AKTC KALSEKAR TECHNICAL CAMPUS
INNOVATIVE TEACHING   EXUBERANT LEARNING

Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2022-23/   Date: 25/01/23

School: SoET-REV. C-SCHEME   **Branch:** MECH. ENGG.   **SEM:** VI

To,
Exam Controller,

AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format SC	Format HC	No. of Copies
1	Machine Design	MEC601		✓	
2	Turbo Machinery	MEC602		✓	
3	Heating, Ventilation, Air conditioning and Refrigeration	MEC603		✓	
4	Automation and Artificial Intelligence	MEC604		✓	
5	Department Level Optional Course II	MEC605			

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

7/12/22

opm   Sem-VI- CBCS-C-19- KT ME - R-19

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

N.B.   **(1)** Question no. **1** is **compulsory**.
      (2) Attempt any **three** questions out of remaining **five** questions.
      (3) Use of standard data book like PSG, Mahadevan is permitted.
      (4) Figures to the **right** indicate full **marks**.

1.   Attempt any FOUR of the following :   (20)
    (a) Explain the safe region and boundary conditions with suitable sketch for the maximum principal stress theory.
    (b) Describe various stresses in a belt with formula and its meaning.
    (c) Compare between rolling contact and sliding contact bearing.
    (d) Give detail classification of coupling.
    (e) Which threads are used in power screw? Give reason for your answer.

2.   **(a)** Design a knuckle joint to connect two rods subjected to a load of 40 KN. The (12)
material for rod and knuckle pin can be assumed as 40C8. A suitable factor of safety can be considered if required for designing the joint.
  (b) A helical compression spring is subjected to a load that ranges from 600 N to 1200 (08)
N. If the compression in the spring for the maximum load is 30 mm and spring index in 6, design the spring. The yield stress in shear for the spring material is 960MPa, endurance strength on shear as 480MPa and modulus of rigidity as 80×10^3 MPa.

3.   **(a)** Determine the life of a mechanical element subjected to complete reversed bending (12)
stress cycle as follows:
    i) ± 300 MPa for 30% of time   ii) ± 275 MPa for 25% of time
    iii) ± 400 MPa for 10% of time   iv) ± 325 MPa for 25% of time
    v) 0 MPa for 10% of time
    The material has ultimate tensile strength of 1200MPa. The operating temperature is 400°C and fatigue stress factor = 0.7.
  (b) Explain the terms: coefficient of speed fluctuation and coefficient of steadiness. (08)

4.   **(a)** A welded joint as shown in Fig. 1, is subjected to an eccentric load of 60 KN in the (10)
plane of the welds. Determine the size of the welds, if the permissible shear stress for the weld is 100 N/mm². Assume static conditions.
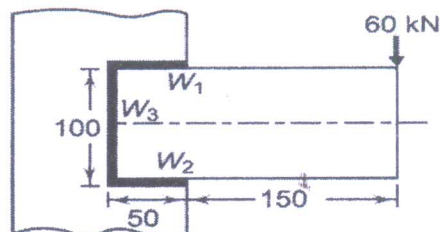
Figure 1 – Q 4 (a)

(b) Explain with a suitable sketch the working of a single plate clutch. (1

5. (a) Determine the suitable diameter for the solid shaft, if it is supported by two bearings (10) placed 1m apart. A 300 mm diameter pulley is mounted at a distance of 250 mm to the right of left hand bearing and this drives a pulley directly below it with the belt. Another pulley 400 mm diameter is placed 350 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulley is 180° & $\mu = 0.3$. The shaft transmits 10KW at 1440 rpm and weight of pulley A is 250N and that of B is 500 N. Assume that the torque of one pulley is equal to that of the other pulley.

(b) A hydrodynamically lubricated full journal bearing is used to support a radial load (10) of 15 KN. The speed of journal is 1500 r.p.m. and l/d ratio is 1. If the permissible bearing pressure is 1.5 N/mm², determine the following:
   i) length and diameter of bearing
   ii) minimum oil film thickness
   iii) coefficient of friction
   iv) oil flow rate
   v) temperature rise.

6. (a) Select a suitable deep groove ball bearing for the shaft diameter of 60 mm and (10) reliability of 98 %. The shaft rotates at 1440 r.p.m. and the bearing carries a radial load of 2500 N and an axial load of 1200N. Expected life of braring is 25000 hours and consider a load factor of 1.2.

(b) Explain the various design considerations for casting with suitable sketches (10) wherever applicable.

