

Hall Ticket Number :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**R-19**

**Code: 19A364T**

III B.Tech. II Semester Supplementary Examinations May/June 2024

## **Design of Machine Elements-II**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks)

\*\*\*\*\*

Marks

### **UNIT-I**

1. Following data is given for a 360° hydrodynamic bearing :
- Radial load = 10Kn, Journal speed = 1440 rpm,  
Unit bearing pressure = 1000 kPa, clearance ratio (r/c) = 800  
viscosity of lubricant = 30 Pa s
- Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate:
- (i) dimensions of bearing; (ii) coefficient of friction;  
(iii) power lost in friction; (iv) total flow of oil;  
(v) side leakage; and (vi) temperature rise. 14M

**OR**

2. a) What are the various terms used the journal bearings analysis and design. Give their definitions in brief. 7M
- b) Explain with reference to the neat sketch the importance of the bearing characteristic curve. 7M

### **UNIT-II**

3. A shaft is mounted on two roller bearings, which are 350 mm apart. The shaft carries a bevel gear at the middle. At a shaft speed of 900 rpm; the gear forces are: radial load = 10 kN, and thrust load = 3.5 kN. Determine the rated dynamic capacity of the bearing, for a desired life of 10,000 hours. The service factor is 1.5, thrust factor is 0.67 and radial load factor is 0.67. 14M

**OR**

4. a) Explain briefly about Static and Dynamic load rating of rolling contact bearings. 4M
- b) A ball bearing subjected to a radial load of 5 kN is expected to have a life of 8000 hours at 1440 rpm with a reliability of 99%. Calculate the dynamic load capacity of the bearing so that it can be selected reliability of 90%. 10M

### **UNIT-III**

5. Design a cast iron piston for a single acting four stroke diesel engine with the following data
- Cylinder bore = 300mm; Length of stroke = 250mm; Speed = 600 rpm  
Brake mean effective pressure = 0.6 MPa;  
Maximum gas pressure = 4MPa;  
Fuel consumption = 0.25 kg per BP per h  
l/d ratio for bush in small end of connecting rod = 1.5  
Assume suitable data if required and state the assumptions made. 14M

**OR**

6. Describe the design procedure for the connecting rod of an I.C.Engine. 14M

<b>UNIT-IV</b>
----------------

7. A semi-elliptic leaf spring used for automobile suspension consists of three extra full-length leaves and 15 graduated-length leaves, including the master leaf. The centre-to-centre distance between two eyes of the spring is 1 m. The maximum force that can act on the spring is 75 kN. For each leaf, the ratio of width to thickness is 9:1. The modulus of elasticity of the leaf material is 207 000 N/mm<sup>2</sup>. The leaves are pre-stressed in such a way that when the force is maximum, the stresses induced in all leaves are same and equal to 450N/mm<sup>2</sup>. Determine
- (i) The width and thickness of the leaves;
  - (ii) The initial nip; and
  - (iii) The initial pre-load required to close the gap C between extra full-length leaves and graduated-length leaves.
- 14M

**OR**

8. a) State the advantages and disadvantages of V belt drive over flat belt drive. 4M
- b) A V-belt drive system transmits 100 kW at 500 rpm. The belt has a mass of 0.6 kg/m. The maximum permissible tension in the belt is 900 N. The groove angle is 38° and the angle of contact is 160°. Find minimum number of belts and pulley diameter. The coefficient of friction between belt and pulley is 0.2 10M

<b>UNIT-V</b>
---------------

9. The following data is given for a spur gear. Number of teeth on pinion = 30, number of teeth on gear = 60, speed of pinion = 1440 rpm, pressure angle = 20° involute type, module = 3 mm, face width = 32 mm, both gears are made of steel with ultimate strength 560 MPa. Determine (a) the rated power on the basis of bending failure if the factor of safety is 1.5, (b) the factor of safety on the basis of dynamic failure. 14M

**OR**

10. a) What are the advantages of Spur gears? 5M
- b) Explain Lewis beam strength equation. 9M

\*\*\*

Hall Ticket Number :										
----------------------	--	--	--	--	--	--	--	--	--	--

<b>R-19</b>
-------------

**Code: 19A362T**

III B.Tech. II Semester Supplementary Examinations May / June 2024

**Engineering Metrology**  
(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

\*\*\*\*\*

Answer five questions by choosing one question from each unit (5 x 14 = 70 Marks)

