Guru Gobind Singh College of Engineering & Research Centre, Nashik

Mechanical Engineering

UT-I - 2022-23

Subject : [402049_Th] Energy Engineering - Theory   **Faculty :** Milind Patil
Year : FINAL YEAR - SEM-8: BEME-B   **Marks :** 30   **Date :** NaN undefined, NaN   **Duration :** 60 Minutes

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1. **All questions are compulsory**
2. **Draw a neat sketches where necessary**
3. **Use of Steam table, Molier chart and Non programmble calculator is allowed**

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1   Identify, represent and draw the different components and circuits involved in a modern thermal power plant layout.   **(4.00 Marks)**

Bloom's Level : Create,Evaluate,Analyze,Apply,Understand,Remember   **Course Outcome :** CO1

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2   What is the FBC system used in a thermal power plant combustion technology? Identify the merits and demerits of the same.   **(4.00 Marks)**

Bloom's Level : Evaluate,Analyze,Apply,Understand,Remember   **Course Outcome :** CO1

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3   Consider the reheat cycle used in a thermal power plant operating under the following constraints   **(7.00 Marks)**
   - Steam pressure and temperature at turbine inlet 100 bar and 500 ^{O}C
   - HP and LP turbine isentropic efficiency – 80%
   - Reheat pressure – 8.5 bar
   - Pressure loss in the re-heater is limited to 0.5 bar
   - Condenser pressure – 0.05 bar

Neglecting pump work, evaluate the thermal efficiency of the cycle. Comment on your findings when compared with simple cycle operating between 100 bar, 500 ^{O}C and condenser pressure 0.005 bar

Bloom's Level : Evaluate,Analyze,Apply,Understand,Remember   **Course Outcome :** CO1

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4   What is the significance of condenser in a thermal power plant? Which type of condenser you will suggest for thermal power plant?   **(4.00 Marks)**

Bloom's Level : Evaluate,Analyze,Apply,Understand,Remember   **Course Outcome :** CO2

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5   Represent the elements of the steam condensing plant. Why cooling tower is necessary? What are the types of cooling tower and what are the effects of cooling tower on the environment?   **(4.00 Marks)**

Bloom's Level : Evaluate,Analyze,Apply,Understand,Remember   **Course Outcome :** CO2

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6   Design a surface condenser for estimation of the surface area, number of tubes, cooling water required and length of the tubes for the following condenser operating conditions   **(7.00 Marks)**
   - Mass flow rate of steam – 250 t/hr
   - Temperature of steam entering the steam condenser – 40 ^{O}C
   - Cooling water inlet and exit temperature – 32 and 38 ^{O}C
   - Total absolute pressure of the condenser – 0.078 bar
   - Velocity of circulating water – 1.8 m/s
   - Condenser tube diameter – 25.4 mm
   - Overall heat transfer coefficient – 2600 W/m.K

Bloom's Level : Create,Evaluate,Analyze,Apply,Understand,Remember   **Course Outcome :** CO2
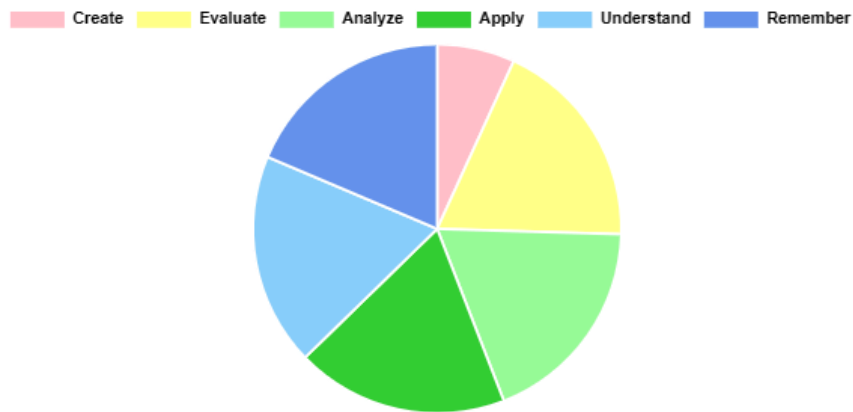
Title : UT-I
Subject : Energy Engineering - Theory
Faculty : Milind Patil
Year : FINAL YEAR - SEM-8: BEME-B
Marks : 30

Marks distribution as per Bloom's level

Bloom's Level	Linked Question Count	Marks	Percentage
Create	2	11	36.67
Evaluate	6	30	100.00
Analyze	6	30	100.00
Apply	6	30	100.00
Understand	6	30	100.00
Remember	6	30	100.00

