S7 - MECHANICAL QUESTION BANK 2024

Questions compiled by

DEPARTMENT OF MECHANICAL ENGINEERING

VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL CAMPUS, KILIMANOOR, THIRUVANATHAPURAM

CODE MET 401	COURSE NAME: Design of Machine Elements	L-T-P 2-1-0	Credit: 4
Q.No	**Module I**		**Marks**
1	Draw the stress- strain behaviour of the following materials i) Ductile ii) brittle and iii) perfectly elastic-plastic	KTU Model	3 Marks
2	Explain maximum principal stress theory and max shear stress theory of failure	KTU Model	3 Marks
3	What is the fatigue stress concentration factor?	KTU Model	3 Marks
4	Explain the steps involved in the design process.	May 2020	3 Marks
5	What is factor of safety? What are the factors affecting factor of safety?	May 2020	3 Marks
6	What are the endurance strength modification factors?	KTU Model	3 Marks
7	Explain the effect of stress concentration on ductile and brittle materials under static and variable loading.	June 2021	6 Marks
8	Explain impact factor.	June 2021	2 Marks
9	How will you design a component made of steel subjected to variable load for a finite life?	May 2020	4 Marks
10	What do you mean by preferred numbers? Explain with the help of an example	May 2020	5 Marks
11	Define the term notch sensitivity. Establish the relationship between notch sensitivity and fatigue stress concentration factor.	KTU Model	5 Marks
12	A cantilever beam of square section supports an electric motor weighing 1000 N at a distance of 400 mm from the fixed end. If the allowable stress of beam material is 100 N/mm2, Determine section of beam.	May 2022	5 Marks
13	What is the effect of centrifugal tension on power transmission by a belt drive?	May 2022	3 marks
14	What types of stresses are induced in shafts?	May 2023	3 marks
15	What is the manufacturing method for connecting rod?	May 2023	3 marks
16	A shaft of a motor is supported at two points which are 900 mm apart. The motor develops 20 kW at 1500 rpm. The armature of the motor can be considered as a uniformly distributed load of 15 N/mm, centrally spread over a length of 600 mm,selecting a suitable material and choosing appropriate value for the factor ofsafety, determining the diameter of the motor shaft.	May 2023	14 marks
17	Select a suitable flat belt for a horizontal drive for a compressor. An electric motor of 6.5 kW having a speed of 1500 rpm is used to drive the compressor. The speed of the compressor pulley is 500 rpm. Assume a service factor of 1.2, slip = 2.5 %, and working stress of 2.3 MPa.	May 2023	14 marks
Q.No	**Module II**		**Marks**
1	What is the principle of operation of a centrifugal clutch? What are its applications?	May 2022	3 marks
2	Differentiate between self locking and self energizing block brakes.	KTU Model	3 marks
3	What are the advantages and disadvantages of a band brake?	May 2022	4 marks
4	A multi plate clutch having effective diameters 250 mm and 150 mm has to transmit 60 kW at 1200 rpm. The end thrust is 4.5 kN and coefficient of friction is 0.08. Calculate the number of disks assuming (i) uniform wear condition and (ii) uniform pressure condition.	KTU Model	12 marks
5	Determine the main dimensions of a cone clutch faced with leather to transmit 30 kW at 750 rpm from an electric motor to an air compressor. Assume an over load factor of 1.75. Due to possibility of contamination of lining, a low value of coefficient of friction 0.2 is recommended	May 2022	12 marks
6	What is the principle of operation of a centrifugal clutch? What are its applications?	KTU Model	3 marks
7	A simple band brake as shown in figure below is to be designed to absorb a power of 32 kW at a rated speed of 850 rpm. Assume μ = 0.25. Determine, (i) The effort required to stop clockwise rotation of the brake drum, (ii) The effort required to stop counter clockwise rotation of the brake drum,(iii) The dimensions of the rectangular cross-section of the brake lever assuming its depth to be twice the width, and (iv) the dimensions of the cross-section of the band assuming its width to be ten times the thickness.	KTU Model	11 marks
8	What are the advantages and disadvantages of band brake?	KTU Model	4 marks
9	Determine the main dimensions of a cone clutch faced with leather to transmit 30 kW at 750 rpm from an electric motor to an air compressor. Assume an over load factor of 1.75. Due to possibility of contamination of lining, a low value of coefficient of friction 0.2 is recommended.	KTU Model	12 marks
10	What is the principle of operation of a centrifugal clutch? What are its applications?	June 2021	3 marks
11	A single dry plate clutch is to be designed to transmit 8 kW at 1000 rpm. a) Find out the clutch dimensions assuming the ratio of the mean radius to the face width as 4.	June 2021	15 marks

