Time: 3hrs.   **Total Marks:80**

N.B.:   (1) Question No.1 is **Compulsory**.
         (2) Attempt any **THREE** from question No.2 to 6.
         (3) Use illustrative diagrams whenever possible.
         (4) Assume suitable data if necessary and mention it clearly.

Q1   Attempt any **Four** Questions   20
   a)   What is difference between Pyrheliometer and Pyranometer?
   b)   What are the advantages and disadvantages of fuel cell?
   c)   Differentiate between horizontal axis and vertical axis wind turbines.
   d)   Describe in brief a community type biogas plant.
   e)   State and explain methods of hydrogen production technologies.
   f)   What are advantages and limitations of wave energy conversion?

Q2   a)   Define and explain the following: 10
         i)   Latitude
         ii)   Declination
         iii)   Surface azimuth angle
         iv)   Hour angle
         v)   Day length
     b)   What is the importance of Non-Conventional Energy Sources in the context of   10
          present energy scenario?

Q3   a)   Estimate the monthly average daily global radiation on a horizontal surface at   10
          Vadodara (22°00'N,73°10'E) during the month of March if the average sunshine
          hours per day is 9.5. Take a=0.28, b=0.48.
     b)   Explain energy status of India and Maharashtra and role of Non-Conventional   10
          Energy Sources.

Q4   a)   What is Betz Coefficient? Show that the ideal maximum theoretical efficiency   10
          (or the maximum power coefficient) is 59% for a horizontal axis windmill.
     b)   How is Geothermal energy tapped? Enumerate problems in tapping.   10

Q5   a)   Explain single and double basin tidal power plants with neat sketches.   10
     b)   Explain in detail classification of biogas plants and their construction, principle   10
          of working. Discuss various factors which affect performance of biogas plant.

Q6   a)   Calculate the following parameters of a bio-gas system: 10
          (i)   The volume of biogas digester
          (ii)   The power available from bio-digester
          Given- Calorific value of methane:28MJ/m^3, Burner efficiency:70%, Number of
          cows:8, Retention period: 20 days, Temperature of fermentation: 30°C, Dry
          matter (cow dung) collected per cow per day: 2kg, Density of dry matter in the
          fluid (slurry) in the digester:50kg/m^3, Biogas yield:0.2m^3 per kg of dry input,
          Methane proportion in the biogas:0.7.
     b)   Explain with neat sketch Wind Energy conversion system. Classify Windmills.   10

(3 Hours)   **Total Marks: 80**

N.B.   1) **Question No. 1 is compulsory**
        2) Solve **Any Three** from remaining **Five** questions.
        3) Use of standard data book like PSG, Mahadevan and Kale Khandare is
           permitted
        4) Assume suitable data if necessary, giving justification

Q 1   Answer any **Four** from the following

     a)   What is bend in rope pulley system of hoisting mechanism? State the effect of bend on   **5**
        the rope life.
     b)   Explain the optimum design concept in system design.   **5**
     c)   Why cavitation occurs in a centrifugal pump? State the remedial measures for the same.   **5**
     d)   List the different types of piston rings and their functions.   **5**
     e)   Why geometric progression is preferred for the speed selection in the multi speed gear   **5**
        box design?

Q 2   a) Explain the rope construction in hoisting rope with example.   **5**
     b) Select a suitable hook with trapezoidal cross section and check it at most critical cross   **15**
       section for design hoisting load of 50 kN. Also select the suitable thrust bearing for it.

Q 3   a) State the fanning effect in the belt conveyor system.   **5**
     b) Determine the width of the conveyor belt and motor capacity for the following   **15**
       specification
       Material to be conveyed   : Coal
       Capacity   : 150 TPH
       Inclination   : 10 degree
       Centre to Centre distance   : 60 m

Q 4   a) Explain the ovality of the piston with neat sketch.   **5**
     b) Determine bore diameter and design a piston for a 4-stroke, single cylinder, water   **15**
       cooled, vertical diesel engine with following specifications:
     Indicated power = 20 kW
     Speed = 1200 rpm
     Compression Ratio = 14

Q 5   a) Describe the working of the gear pump with neat sketch.   **5**
     b) Design a volute casing for a centrifugal pump having impeller with outer diameter 320   **15**
       mm and inner diameter 160 mm. The specifications for the pump are
       Total manometric head: 20 m
       Discharge: 900 LPM
       Motor speed : 1440 rpm

Q 6   a) A six speed gear box is to be designed for a machine tool with geometric progression ratio   **20**
       as 1.41 and N_{max} = 1440 rpm
    i.   Draw and Select suitable structural diagram.
   ii.   Draw a ray diagram and speed chart
  iii.   Determine the number of teeth on each gear
  iv.   Draw the deviation diagram

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Duration: 3 hrs   **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
   (2) Attempt any three questions out of the remaining five.
   (3) All questions carry equal marks.
   (4) Assume suitable data, if required and state it clearly.