NOTE : Percentage for each Bloom's level is calculated using following formula

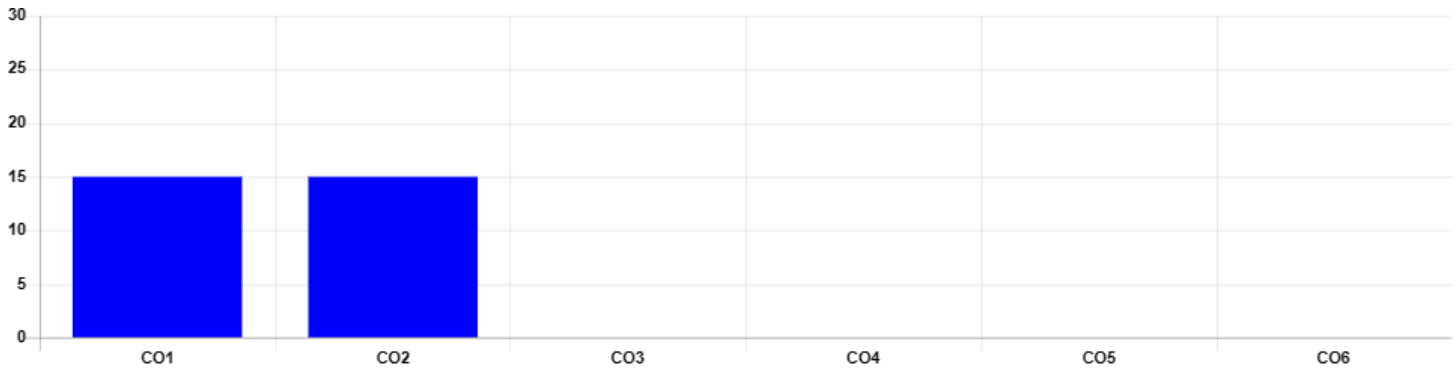*Percentage = (Marks per Bloom's level / Total marks of all questions [OPTIONAL question included]) * 100*

Total marks of all questions [OPTIONAL question included] = 30

Title : UT-I
Subject : Energy Engineering - Theory
Faculty : Milind Patil
Year : FINAL YEAR - SEM-8: BEME-B
Marks : 30

Marks distribution as per course outcome

Course Outcome	Linked Question Count	Marks	Percentage
CO1	3	15	50.00
CO2	3	15	50.00
CO3	0	0	0.00
CO4	0	0	0.00
CO5	0	0	0.00
CO6	0	0	0.00

NOTE : Percentage for each course outcome is calculated using following formula

*Percentage = (Marks per course outcome / Total marks of all questions [OPTIONAL question included]) * 100*

Total marks of all questions [OPTIONAL question included] = 30

Guru Gobind Singh College of Engineering & Research Centre, Nashik

Mechanical Engineering

UT-2 - 2022-23

Subject : [402049_Th] Energy Engineering - Theory   **Faculty :** Milind Patil

Year : FINAL YEAR - SEM-8: BEME-B   **Marks :** 70   **Date :** 17 May, 2023   **Duration :** 150 Minutes

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1) Solve any ONE question from Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6 and Q.7 OR Q.8 2) Use Log paper where necessary 3) Use Molier chart and steam table is allowed 4) Use of non-programable calculator is allowed 5) State the assumptions made clearly (If any) 6) Neat sketches are required where necessary 7) Do not attach molier chart to the answer sheets 8) Log papers must be identified with the seat number and name

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1   **Q.1**

1.1   Discuss construction and operation of different components of high head hydro-electric power plant with neat diagram.   **(7.00 Marks)**

Bloom's Level : Create,Apply,Understand   **Course Outcome :** CO3

1.2   Mean monthly discharge for the 12 months at a particular site of river is tabulated as below.   **(10.00 Marks)**
1. Draw hydrograph and flow duration curve and find average monthly flow
2. Estimate power available at mean flow of water if the available head is 80 m at the selected site if turbine efficiency is 90% and generator efficiency is 95% . Take 30 days in the month

Month	Discharge in millions m^3 per month	Month	Discharge in millions m^3 per month
April	500	Oct	2000
May	200	Nov	1500
Jun	1500	Dec	1500
Jul	2500	Jan	1000
Aug	3000	Feb	800
Sep	2400	Mar	600

Bloom's Level : Create,Evaluate,Apply,Understand,Remember   **Course Outcome :** CO3