Marks CO BL

<b>UNIT-I</b>
---------------

1. Differentiate between Hole basis system and shaft basis system with neat sketches 14M CO1 L2

**OR**

2. Explain about the Taylor's principle of gauge design with neat sketches 14M CO1 L2

<b>UNIT-II</b>
----------------

3. Illustrate the working principle of NPL Flatness interferometer with a sketch 14M CO2 L3

**OR**

4. With the help of neat sketches, explain how a sine bar is used to determine the taper angle of an inclined surface? 14M CO2 L2

<b>UNIT-III</b>
-----------------

5. Explain any one mechanical comparator with its advantages, disadvantages and applications. 14M CO3 L2

**OR**

6. Explain the principle of pneumatic comparator with a diagram 14M CO3 L2

<b>UNIT-IV</b>
----------------

7. Discuss constant Chord method for Gear tooth thickness measurement. 14M CO4 L2

**OR**

8. Recall and explain how various elements of a screw thread are measured. 14M CO4 L1

<b>UNIT-V</b>
---------------

9. a) Compare inspection and quality control. 7M CO5 L2

b) What is sampling? Where do you implement single sampling and double sampling plans? 7M CO5 L1

**OR**

10. What is CMM? Explain types of CMM with neat sketches 14M CO5 L1

\*\*\* End \*\*\*

Hall Ticket Number :

**R-19**

**Code: 19A361T**

III B.Tech. II Semester Supplementary Examinations May/June 2024

## Heat Transfer

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks )

\*\*\*\*\*

Marks CO BL

### UNIT-I

1. Derive the general heat conduction equation in spherical coordinates. 14M 1 3

**OR**

2. The surface of steel plate measuring 1.0m long x 0.6m wide x 0.05m thick is maintained at a uniform temperature of 400°C, and the plate loses 300 watt by radiation. If air at 60°C temperature and 30 W/m<sup>2</sup>°C convective heat transfer coefficient blows over the plate, calculate the temperature on inside surface of the plate. Take thermal conductivity of plate as 40 W/m°C 14M 1 3

### UNIT-II

3. Derive temperature distribution equation for fin with insulated end (short fin) 14M 2 3

**OR**

4. A 50 x 50 cm<sup>2</sup> aluminium slab of 6 mm thick is at 400°C initially and it is suddenly immersed in water, so its surface temperature is lowered to 50°C. Determine the time required for the slab to reach 120°C. Take heat transfer coefficient, h = 100W/m<sup>2</sup>K. 14M 2 3

### UNIT-III

5. a) Explain the formation of hydrodynamic boundary level over a flat horizontal plate. 8M 3 3  
b) Define Prandtl number and Grashof number 6M 3 1

**OR**

6. A large vertical plate 4.0 m high is maintained at 60°C and exposed to atmospheric air at 10°C. Calculate the heat transfer if the plate is 10 m wide 14M 3 3

### UNIT-IV

7. a) Derive an expression for radiation heat exchange between two large parallel planes 7M 4 3

- b) Two parallel grey planes with emissivities of 0.8 and 0.7 are maintained at 800°C and 1500°C. What is the net radiant energy exchange? What would be the reduction in heat transfer if a radiation shield of polished aluminum (Emissivity = 0.04) is placed between them? 7M 4 3

**OR**

8. A vertical square plate, 30 cm by 30 cm, is exposed to steam at atmospheric pressure. The plate temperature is 98°C. Calculate the heat transfer and the mass of steam condensed per hour. 14M 4 3

### UNIT-V

9. A hot gas at the rate of 16.2 kg/sec at 648°C ( $C_p=3.52\text{kJ/kgK}$ ) is used to heat 20.2kg/sec of the incoming fluid from 100°C ( $C_p=4.2\text{kJ/kgK}$ ) in a heat exchanger. If the overall heat transfer coefficient is 0.92 kW/m<sup>2</sup>K for an effective area of 43.8 m<sup>2</sup>, find the fluid outlet temperature for counter flow and parallel flow arrangements. 14M 5 3

**OR**

10. Derive an expression for the LMTD method of Counter flow heat exchangers? 14M 5 3

\*\*\*

**Code: 19A36CT**

III B.Tech. II Semester Supplementary Examinations May / June 2024

**Instrumentation and Control Systems**

( Mechanical Engineering )

Max. Marks: 70

Time: 3 Hours

Answer all five units by choosing one question from each unit ( 5 x 14 = 70 Marks )

\*\*\*\*\*

**UNIT-I**

1. a) What is the function of a sensing element, signal conditioner and indicating element of a measuring instrument? 7M
- b) Discuss the necessity and importance of static performance of measurement systems 7M

**OR**

2. a) Explain the basic principal of working of piezo-electric transducers 7M
- b) Write short notes on calibration procedures for transducers 7M

