Q. No. 1(a) Use Doolittle’s LU factorization method, to solve the following system of equations:

\[2x + y + 4z = 12, \ 8x - 3y + 2z = 20, \ 4x + 11y - z = 33.\]

OR

(a)' Transform the matrix

\[A = \begin{bmatrix} 1 & 2 & 4 \\ 2 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}\]

to tridiagonal form by using Given’s method. Hence find the sturm sequence for the eigenvalues of the matrix A.

(b) Find singular value decomposition (SVD) of the matrix A:

\[A = \begin{bmatrix} 4 & 0 \\ 3 & -5 \end{bmatrix}\]

2(a) If linear interpolation is used to interpolate the error function

\[f(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt.\]

Show that the error of linear interpolation using the data \((x_0, f_0), (x_1, f_1)\) cannot exceed \((x_0 - x_1)^2/(2\sqrt{2\pi\nu})\).
OR

(a)'

(i) Calculate the $n$th divided difference of $\frac{1}{x}$, based on the arguments $x_1, x_2, x_3, \ldots, x_{n+1}$.

(ii) Find the value of the uniform mesh size $h$ that can be used to tabulate the function $f(x) = x^2 \ln x$ on $[5, 10]$ using quadratic interpolation formula such that $\varepsilon = 1 \times 10^{-5}$.

(b)

(i) Verify whether the function defined by

\[
\begin{align*}
f(x) &= \begin{cases} 
-x^2 - 2x^3, & -1 \leq x \leq 0 \\
-x^2 + 2x^3, & 0 \leq x \leq 1
\end{cases}
\end{align*}
\]

is a cubic spline on $[-1, 1]$ or not?

(ii) Obtain a cubic spline fit for the data

<table>
<thead>
<tr>
<th>$x$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

Under the conditions $M(0) = 0 = M(4)$ and valid in the interval $[1, 2]$.

Hence obtain the estimate of $f(1.5)$.

3(a) Find the least squares polynomial approximation of degree two for $f(x) = x^{3/2}$ on the interval $[0, 1]$.

(b) Find $a$ and $b$ by method of least squares approximation method such that $y = ax^b$ fits into the following data:

<table>
<thead>
<tr>
<th>$x$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>0.5</td>
<td>2</td>
<td>4.5</td>
<td>8</td>
<td>12.5</td>
</tr>
</tbody>
</table>

OR

(b)' Determine the minimax linear polynomial approximation in Chebyshev sense to $f(x) = \int_0^x \frac{x^2}{y^3} dy$ defined on $[0, 1]$. 

contd... 2.
4(a) One has $12000 to invest, and there are three different funds from which to choose. The municipal bond fund has a 7% return, the local bank’s CDs have an 8% return, and the high-risk account has an expected 12% return. To minimize risk, one decides not to invest any more than $2000 in the high risk account. For tax reasons, one need to spend at least three times as much in municipal bond as in the bank CDs. Assuming the year end yields are as expected. Formulate an LPP and use graphical method to determine the optimal investment amounts.

OR

(a)' Solve the following LPP, graphically:

Maximize and minimize $P = 2x + y$

Subject to $x + y \geq 4; \quad 3x + y \geq 3; \quad x + 4y \geq 4; \quad x \leq 3; \quad y \leq 2; \quad x, y \geq 0.$

(b) Solve the following LPP, by simplex method:

Maximize $Z = 12x_1 + 6x_2 + 4x_3$

Subject to $4x_1 + 2x_2 + x_3 \leq 60; \quad 2x_1 + 3x_2 + 3x_3 \leq 50; \quad x_1 + 3x_2 + x_3 \leq 45; \quad x_i \geq 0$ for $i = 1, 2, 3.$

xxxxxxxxxxxxxxxxxxxxxx
B. E. AUTUMN END-SEMESTER EXAMINATION - 2018 - I
(CIVIL ENGINEERING)
DISASTER MANAGEMENT ECE-444N (OE)

Duration: Two Hours

Note: Answer all questions. Marks are given in parenthesis. Assume suitable values if data are not given.

Q1(a) Illustrate different types of damping with example. Derive the relation for the determination of Critical damping ratio in free vibration test. (06)

Q1(b) At recording station a difference in time of arrival between P and S waves was observed to be 1.5 seconds. What is the approximate distance from the station at which the event occurred? Assume P-wave velocity as 4 km/s and S-wave velocity as 2 km/s (03)

Q1(c) An empty elevated water tank is pulled by a steel cable by applying a 30 kN force. The tank is pulled horizontally by 5 cm. At the end of five complete cycles, the time is 2.0 s and the amplitude is 2.0 cm. Determine the damping ratio, natural period of undamped vibration, effective stiffness, effective weight and damping coefficient for the given data. (06)

OR

Q1’(c) Find the natural frequency of two simply supported beams with attached mass system. Take L=1m, El= unity and K=48 units. Derive the relation for springs in series and parallel. (06)

2 Answer any three of the following: (3 x 05)

(a) Mention the different factors which affect Ductility

(b) What are the possible damages to RCC buildings in earthquake prone areas?

(c) Discuss the following types of failures in RCC building

contd...
(i) Ductile failure (ii) Flexure failure (iii) Failure of Joints

(d) Illustrate the IS code provision for calculation of seismic lateral force on building

(e) Define the following terms:
   (i) Basic and design wind speed (ii) Terrain category (iii) Hurricanes (iv) Gradient Height

(f) What are Do’s and don’t in wind disasters areas with respect to building.