ME- A\9

Sem-VI-CBCS-C19-KT Time: 3 Hours   Max. Marks: 80

Note:

1. Question No.1 is compulsory.

2. Attempt any three questions from the remaining.

3. Assume suitable data if required.

Q1.	**Solve any four out of five.**	**5 marks each**

a   What is air compressor and why it is needed for multi staging?
b   What are the methods to improve efficiency of Gas Turbine?
c   State the role of Injector, Super heater, fusible plug and Steam stop valve in Boiler.
d   Write detail classification of Pump.
E   Define Boiler as per ASME.

Q2.

a
A Parson reaction turbine running at 400 rpm with 50% reaction develops 75 kW per kg of the steam. The exit angle of the blade is 20° and the steam velocity is 1.4 times the blade velocity. Determine
(a) Blade velocity,
(b) Blade inlet angle.

10 marks

b
What is the difference between fire tube and water tube boiler? Give proper examples of these two.

5 marks

c
What is the difference between Impulse and Reaction steam turbine?

5 marks

Q3.

a
Air enters the compressor of a gas turbine plant operating on air-standard cycle at 100 kPa and 300 K with a volumetric flow rate of 5 m^3/s. The compressor pressure ratio is 10. The turbine inlet temperature is 1400 K. The turbine and compressor each has an isentropic efficiency of 80%. Calculate the thermal efficiency of the cycle, back work ratio and the net power developed in kW. assume density of air = 1.2 kg/m^3

8 marks

b
Draw a general layout of a hydroelectric power plant using an impulse turbine and define the following:
(a) Gross head, (b) Net head, (c) Hydraulic efficiency, and
(d) Overall efficiency of the impulse turbine.

6 marks

c
Write short note on Ram Engine.

6 marks

Q4.

a   Calculate equivalent evaporation and efficiency of the boiler for the following data: Pressure of steam = 9 bar, Quality of steam = 0.97 dry, Quantity of steam = 5600 kg/hr, Temperature of feed water = 36°C, Coal consumption = 700 kg/hr, C.V. of coal = 31380 kJ/kg of fuel. What will be the saving in coal consumption per hour if by putting an economizer the temperature of feed water is raised to 100^0C and other data remains same except the increase in boiler efficiency by 5 %.

10 marks

b   Write Short note on compounding of Impulse turbine.

5 marks

c   What is priming? Why is it necessary?

5 marks

Q5.

a   A centrifugal pump is to discharge 0.118 m^3/sec at a speed of 1450 r.p.m. against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75 percent. Determine the vane angle at the outer periphery of the impeller.

10 marks

b   What is surging and chocking in compressor.

6 marks

c.   What are the different component of centrifugal pump, describe the significance of all the components and working of centrifugal pump with the help of neat sketch.

4 marks

Q6.

a   A Pelton wheel is to be designed for the following specifications:
Power (Brake or Shaft) = 9560 kW;
Head = 350 m;
Speed = 750 rpm;
Overall efficiency = 85%;
Jet diameter is limited to 1/6th of the wheel diameter.
Determine the wheel diameter, diameter of jet and number of jets required.
Take Cv = 0.985 and speed ratio = 0.45

10 marks

b   What is degree of reaction? Draw velocity triangle diagram for 50% reaction turbine.

5 marks

c   What is cavitation in pump and what is the role of NPSH in cavitation?

5 marks

ME - R19

2:30 pm   Sem-VI -CBCS.C19- KT   13/12/22

(3 Hours)   [Total Marks 80]

Note:

1) Question no. **1** is compulsory.

2) Attempt any **three** questions out of the remaining **five** questions.

3) Clearly mention the assumptions made if any.

4) Use of Refrigerant table, P-h chart, Friction chart, Psychrometric chart and Steam table is permitted.

Q.1 Answer any **Four** of the following: 20

a) Explain Standard VCR cycle with schematic, P-h & T-S diagrams.

b) Explain the terms SHF, RSHF, GSHF and ERSHF.

c) Define refrigerant and classify refrigerant giving examples of each.

d) Define By-Pass Factor of a coil. Express it for heating & cooling coil. Also define efficiency of coil.

e) Write short note on Thermal Comfort

f) Define: Specific Humidity, Relative Humidity, DBT, WBT & DPT

Q.2 a) A boot strap cooling system of 10 TR Capacity is used in an aeroplane. The ambient air temperature and pressure are 20 ºC & 0.85 bar respectively. The pressure of air increases from 0.85 bar to 1 bar due to ramming action of air. The pressure of air discharged from the main compressor is 3 bar. The discharge pressure of air from the auxiliary compressor is 4 bar. The isentropic efficiency of each compressor is 80%, while that of turbine is 85%. The heat exchanger effectiveness for both the heat exchanger is 60%. Assuming ramming action to be isentropic, the required cabin pressure of 0.9 bar and temperature of air leaving the cabin not more than 20 ºC, Find: Power required to operate the system, COP of system.   12

b) Explain following Psychrometric Processes with neat sketch.   08
(i) Heating & Humidification.   (ii) Cooling & Dehumidification.   (iii) Sensible Heating
(iv) Sensible Cooling