12	An automotive type internal expanding shoe is shown in the diagram. The face width of the friction lining is 60mm and the coefficient of fiction is 0.35.the maximum intensity of pressure is limited to 1.2 N/mm2..Assume angle θ=0.Calculate (1) the actuating force 'F' (2) The torque capacity of the brake	June 2021	15 marks
13	Why are clutches usually designed on the basis of uniform wear?	May 2023	3 marks
14	What is a differential band brake?	May 2023	3 marks
15	A single plate clutch having one pair of contacting surfaces to transmit 15 kW at 1500 rpm. The coefficient of friction between contact face is 0.35 and the permissible intensity of pressure should not exceed 0.6 N/mm2. The outer diameter of the clutch is 300 mm. Determine the clutch dimensions by assuming uniform wear theory.	May 2023	14 marks
16	A simple band brake is to be designed to stop the rotation of a shaft transmitting a power of 50 kW at a rated speed of 600 rpm. The diameter of the drum is 600 mm, angle of contact of the band on drum is 2250 and the total length of the lever is 1000 mm. Distance between the fulcrum and the other end of the band is 300 mm. The drum rotates in the clockwise direction and free end of the lever at the left side of the drum. Selecting suitable materials determine: (i) band dimensions, (ii) brake lever dimensions, and (iii) diameter of fulcrum pin.	May 2023	14 marks

Q.No	Module-III		Marks
1	Discuss the significance of bearing modulus in the design of journal bearing?	May 2022	3 marks
2	With the help of neat sketches illustrate the working principle of hydrodynamic journal bearings.	KTU Model	3 marks
3	Enumerate any two advantages and disadvantages of rolling contact bearing over sliding ontact bearing.	June 2021	3 marks
4	What is L10 and L50 life of ball bearing?	May 2022	3 marks
5	Discuss the significance of bearing modulus in the design of journal bearing?	KTU Model	3 marks
6	A single row deep groove ball bearing has a dynamic load capacity of 40210 N and operates on the work cycle consists of radial load of 2000 N at 1000 rpm for 25 % of the time, radial load of 5000 N at 1500 rpm for 50 % of time, and radial load of 3000 N at 700 rpm for the remaining 25 % of time. Calculate the expected life of the bearing in hours.	June 2021	10 marks
7	Define static and dynamic load carrying capacity of ball bearing.	KTU Model	5 marks
8	A 80 mm diameter full journal bearing support a radial load of 600N. The speed of the shaft = 1200rpm. Design the bearing.	KTU Model	10 marks
9	Design a ball bearing which is required to support a shaft of 70mm with a radial load of 8kN and a thrust load of 5kN. The rated life of the bearing is to be 1000hours, with inner ring rotating at 1000rpm.	KTU Model	15 marks
10	An 80mm diameter full journal bearing supports a radial load of 600 kgf. The length of bearing is 80mm.The speed of the shaft is 600 rpm. The oil film thickness radial clearance is 0.170 mm. Design the bearing.	May 2022	15 marks
11	A single row deep groove ball bearing is subjected to a radial force of 9kN and a thrust force of 3kN.the shaft rotates at 1400rpm.The expected life L 10h of the bearing is 18000h.The minimum acceptable dia of the shaft is 80mm. Design the bearing.	KTU Model	15 marks
12	A 90 mm diameter full journal bearing support a radial load of 700kgf. The length of the bearing= 90 mm.The speed of the shaft = 700rpm.The oil film thickness= 0.04mm.The radial clearance= 0.180 mm. Design the bearing	May 2022	15 marks
13	State desirable properties of a good lubricant.	May 2023	3 marks
14	Enumerate the advantages of needle roller bearings.	May 2023	3 marks
15	A lightly loaded 0.1 m long journal bearing is acted on by 0.6 kN radial load. The 0.07 m diameter journal is rotating at 1500 rpm. The viscosity of the oil is 3.5 cP and radial clearance of 5 × 10−5 m. Determine the frictional power loss usinng Petroff's equation.	May 2023	14 marks
16	Select suitable deep groove ball bearing for a shaft diameter of 50mm.The shaft operates at 3000 rpm and is acted upon by steady and continuous 5000 N radial load and 2000 N thrust load. The life expectancy of the bearing is 20000 hours.	May 2023	14 marks