Q3(a) Discuss briefly the factors on which coefficient of runoff \( C \) depends. Calculate the mean precipitation by Thiessen’s method for the area composed of an equilateral triangle of sides 6 kilometers. The rainfall readings in centimeters at the three stations are also given in the accompanying figure. (07)

\[ \text{Station: 2} \]
\[ \text{Rainfall: 28} \]

\[ \text{Station: 1} \]
\[ \text{Rainfall: 12.5} \]

\[ \text{Station: 3} \]
\[ \text{Rainfall: 6.8} \]

Q3(b) Write brief note on National Flood Commission of India (Rashtriya Barh Ayog). (08)

Q4(a) Give a brief account of classification of disasters and discuss vulnerability level of Indian populace to the natural disasters. (07)

OR

Q4'(a) Discuss basic elements of disaster mitigation and state of disaster management in India. (07)

Q4(b) Enumerate important causes of landslides and suggest different measures to mitigate landsliding. (08)
2018-19  
B.E. (AUTUMN SEMESTER) EXAMINATION  
BRANCH: MECHANICAL/CIVIL  
RENEWABLE ENERGY SOURCES  
COURSE CODE: EEE-421

Maximum Marks: 60  
Credits: 04  
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>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Classify the energy resources on the basis of usability of energy, traditional use, long term availability, commercial application and origin.</td>
<td>[06]</td>
</tr>
<tr>
<td>1(a')</td>
<td>What is energy conservation and energy audit? Also, write the classification of energy audit.</td>
<td>[06]</td>
</tr>
<tr>
<td>1(b)</td>
<td>What is topping cycle and bottoming cycle in cogeneration system? Also explain combined cycle cogeneration system with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(a)</td>
<td>What are extraterrestrial and terrestrial radiations? Explain with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(a')</td>
<td>Discuss in brief the construction of solar PV cell, module, panel and array. Also write the applications of solar PV.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Explain briefly Linear Fresnel lens collector and Hemispherical Bowl Mirror concentrator.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(a)</td>
<td>Explain the working of Alkaline Fuel Cell (AFC) with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(a')</td>
<td>Explain the working of Molten Carbonate Fuel Cell (MCFC) with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(b)</td>
<td>How biogas is produced from waste biomass?</td>
<td>[06]</td>
</tr>
<tr>
<td>4(a)</td>
<td>How wind energy conversion system works?</td>
<td>[06]</td>
</tr>
<tr>
<td>4(a')</td>
<td>Explain briefly the main components of Horizontal Axis Wind Turbine with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>4(b)</td>
<td>Explain Seeded Inert Gas carrier system with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(a)</td>
<td>Explain the working of open cycle OTEC plant with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(a')</td>
<td>What are different types of geothermal energy resources? Explain any one of them with the help of diagram.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(b)</td>
<td>Explain single basin single effect Ocean Tidal Energy Conversion scheme.</td>
<td>[06]</td>
</tr>
</tbody>
</table>
Answer all the questions. Assume suitable data if missing.

1(a). Define “Lapse rate”. What are the atmospheric stability conditions? With the help of proper diagrams, describe the Plume behaviour as a function of atmospheric stability conditions. [10]

1(b). What do you understand by the term ‘Heat Island Effect’. Discuss its effect on large cities. [05]

OR

1’(a). With the help of a schematic diagram, describe the interrelationship between air quality models, air monitoring and air quality criteria, which are essential for the development of a software for the purpose. Also discuss various techniques for urban modelling. [09]

1’(b). For a combustion system, following information is given. Determine PM INDEX. (Tolerance Factor) [06]

<table>
<thead>
<tr>
<th>Substance</th>
<th>PM</th>
<th>SOx</th>
<th>NOx</th>
<th>CO</th>
<th>HC</th>
<th>OOO</th>
<th>SR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Matter</td>
<td>143.0</td>
<td>123.0</td>
<td>136.0</td>
<td>7250.0</td>
<td>2157.0</td>
<td>43.2</td>
<td>400.0 cal/cm²-day</td>
</tr>
<tr>
<td>Sulphur Oxides</td>
<td>1430</td>
<td>514</td>
<td>40,000</td>
<td>19,300</td>
<td>214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Oxidant</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Solar Radiation</td>
<td></td>
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</tr>
</tbody>
</table>

2. What are the major pollutants emitted from combustion systems? Describe formation mechanism, effects and means of reduction of sulphur oxides. [15]

Contd... 2.
2'. What do you understand by 'Photochemical Smog'? Describe the nature of Photochemical smog and its effects. Also, discuss the results obtained from a smog chamber.

3(a). What do you understand by Iso-kinetic sampling conditions?

3(b). Explain with the help of line diagram, the Gas Filter Correlation (GFC) CO analyzer. What advantages it has over the conventional NDIR analyzer?

4(a). What are the sources of Evaporative emissions in petrol engines? Discuss the methods used to control them.

4(b). A regenerative afterburner using a fuel having a calorific value of 45 MJ/kg, has to handle 9 m$^3$/s of polluted air in such a way that the exhaust temperature should be 850 °C. The heat exchanger used has an effectiveness of 0.75. Determine the air-fuel ratio required and the temperature of exhaust gas leaving the regenerator. The inlet conditions of air are 25 °C & 1 atm.