield between two parallel surfaces, the direct radiation heat transfer between the parallel plates is halved. [6]

(b) Two large parallel planes having emissivities 0.3 and 0.5 are maintained at temperatures 900^0C and 400^0C respectively. A radiation shield having an emissivity of 0.05 on both sides is placed in between the two planes. Calculate

       (i) The heat transfer per m^2 area if the shield were not present

       (ii) The temperature of the shield

       (iii) Heat exchange per m^2 area when the shield is present. [6]

6. A vertical tube of 50 mm outside diameter and 2 mm long it exposed to steam at atmospheric pressure. The outer surface of the tube is maintained at a temperature of 84°C by circulating cold water through the tube. Determine the rate of heat transfer and also condensate mass flow rate. [6]

7. (a) Explain the significance of Schmidt, Lewis and Sherwood numbers in convection mass transport phenomena. [6]
(b) O_2 gas at 25^{0}C and a pressure of 2 bar is flowing through a rubber pipe of inside diameter 25 mm and wall thickness 2.5 mm. The diffusivity of O_2 through a rubber is 0.21×10^{-9} m^2/s and the solubility of O_2 in rubber is 3.12×10^{-3}k mol/ m^3 bar. Find the loss of O_2 by diffusion per meter length of pipe. [6]

8. Illustrate the following
     i) Analogy between heat and mass transfer [6]
     ii) Mass convection [6]

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Subject Code: R16MTE104

M.Tech - I Semester Regular and Supplementary Examinations, Dec-2018.
ADVANCED IC ENGINES
(TE)

Time: 3 hours   Max Marks: 60

Answer any FIVE questions.
All questions carry EQUAL marks
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1. (a) Briefly explain the stages of combustion in SI engines elaborating the flame front Propagation?

   (b) List out and explain the main factors affecting the penetration of the fuel spray in CI engines? [6+6]

2. (a) A 4-stroke diesel engine has a cylinder bore 12.5 cm and a stroke of 15.6 cm and runs at 550 rpm. The engine uses 60% excess air with fuel having 87% C and 13% hydrogen. The indicated thermal efficiency is 40%, the mechanical efficiency is 89% and the volumetric efficiency is 88%. Calculate the brake power, SFC and the BMEP. Fuel has a heating value of 41200 kJ/kg and the ambient conditions are 1 bar and 20°C. [12]

3. (a) Compare induction swirl with compression swirl with respect to their advantages and disadvantages.
   (b) Explain Turbo charging in CI engines. [6+6]

4. What do you understand by charge stratification? Explain the method of achieving the same with suitable sketches. Discuss the advantages and disadvantages of charge stratification. [12]

5. (a) Give a brief account of emissions from CI engines.
   (b) Describe the mechanism of formation of CO, UBHC and NOx emissions. [6+6]

6. (a) Explain the reasons for looking for alternate fuels for IC engines.
   (b) Illustrate the advantages and disadvantages of using hydrogen in SI engine. [6+6]

7. (a) Explain advantages and disadvantages of electric vehicles.
   (b) Discuss the working principle of solar car. [6+6]

8. Write short notes on the following   [4+4+4]
   1. MPFI in SI engines
   2. Catalytic converters
   3. Biofuels

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Narasaraopeta Engineering College (Autonomous)

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Subject Code: R16MTE106

M.Tech - I Semester Regular & SupplementaryExaminations, Dec- 18 /Jan - 19.
FUELS AND COMBUSTION
(TE)

Time: 3 hours   **Max Marks: 60**

Answer any FIVE questions.
All questions carry EQUAL marks of 12.
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1. (a) Name the main classification of coal. [6]
   (b) Explain carbonization. [6]

2. (a) Explain rate of reaction. [6]
   (b) Explain dew point of products. [6]

3. (a) Explain flash point, specific heat & calorific value for a fuel with proper example. [6]
   (b) What is the typical reaction under which a nuclear power plant operates? What is the issue faced with this type of reaction & how this is controlled? Explain with proper diagram. [6]

4. (a) Describe in detail the factors influencing flame velocity? [6]
   (b) Explain the Stoker firing. [6]

5. (a) Sketch and explain the concept of fluidized bed combustion and its significance. [6]
   (b) what are the different factors affecting the burning velocity of fuel. [6]

6. (a) Explain the different parameters influence the turbulent flame. [6]
   (b) Explain pulverized system of firing. [6]

7. (a) Explain the legislative measures required for pollution free environment. [6]
   (b) What are the basic elements exhausted with the flue gases which are hazardous for human health? What are the effects of SO_2, NO_X and Hydrocarbons on the human lives? [6]

8. Write short notes on the following: [4+4+4]
   a) Equilibrium composition of gaseous mixtures.
   b) Working of pulverized fuel furnace.
   c)Phenomenon of droplet combustion.
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Subject Code: R16MTE110

M.Tech - I Semester Regular and Supplementary Examinations, Dec-2018.
THERMAL & NUCLEAR POWER PLANTS
(TE)

Time: 3 hours   Max Marks: 60

Answer any FIVE questions.
All questions carry EQUAL marks of 12.
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1. (a) Discuss volumetric and gravimetric analysis
   (b) Draw and explain general layout of steam power plant   [6+6]

2. (a) Distinguish natural draught and forced draught cooling towers
   (b) Discuss a the following
      i) Preheater
      ii) Superheater
      iii) Regenerator   [6+6]

3. (a) Describe open and closed cycle gas turbine power plants with its merits and demerits
   (b) Explain Fluidized bed combustion with its advantages and disadvantages   [6+6]

4. (a) Explain pressurised and gas cooled reactors with its merits
   (b) What is the necessity of nuclear power in India enumerate it   [6+6]

5. (a) Explain the following
      i) Load factor
      ii) Utilization factor
      iii) Demand factor
      iv) Diversity factor
   (b) What is meant by depreciation and discuss straight line and sinking fund methods   [6+6]

6. (a) Explain Bourdon tube pressure gauge with a neat sketch
   (b) What are Thermistors? Explain the working principle of Thermistors   [6+6]

7. (a) Describe X-ray flow meter with a sketch
   (b) Explain pollution control using chemical converters   [6+6]

8. (a) With a neat sketch explain boiling water reactor
   (b) What is a nuclear reactor and describe the components of nuclear reactor   [6+6]

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