**UNIT-II**

3. a) What do you mean by low pressures? List out various indirect methods for measurement of low pressure and explain any two methods. 7M
- b) Explain the disappearing filament pyrometers setup and explain its operation 7M

**OR**

4. a) Explain any two temperature measurement equipment's with neat sketches 10M
- b) Classify pressure measurement techniques 4M

**UNIT-III**

5. a) Name the different vibration sensing system used in practice. Explain any one such system for the measurement of vibration. 8M
- b) Explain mechanical torsion meter and derive its equation. 6M

**OR**

6. a) With a neat sketch explain Elastic force meters. 7M
- b) Explain the working of optical torsion meter for the measurement of torque with a neat sketch. 7M

**UNIT-IV**

7. a) Derive, from the first principles, the relationship for gauge factor of a strain gauge. 7M
- b) What is temperature compensation and how it is achieved when using bonded strain gauge for the measurement of axial thrust, bending loads and torque? 7M

**OR**

8. a) What is the function of Rosettes? Explain the working of (i) Rectangular strain gauge rosettes and (ii) Delta strain gauge rosettes. 7M
- b) Explain the principles operation of electrical resistance strain gauges and their merits and demerits. 7M

**UNIT-V**

9. a) Describe typical closed-loop control systems that can be used in order to control the temperature of water being heated by steam, and Draw the block diagram of the arrangement and mention the use of feedback in application. 8M
- b) What is Automatic control? Describe the automatic tank level control system. 6M

**OR**

10. a) Distinguish between
- i) Manual control system and Automatic control systems. 7M
- ii) Position control and Velocity control. 7M
- b) What are the elements of control system? Discuss about open system with block diagram. 7M

\*\*\*\*\*

Hall Ticket Number :

R-19

Code: 19A363T

III B.Tech. II Semester Supplementary Examinations May/June 2024

**Applied Thermodynamics-III**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks )

\*\*\*\*\*

Marks CO BL

**UNIT-I**

1. a) Classify the gas turbine cycles? 4M CO1 L4  
 b) A Gas turbine plant works between the temperature limits of 11520 K and 2880 K. Isentropic efficiency for compressor and turbines are 0.85 and 0.8 respectively. Determine the optimum pressure ratio for maximum work output and also for maximum Cycle thermal efficiency. 10M CO1 L3

**OR**

2. a) Write the basic differences between Propeller Jet and Turbojet engines. 7M CO1 L2  
 b) With a neat sketch explain the working principle of Pulse jet engine. 7M CO1 L2

**UNIT-II**

3. a) Discuss the advantages of the dense air refrigeration system over an open air refrigeration system? 7M CO2 L2  
 b) Mention the advantages of vapour compression refrigeration system over air refrigeration system. 7M CO2 L2

**OR**

4. An ice plant produces 15 tonnes of ice per day at 0°C using water at room temperature of 30°C. Calculate the power rating of the compressor-motor if the COP of the plant is 2.5. Consider overall electro-mechanical efficiency of compressor-motor is 0.9. Consider latent of heat of freezing for water is 335 kJ/kg. Specific heat of water is 4.184 kJ/kgK 14M CO2 L3

**UNIT-III**

5. a) Draw a neat line diagram of Electrolux refrigerator and explain its working principle. 10M CO3 L2  
 b) What are the desirable requirements of a Refrigerant - Absorption pair? 4M CO3 L1

**OR**

6. a) Define a refrigerant. How are refrigerants classified? 4M CO3 L1  
 b) With the help of neat diagram, explain the working of practical vapour absorption refrigeration system. 10M CO3 L2

**UNIT-IV**

7. The sling psychrometer in a laboratory test recorded the following readings: Dry bulb temperature = 35°C, Wet bulb temperature = 25°C. Calculate the following: (i) Specific humidity (ii) Relative humidity (iii) Vapour density in air (iv) Dew point temperature (v) Enthalpy of mixture per kg of dry air. Take atmospheric pressure = 1.0132 bar. 14M CO4 L3

**OR**

8. a) Describe the working of winter air-conditioning system with a neat sketch. 7M CO4 L2  
 b) Elaborate the requirements of human comfort and define effective temperature. 7M CO4 L2

**UNIT-V**

9. a) Write a short note on air-washer type humidifier with diagram. 7M CO5 L2  
 b) List out the different dehumidifiers and explain in detail any one of them. 7M CO5 L2

**OR**

10. a) With the aid of a neat sketch, explain the working of an Air to Air heat pump circuit. 7M CO5 L2  
 b) Describe Calcium chloride absorption system with a diagram. 7M CO5 L2

\*\*\*