

1/6/17

Q. P. Code : 635900

(4 Hours)

MAXIMUM MARKS: 100

- Question No. 1 is compulsory.
- Attempt any four questions from the remaining.
- Assumption made should be clearly stated.
- Use of PSG Design Data Book is permitted.

Q.1 Answer any four

- Draw a bevel gear and show Pitch Cone, Pitch angle, Back cone, Addendum and dedendum angle. 5
- Explain advantages and disadvantages of rolling element bearing and sliding contact bearing. 5
- Explain Bend and its significance in the design of the rope for hoisting mechanism. 5
- Explain the interference phenomenon in involute gears. State the condition to avoid the interference. 5
- For axial loading which types of RC bearings are used, explain with neat sketches. 5

Q.2 (a) Design a pair of steel spur gears to transmit 12 KW at 900 rpm of pinion in continuous service. Check for dynamic load and contact stresses. The desire transmission ratio is 3:1. Write constructional details with neat sketches. 20

Q.3 (a) Design a Worm drive used for transmitting power of 10KW with a transmission ratio of 28. The worm is rotating at 1440 rpm. The material of the worm is phosphor bronze. The tooth form is 20 degree involute type. 12

- Explain how Reliability, Speed, Temperature and Load affects the life of the rolling element bearing. 08

[TURN OVER]

- Q.4 (a) Select the suitable rolling contact bearing for an expected life of 10 10000 hrs. if the inner race is rotating and loads are steady. The bearing undergoes the following work cycle.
- Radial load 4500N at 300rpm for 50% of the time.
 - Radial load 5500N at 400rpm for 30% of the time.
 - Radial load 6500N at 500rpm for 20% of the time.
- (b) A shaft of 100mm diameter is supported in a foot step bearing which is counter bored at the end with a hole diameter of 40 mm. The speed of the shaft is 100 rpm and the allowable bearing pressure is 0.8MPa. Determine the load which can be supported and power lost in the friction. 10
- Q.5 (a) For the following specification of an EOT Crane,
Application - Class II
Load to be Lifted - 200 KN
- Design a rope of 6x37 type and find its life in months. 8
 - Select standard sheave and design Axle and Bearing. 6
 - Design the crane hook and find induced stresses at most critical section. 6
- Q.6 (a) Explain different types of cam follower motion and their application. 4
- (b) A Rotary disc cam with central translatory roller follower has following motion. 16
Forward Stroke of 30mm in 120° of cam rotation with cycloidal motion, dwell of 60° of cam rotation and return stroke of 30mm in 120° of cam rotation with SHM. Remaining dwell to complete the cycle. Mass of the follower is 1 Kg and cam shaft speed is 600 rpm. The maximum pressure angle during forward stroke and return stroke is limited to 24° . The external force during forward stroke is 500 N and that of return stroke is 50N. Find cam dimension, roller follower along with pin and spring.

[TURN OVER]

Q.7 (a) What is function of stuffing box and explain why delivery valve is closed at the starting of the centrifugal pump. 5

(b) Refer the data given for a Centrifugal Pump.

Manometric Head: 30 m

Discharge: 200 Litres per Minute

- i) Decide diameters of the suction and delivery pipes. 3
- ii) Select the type of motor and determine the power and speed. 3
- iii) Design the impeller (impeller dia., inlet and outlet vane angles, no. of vanes, width at inlet and outlet.) 6
- iv) Design the shape of volute casing. 3

(2)

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(R R A C)

19/5/17

Q.P. Code : 635701

(3 Hours)

[Total Marks: 100]

- Note: 1) Question no. 1 is compulsory.
2) Attempt any **four** questions out of the remaining **six** questions.
3) Clearly mention the assumptions made if any.
4) Use of Refrigerant tables, Friction charts, Psychometrics chart, and Steam table are permitted.

- Q.1** Solve any four 20
- (a) Explain construction and working of simple of vapour compression system.
 - (b) Explain the need of air craft refrigeration.
 - (c) Explain the term 'by pass factor' used for heating and cooling coil.
 - (d) Derive the relationship of COP between refrigerator and heat pump.
 - (e) Define the term effective temperature. ? Explain briefly effective temperature chart.
- Q.2** (a) Explain the household refrigeration system in detail. Draw sketches and various parts involved. 10
- (b) What do mean by cooling, refrigeration and air conditioning. Explain with example 10
- Q.3** A bootstrap refrigeration system is used for air conditioning of an air craft. The following observations are made: 20
- The ambient air temperature is 15°C and 0.85 bar. Pressure increases to 1 bar due to ramming. The ram is compressed in primary compressor to 3.25 bar. Pressure in the secondary compressor is 4.25 bar. The cabin pressure is 0.9 bar and temperature of air leaving the cabin is 22°C. Ramming action is isentropic. Ram air is used for heat exchanger. Assume compressor efficiency = 0.9, Turbine efficiency = 0.85, Effectiveness of heat exchanger = 0.7. Find a) Temperature of air entering the compressor b) Temperature of air leaving the turbine c) Mass of air circulated per unit per ton d) COP.
- Q.4** (a) What do you mean by defrosting? Classify defrosting method. Explain one method in brief. 10
- (b) A vapour compression system using R12 works between -10°C and 35°C as evaporator and condenser temperature respectively. Using P-H chart determines: 10
- (i) COP
 - (ii) Mass flow of refrigerant per TR
 - (iii) Piston displacement per TR using volumetric efficiency = 84%
- Q.5** Following data relates to an air conditioned room. 20
- Outside conditions = 36 °C DBT, 27°C WBT
Inside conditions = 24°C DBT, 50 % RH
Sensible heat load = 12 kW
Latent heat load = 7.3 kW
Apparatus dew point = 7°C
By-pass factor of the cooling coil used = 0.1
Return air from the room is mixed with the outside air before entering the cooling coil in the ratio of 4:1 and return air from room is also mixed after the cooling coil in the ratio 1: 4. The air may be reheated, if necessary, before supplying to the conditioned room. Determine i) Supply air condition to the room ii) Refrigeration load iii) Quantity of fresh air supplied.

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- Q.6 (a) What are types of expansion devices? Explain with neat sketch of thermostatic expansion valve. 10
- (b) Explain various duct design methods with a neat sketch of friction chart 10
- Q.7 Write short notes on any **four** of the following: 20
- a) Commercial ice manufacturing
 - b) Cooling tower
 - c) Air condition and human comfort
 - d) Deep sea water air conditioning
 - e) Lithium bromide-water absorption refrigeration system