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2   **Q. 2**

2.1   Consider the requirement of selection of diesel power plant discuss the various factors that you will consider for the selection of site. What are the applications of diesel power plant?   **(7.00 Marks)**

Bloom's Level : Create,Evaluate,Apply,Understand,Remember   **Course Outcome :** CO3

2.2   Discuss with neat sketch PWR and BWR nuclear reactors and also state their advantages and limitations   **(10.00 Marks)**

Bloom's Level : Create,Apply,Understand,Remember   **Course Outcome :** CO3

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3   **Q. 3**

3.1   Explain the gas and steam combined cycle plant with cycle arrangement, T-s diagram, advantages and disadvantages.   **(8.00 Marks)**

Bloom's Level : Create,Evaluate,Apply,Understand   **Course Outcome :** CO4

3.2   Consider Brayton cycle with reheating with following data   **(10.00 Marks)**
   - Power Developed = 5.5 MW
   - Air entry to compressor of a gas-turbine power plant at 1 bar, 27 ^{O}C.
   - The maximum cycle temperature, pressure is 820 K, 6 bar respectively.
   - The two stage expansion with reheating pressure of 2.4 bar is used in the plant.
   - The isentropic efficiency of compressor = 82%
   - The isentropic efficiency of both turbines = 85%
   - In the re-heater gas is heated up to maximum cycle temperature.
   - Take adiabatic index for air, gas as 1.4,1.33 respectively.
   - Take specific heat for air, gas as 1 KJ/Kg-K, 1.15 KJ/Kg-K respectively.
   - Neglect mass flow rate of fuel.

Draw cycle arrangement and T-s diagram and evaluate
(a) The thermal efficiency of cycle
(b) mass flow rate of air

Bloom's Level : Create,Evaluate,Apply   **Course Outcome :** CO4

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4   **Q. 4**

4.1   What do you mean by cogeneration? What is a need of Cogeneration in gas power cycle?   **(8.00 Marks)**
Explain Cogeneration in gas power cycle with simple block diagram.

Bloom's Level : Evaluate,Understand,Remember   **Course Outcome :** CO4

4.2   Discuss the Kalina (Cheng) Cycle with cycle arrangement, T-s diagram. What are   **(10.00 Marks)**
advantages and disadvantages of it?

Bloom's Level : Create,Understand,Remember   **Course Outcome :** CO4

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5   **Q. 5**

5.1   What are functions of relays? Enlist different types of the same. Explain working of any   **(10.00 Marks)**
one relay with diagram.

Bloom's Level : Evaluate,Analyze,Understand,Remember   **Course Outcome :** CO5

5.2   What are functions of circuit breaker? Enlist different types of the same. Explain working of   **(7.00 Marks)**
anyone circuit breaker system with diagram.

Bloom's Level : Evaluate,Analyze,Understand,Remember   **Course Outcome :** CO5

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6   **Q. 6**

6.1   What are different methods thermal energy storage? Explain anyone with simple   **(7.00 Marks)**
diagram.

Bloom's Level : Evaluate,Understand,Remember   **Course Outcome :** CO5

6.2   A power plant of 210 MW installed capacity has the following details Capital cost = Rs.   **(10.00 Marks)**
17500/kW installed Interest and Depreciation = 13% Load factor = 0.6 Capacity factor = 0.54
Annual running cost = Rs. 200 x 10^6 Auxiliary consumption = 7% Evaluate, cost of power
generation per kWh and the reserve capacity