1   Attempt any FOUR   [20]
   a) Discuss the career opportunities in the field of Environmental
      management.
   b) What is meant by disaster? Write a note on industrial Disaster.
   c) Explain the concept of TQEM?
   d) Define Renewable and Non-Renewable energy with examples.
   e) What are the objectives of Wildlife (Protection) Act?

2 a What is Sustainable Development? Elaborate on the need and goals of   [10]
      Sustainable Development.
   b Describe the energy scenario in India.   [10]

3 a Discuss the role of Regulatory Agencies and Pollution Control Boards in   [10]
      obtaining Environmental Clearance for a Project.
   b Discuss the loss of Biodiversity and also state the link between Biodiversity and [10]
      Climate Change.

4 a What is Corporate Environmental Responsibility? Explain it.   [10]
   b With reference to EMS, explain PDCA cycle with neat diagram.   [10]

5 a Write short note on: [10]
      (a) Atomic hazards
      (b) Biomedical hazards
   b Discuss the salient features of the Water (Prevention and Control of Pollution) [10]
      Act.

6 a Define food chain and food web.What is ecological pyramid? Discuss different [10]
      types of ecologicalpyramid.
   b What is ISO 14000? What are the benefits of ISO 14000?Why it is important?   [10]

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Note:
1. Question No.1 is compulsory.
2. Attempt any three questions from the remaining.
3. Assume suitable data if required.
4. Use of a steam table is permitted.

Q1.   **Attempt any four.**   **5 Marks Each**

a   Differentiate water tube boilers from fire tube boilers.

b   Write a short note on adiabatic flame temperatures.

c   What are the methods of improving the thermal efficiency of simple open-cycle gas turbines?

d   Differentiate between jet engines and rocket engines.

e   Obtain the expression for the force exerted by a jet of water on a fixed curved plate when the jet strikes at the center of a symmetrically curved blade.

Q2.   **20 Marks**

a   The following data refer to two types of boilers A and B. Compare their efficiency.
Boiler A: Steam produced / kg of fuel = 15 kg, Pressure of steam = 13 bar, Quality of steam (superheat) = 250°C, Feed water temperature = 65°C, Calorific value of oil = 45980   kJ/kg of fuel.
Boiler B: Steam produced / kg of fuel = 10 kg, Pressure of steam = 13 bar, Quality of steam = dry and saturated, Feed water temperature = 26°C, Calorific value of oil = 33890 kJ/kg of fuel.   **10 Marks**

b   Write short notes on (i) Net Positive Suction Head (ii) Centrifugal pumps.
                                                                             10 Marks

Q3.   **20 Marks**

a   With the help of a neat diagram explain the construction and working of a Pelton wheel turbine.   **6 Marks**

b   Define slip, percentage slip, and negative slip of a reciprocating pump.   **4 Marks**

c   A Francis turbine working under a head of 30 m has a wheel diameter of 1.2 m at the entrance and 0.6 m at the exit. The vane angle at the entrance is 90° and the guide blade angle is 15°. The water at the exit leaves the vanes without any tangential velocity and the velocity of flow in the runner is constant. Neglecting the effect of the draft tube and losses in the guide and runner passages, determine the speed of the wheel in rpm and vane angle at the exit.   **10 Marks**

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Q4.   **20 Marks**

a   Define (i) Thrust power (ii) Propulsive power (iii) Propulsive efficiency and (iv) Jet efficiency.   **8 Marks**

b   Calculate the theoretical air-fuel ratio for the combustion of Octane.   **6 Marks**

c   What are the different compounding methods of Impulse turbines?   **6 Marks**