Q.3 a) A Vapour Compression Refrigeration System using R-12 works between -25°C and 40°C as evaporator & condenser temperature respectively. Using P-h chart, Determine;
1. COP.
2. Mass of Refrigerant per TR.
3. Piston Displacement per TR using Volumetric Efficiency = 83%.
4. Heat Rejected in the Condenser per TR.
5. Ideal COP.   12

b) Enlist the types of Air Cooling Systems. Explain Simple Air Cooling System with T-S diagram, processes involved in the cycle & application.   08

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Q.4 a) The readings from the Sling Psychrometer are as follows;
Dry Bulb Temperature = 30°C; Wet Bulb Temperature = 20°C; Barometric Reading = 740 mm of Hg;
Using Steam Table, Determine;
1. Dew Point Temperature.
2. Relative Humidity.
3. Specific Humidity.
4. Enthalpy of the mixture per kg of dry air.   10

b) Derive an expression for an equivalent diameter of a circular duct for rectangular duct for same frictional loss per unit length when quantity of air flowing through both ducts is same.   06

c) Write short note on Applications of Refrigeration & AC.   04

Q.5 a) The following data is given for Summer air conditioning of a building:
Outside design conditions = 43°C DBT, 27°C WBT
Inside design conditions = 25°C DBT, 50 %RH
Room Sensible Heat Gain = 84,000 kJ/hr
Room Latent Heat Gain = 21,000 kJ/hr
By-Pass Factor of cooling coil = 0.2
The return air from the room is mixed with the outside air before entering the cooling coil in the ratio
of 4:1 by mass. Determine;
1. Apparatus Dew Point of the cooling coil.
2. Inlet & Outlet conditions of air for cooling coil.
3. Fresh air mass flow rate.
4. Capacity of cooling coil in TR.   14

b) Classify cooling towers. Explain any one type in details. Define Tower Range, Tower Approach & Tower Efficiency.   06

Q.6) Write short note on any **Four** of the following: 20
a) Classification of Heat Pumps.
b) ICE plant.
c) Thermostatic Expansion Valve.
d) ASHRAE Numbering system for Refrigerants.
e) Effective Temperature.
f) Duct design methods.

ME   R-19

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

Sem - VI CBCS-C19 - KT

NB   1) Question No. 1 is compulsory
      2) Attempt any three questions out of the remaining five questions.
      3) Figures to the right indicate full marks.
      4) Assume suitable data wherever required but justify the same.

Q1.   **Attempt any four**   **(20)**

    A. Define degree of Freedom (DoF) for robot. Explain robot anatomy in detail.
    B. Explain Liner regression and its application in AI.
    C. Write short note on PLC Structure, Advantages and Disadvantages.
    D. Explain in detail Levels of Automation.
    E. Draw & Explain the electro pneumatic circuits for direct & Indirect control for
   Double active cylinder 5/2 DCV both solenoid operated.

Q2   A. Write detail note on Robot Configurations with respect to joints, applications,   **(8)**
             advantages & Disadvantages. (any two)
         B. Write short note on Basic model of ANN.   **(6)**
         C   Explain FRL unit used in Pneumatics.   **(6)**

Q3   A. Explain Breadth first search Algorithm in detail with example   **(10)**
         B. Design electro Pneumatic circuit for two cylinder operation with following   **(10)**
             sequence using 5/2 both side solenoid operated valve as DCV.
                           (AB) + A – Delay B-
             With user selection option single cycle & Multicycle operation.

Q4   A. Design simple hydraulic circuit for two cylinder operation with following   **(12)**
             sequence using 4/2 pilot operated valve as DCV using cascade method
                           A+ B+ Delay A- B-
             With user option of single cycle – multi cycle. Also draw displacement diagram.
         B. Compare Supervised, Unsupervised and reinforcement learning with different   **(08)**
             parameters.

Q5   A. Explain any two intelligent agents in detail.   **(08)**

         B. Explain tree and graph search.   **(06)**
         C. Explain selection criteria for Robot.   **(06)**

Q6   A. Differentiate between uninformed and informed search algorithms.   **(05)**
         B. Write detail note on types of end effecters used in robotics.   **(05)**
         C. Identify following valve specification & discuss in detail.   **(05)**
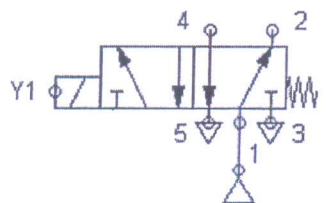
    D. Write short note on timers and counters used in PLC Circuits.   **(05)**
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