Q.No	Module-IV		Marks
1	Design a spur gear drive required to transmit 15 kW at 800 rpm of the pinion. The speed ratio is 3.2:1. Use 20° full depth involute system. Check the gear pair for safe endurance strength and surface durability based on the calculation of dynamic load from Buckingham's equation.	KTU Model	15 marks

2	A helical gear speed reducer is to be designed. The rated power of the speed reducer is 75 kW at a pinion speed of 1200 rpm. The speed ratio is 3:1. For medium shock conditions and 24 hr operation, design the gear pair. The teeth are 20o full depth involute in the normal plane and helix angle is 30 o .	June 2021	15 marks
3	A motor shaft rotating at 1440 rpm has to transmit 15 kW power to a low speed shaft running at 500 rpm. A 200 pressure angle full depth involute system of gear tooth is used. The pinion has 25 teeth. Both gear and pinion are made of cast iron having allowable static strength of 55 MPa. Design a suitable spur gear drive and check the design for dynamic load and wear.	KTU Model	15 marks
4	A helical gear speed reducer is to be designed. The rated power of the speed reducer is 75 kW at a pinion speed of 1200 rpm. The speed ratio is 3:1. For medium shock conditions and 24 hr operation, design the gear pair. The teeth are 20o full depth involute in the normal plane and helix angle is 30 o .	June 2021	16 marks
5	Design a helical gearing to transmit 60 HP. The pinion runs at 6000 rpm. The speed ratio is 3. Check also the gear pair for safe endurance strength and surface durability based on the estimate of dynamic load from Buckingham's equation.	KTU Model	15 marks
6	A pair of helical gears with 23o helix angle is to transmit 12.5 kW at 1600 rpm of the pinion at a velocity ratio of 4:1. Both gears are to be made of hardened steel, with an allowable stress of 109.87 N/mm2 Use 20° involute system for the gear pair. Design the gear pair and check the design against safety also.	June 2021	15 marks
7	The vertical spindle of a drilling machine is to be driven by a pair of right angled bevel gears with 20° involute teeth. The speed reduction is 3:1. The drill requires a power of 15 HP at 500 rpm. A service factor of 1.15 may be taken and select suitable materials for gear and pinion. Design the gear pair and check its safety.	KTU Model	15 marks
8	A pair of spur gear is required to transmit 18kW power. The input shaft rotates at 600rpm and the output shaft rotates at 160rpm. Design the spur gear.	KTU Model	15 marks
9	Design a helical gearing to transmit 60 HP. The pinion runs at 6000 rpm. The speed ratio is 3. Check also the gear pair for safe endurance strength and surface durability based on the estimate of dynamic load from Buckingham's equation.	KTU Model	20 marks
10	A pair of 20o full depth involute bevel gears is used to connect two shafts at right angles having a velocity ratio 2.5: 1. The gear is made from cast steel and the pinion is from the forged steel. Pinion transmits 37.5 kW at 750 rpm.Design the gear drive and check the design for dynamic and wear loads.	May 2022	20 marks
11	A helical gear speed reducer is to be designed. The rated power of the speed reducer is 75 kW at a pinion speed of 1200 rpm. The speed ratio is 3:1. For medium shock conditions and 24 hr operation, design the gear pair. The teeth are 20o full depth involute in the normal plane and helix angle is 30 o .	KTU Model	16 marks
12	What are the advantages of 20 degree full depth involute teeth gears?	May 2023	3 marks
13	Compare the contact between mating teeth of parallel and crossed helical gears.	May 2023	3 marks
14	Design a pair of spur gear to transmit 20 kW power with velocity ratio of 4:1.The pinion is rotating at 1200 rpm. The centre distance between parallel shaft is 150mm.The allowable static stress for pinion and gear materials are 206.3 MPa and 137.2 MPa respectively.	May 2023	14 marks
15	Design a pair of equal diameter helical gears to transmit 35 kW at 1000 rpm. Theparallel shafts are 0.5 m apart. Assume the helix angle is 300, pressure angle is 200 stub.The gear is made of steel.	May 2023	14 marks
Q.No	**Module V**		**Marks**
1	A pair of 20o full depth involute bevel gears is used to connect two shafts at right angles having a velocity ratio 2.5: 1. The gear is made from cast steel and the pinion is from the forged steel. Pinion transmits 37.5 kW at 750 rpm.Design the gear drive and check the design for dynamic and wear loads.	May 2022	16 marks
2	Design a worm gear drive to transmit 20 HP from worm at 1440 rpm to the worm wheel that should be rotated at 200 rpm	KTU Model	10 marks
3	Design a worm gear drive to transmit 20 HP from worm at 1440 rpm to the worm wheel that should be rotated at 40+/-2%rpm.	KTU Model	10 marks
4	The vertical spindle of a drilling machine is to be driven by a pair of right angled bevel gears with 20° involute teeth. The speed reduction is 3:1. The drill requires a power of 15 HP at 500 rpm. A service factor of 1.15 may be taken and select suitable materials for gear and pinion. Design the gear pair and check its safety.	May 2022	16 marks
5	A pair of 20o full depth involute bevel gears is used to connect two shafts at right angles having a velocity ratio 2.5: 1. The gear is made from cast steel and the pinion is from the forged steel. Pinion transmits 37.5 kW at 750 rpm.Design the gear drive and check the design for dynamic and wear loads.	May 2022	16 marks