Bloom's Level : Create,Evaluate,Apply   **Course Outcome :** CO5

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7   **Q. 7**

7.1 Describe Low temperature flat plate collector solar power plant with a suitable sketch and demerits **(6.00 Marks)**

Bloom's Level : Create,Apply,Understand **Course Outcome :** CO6

7.2 Discuss superheated steam & flash steam system geothermal energy system with diagram and demerits **(6.00 Marks)**

Bloom's Level : Create,Apply,Understand **Course Outcome :** CO6

7.3 Describe dolphin type wave machines with diagram and merits **(6.00 Marks)**

Bloom's Level : Apply,Understand **Course Outcome :** CO6

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8 **Q. 8**

8.1 Discuss Claude & Anderson Ocean Thermal Energy system with diagram and merits. **(6.00 Marks)**

Bloom's Level : Create,Apply,Understand **Course Outcome :** CO6

8.2 How fuel cell works? What are different types of fuel cells? Explain its advantages. **(6.00 Marks)**

Bloom's Level : Evaluate,Understand,Remember **Course Outcome :** CO6

8.3 How single basin flood & ebb type tidal Energy system works? Explain it with diagram and merits **(6.00 Marks)**

Bloom's Level : Evaluate,Understand,Remember **Course Outcome :** CO6
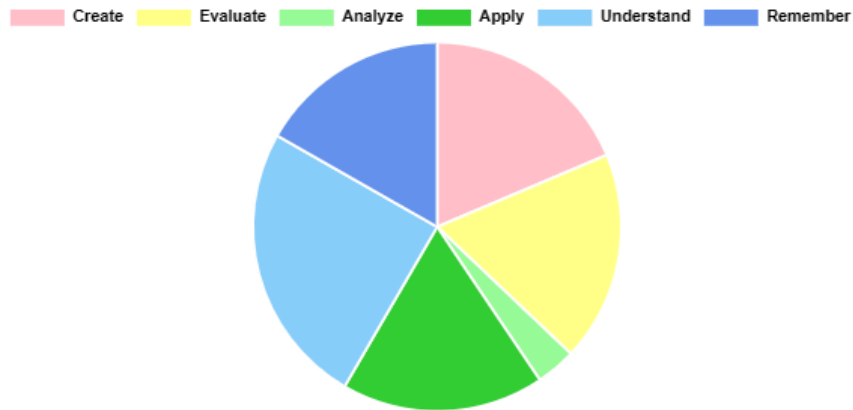

Title : UT-2
Subject : Energy Engineering - Theory
Faculty : Milind Patil
Year : FINAL YEAR - SEM-8: BEME-B
Marks : 70

Marks distribution as per Bloom's level

Bloom's Level	Linked Question Count	Marks	Percentage
Create	11	90	64.29
Evaluate	11	89	63.57
Analyze	2	17	12.14
Apply	11	86	61.43
Understand	16	120	85.71
Remember	10	81	57.86

NOTE : Percentage for each Bloom's level is calculated using following formula

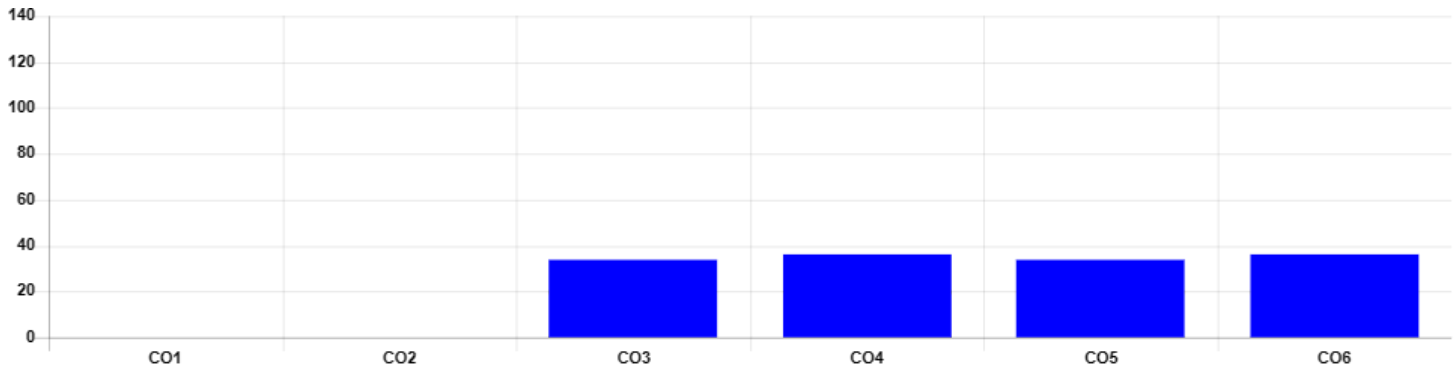*Percentage = (Marks per Bloom's level / Total marks of all questions [OPTIONAL question included]) * 100*

Total marks of all questions [OPTIONAL question included] = 140

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Marks : 70

Marks distribution as per course outcome

Course Outcome	Linked Question Count	Marks	Percentage
CO1	0	0	0.00
CO2	0	0	0.00
CO3	4	34	24.29
CO4	4	36	25.71
CO5	4	34	24.29
CO6	6	36	25.71

NOTE : Percentage for each course outcome is calculated using following formula

*Percentage = (Marks per course outcome / Total marks of all questions [OPTIONAL question included]) * 100*

Total marks of all questions [OPTIONAL question included] = 140