Q5.   **20 Marks**

a   In a stage of an impulse turbine provided with a single-row wheel, the mean diameter of the blade ring is 80 cm and the speed of rotation is 3000 rpm. The steam issues from the nozzles with a velocity of 300 m/s and the nozzle angle are 20°. The rotor blades are equiangular and due to friction in the blade channels, the relative velocity of the steam at outlet from the blade is 0.86 times the relative velocity in the blade. What is the power developed in the blades when the axial thrust on the blades is 140 N?   **10 Marks**

b   The penstock supplies water from a reservoir to the Pelton wheel with a gross head of 500 m. One-third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is 2 m^3/s. The angle of deflection of the jet is 165°. Determine the power given by the water to the runner of the Pelton wheel. Take speed ratio 0.45 and velocity coefficient 1.0.   **10 Marks**

Q6.   **20 Marks**

a   In a gas turbine plant, the pressure ratio through which air at 15°C and 1 bar is compressed to 8 bar with a compression efficiency of 87 %. The air is then heated in the regenerator and the combustion chamber till its temperature is raised to 1500 K, and during this process, the pressure falls by 0.16 bar. The air is expanded in the turbine and passes to the regenerator which has 75 % effectiveness and causes a pressure drop of 0.14 bar. If the isentropic efficiency of the turbine is 88 % determine the thermal efficiency of the plant.

   10 Marks

b   A Single-acting reciprocating pump has a stroke length of 15 cm. The suction pipe is 7 meters long and the ratio of the suction diameter to the plunger diameter is 3/4. The water level in the sump is 2.5 meters below the axis of the pump cylinder, and the connecting sump and pump cylinder is 7.5 cm in diameter. If the crank is running at 75 rpm, determine the pressure head on the piston: (i) in the beginning of the suction stroke, (ii) in the end of the suction stroke, and (iii) in the middle of the suction stroke. Take the coefficient of friction as 0.01.   **10 Marks**

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(3 Hours) (80 marks)

N.B.: (1) Q. No. 1 is compulsory
    (2) Answer any THREE questions from the remaining questions.
    (3) Figures to the right indicate full marks.
   (4) Illustrate answers with neat sketches where ever required.

1.   Write short note on. **(Any Four)**   20

  (a)   Contribution of F. W. Taylor

  (b)   FAST Diagram

  (c)   Job evaluation process

  (d)   Business Process Reengineering (BPR)

  (e)   Maynard Operation Sequence Technique (MOST)

  (f)   Application of IT in Agile manufacturing

2. (a) Define Productivity. Explain productivity measures and productivity improvement techniques in brief.   10

  (b) Define Value Engineering. Write steps of the Value Engineering. Distinguish Value Engineering and Value Analysis.   10

3. (a) What is work measurement? Enlist various techniques of work measurement and explain PMTS in detail.   10

  (b) Discuss information recording techniques of method study in brief. Illustrate string diagram with example.   10

4. (a) Describe factors affecting facility location. Explain any one method for evaluation of facility location.   10

  (b) What are incentive schemes? What are the characteristics of good incentive schemes?   10

5. (a) The observed times and the performance ratings for the five elements are given in the table. Compute the standard time assuming rest and personal allowance as 15% and contingency allowance as 2% of the basic time.   10

Element	1	2	3	4	5
Observed Time (min)	0.2	0.08	0.50	0.12	0.10
Performance Rating	85	80	90	85	80

  (b) Explain: (i) Flexible Manufacturing system, (ii) Lean manufacturing system   10

6. (a) The precedence diagram for activity A to G is shown below. The element   10
time required for the activities are shown in the diagram. The line operates
for 7 hours per day and the output of 550 units are desired.

1. Calculate the cycle time and theoretical minimum number of work
stations required.

2. Group the tasks in appropriate number of workstations

3. Calculate the balance efficiency.
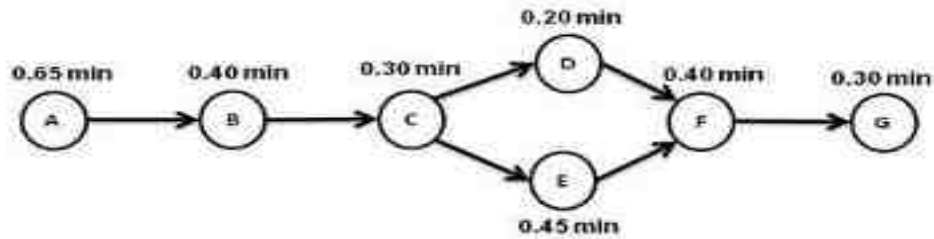
(b) What is Material Handling System? What are the important principles of   10
Material Handling?