6	A pair of bevelgear is required to transmit 20kW power. The input shaft rotates at 700rpm and the output shaft rotates at 170rpm. Design the bevelgear.	May 2022	10 marks
7	A pair of bevel gear is required to transmit 15kW at 2000rpm. The output shaft is running at 500rpm. The helix angle is 30˚. Design the pair of gears.	KTU Model	10 marks
8	What are the applications of worm gear?	KTU Model	4 marks
9	Why worm gear arrangement is used for high speed reduction?	June 2021	4 marks
10	Why worm gear arrangement is used in windshield wipers in automobiles?	KTU Model	4 marks
11	List out any four applications of bevel gears.	June 2021	4 marks
12	What is the relationship between actual and virtual number of teeth and the pitch angle in bevel gears?	May 2023	3 marks
13	Why is the efficiency of worm gear drive low?	May 2023	3 marks
14	a) Under what circumstances the bevel gears are used? Give a detailed classification of bevel gears.b) With a neat sketch explain the terminology of bevel gears.	May 2023	14 marks
15	Five kW of power at 1500 rpm is supplied to the worm shaft. The normal pressure angle is 200 degrees and coefficient of friction is 0.1. Determine the components of gear tooth force acting on the worm and worm wheel. The worm and worm gear is designated as 3/60/10/8.	May 2023	14 marks

CODE: CET455	COURSE NAME: ENVIRONMENTAL HEALTH AND SAFETY	L-T-P 2-1-0	Credit: 3
Q.No	**Module I**	Month & Year	Marks
1	What are the socio- economic reasons in safety?	KTU Model	3
2	Define industrial hygiene.	KTU Model	3
3	Briefly explain about occupational related diseases found in the industries.	KTU Model	14
4	Write the short notes on : (i) Silicosis (ii) Asbestosis (iii) Anthracosis (iv) Anthrax.	KTU Model	14
5	Classify any two occupational related diseases.	June 2022	6
6	Compare local and chronic industrlal toxins.	June 2022	4
7	Identify suitable measures of reducing industrial toxins.	June 2022	5
8	Outline the differences between silicosis and asbestosis.	June 2022	6
9	Write the effects of lead on occupational health.	May 2019	4
10	What are the local, systemic and chronic effects of industrial toxicology?	May 2019	6
11	Describe the role of an industrial hygienist.	May 2019	5
Q.No	**Module II**	Month & Year	Marks
1	Define noise. What are the compensation aspects of noise?	KTU Model	3
2	Explain about the biohazard control program.	KTU Model	3
3	Write briefly about the classification of bio hazardous agents.	KTU Model	7
4	What are the precautionary measures for chemical hazards?	KTU Model	7
5	Write short notes on : (i) Vapour (ii) Fog (iii) Dust (iv) Fumes.	KTU Model	14
6	Summarize the effects of chemical hazards due to dust and mist.	June 2022	4
7	Explain the classification of biohazardous agents.	June 2022	6
8	Choose any two methods of controlling chemical hazards.	June 2022	4
9	Write a short note on noise exposure regulation.	May 2019	5
10	List out the major causes of electrical hazard.	May 2019	6
11	What are the effects of electric shock on human body?	Oct 2019	4
Q.No	**Module III**	Month & Year	Marks
1	Discuss the possible electrical injuries in a construction industry.	KTU Model	3
2	What are the hazards due to radiation?	KTU Model	3
3	Explain effects of radiation on human body and the methods of radioactive waste disposal.	KTU Model	14
4	What are the requirements for safe work platform?	KTU Model	7
5	Discuss about the scaffolding inspections.	KTU Model	7
6	Explain the most relevant types of ionizing radiation and their effects.	June 2022	5
7	Summarize the types and effects of radiation on the human body.	June 2022	6
8	Identify suitable measures for protection against voltage fluctuations.	June 2022	3
9	Compare the uses of scaffolding and working platform.	June 2022	6
10	Outline the safety measures to be adopted by workers in a construction industry.	June 2022	3
11	Explain the effects of radiation and industrial hazards on human body.	June 2022	6
12	Summarize the safety measures while executing concreting work.	June 2022	4
13	Classify the various methods adopted for recycling and reuse of radioactive wastes.	June 2022	8
Q.No	**Module IV**	Month & Year	Marks
1	What are the criteria air pollutants?	KTU Model	3
2	Describe the Depletion of Ozone Layer.	KTU Model	3
3	Describe the effect of air pollution on environment.	KTU Model	14
4	Describe the effect of water pollution on environment.	KTU Model	14
5	Explain the concept of clean coal combustion and its significance.	June 2022	6

6	Classify the air pollutants from industries and explain its effects on human health.	June 2022	6
7	Identify the causes of depletion of ozone layer and suggest suitable measures for improving the situation.	June 2022	5
8	Summarize the effluent quality standards of waste water.	June 2022	6
9	Differentiate point and non point source of water pollution with example..	June 2022	6
10	Identify the various techniques for identification, characterization and classification of hazardous wastes.	June 2022	7
11	Summarize the health hazards caused by water pollutants.	June 2022	6
12	Classify the methods for hazardous waste management and their merits and demerits.	June 2022	7
Q.No	**Module V**	**Month & Year**	**Marks**
1	What are the benefits of safety inspection?	KTU Model	3
2	Discuss the role of an individual in conservation of natural resources.	KTU Model	3
3	What is First aid? Explain CPR.	KTU Model	7
4	What are the important points to be considered in carrying out workplace inspection?	KTU Model	7
5	Explain the first aid measure to be taken during i)gas poisoning, ii)heart attack, iii)chemical splash and iv)electric shock.	KTU Model	10
6	Briefly explain the elementary first aid.	KTU Model	4
7	Explain the importance of industrial hygiene.	June 2022	5
8	Explain pollution control measures adopted in any two major industries.	May 2019	6
9	Write short note on the safety aspects of the following (i)Scaffolding and working platform (4) (ii)Welding and cutting	May 2019	8
10	List out the modern pollution control methods	Sep 2020	6

CODE: MET473	COURSE NAME: AIR CONDITIONING & REFRIGERATION	L-T-P 2-1-0	Credit: 3
Q.No	Module 1	Month & Year	Marks
1	Explain the history of refrigeration?	Dec 2018	3
2	Explain the application of refrigeration?	Dec 2020	3
3	Define COP and Ton of refrigeration.	May 2019	3
4	What are the limitations of Carnot refrigeration cycle?	Dec 2022	3
5	With the help of necessary sketches prove that $COP_{Heat\ Pump} = COP_{Refrigerator} + 1$	May 2018	3
6	Define COP of a refrigeration machine and heat pump?	June 2020	3
7	Derive COP of a Carnot refrigerator and point out the limitations of reversed Carnot cycle and establish the significance of cycle.	May 2018	3
8	Describe working of a simple air conditioning system used for aircrafts	Dec 2020	3
9	Why aircrafts prefer air refrigeration system?	May 2018	3
10	What is a boot strap refrigeration system?	May 2019	3
11	Describe working of a simple air conditioning system used for aircrafts	Dec 2020	3
12	With the help of neat sketches explain the working of a simple vapour compression system	Dec 2019	3
13	In a Bell-Coleman refrigerator air is drawn into the cylinder of the compressor from cold chamber at a pressure of 1.03 bar and temperature 12oC. After isentropic compression to 5.5bar the air is cooled at constant pressure to a temperature of 22oC.The polytropic expansion pV1.25= constant follows and air expanded to 1.03 bar is passed to cold chamber. Determine (1) Work done/kg of air flow (2) Refrigerating effect/kg of air flow (3) COP	May 2019	7
14	a) Derive an expression for COP of an Reversed Brayton cycle air refrigeration system		3
15	b) A regenerative air cooling system is used for an airplane to take 20 TR. The ambient air at a pressure of 0.8 bar and temperature 10oC is rammed isentropically till pressure rises to 1.2 bar. The air bled off the main compressor at 4.5 bar is cooled by the ram air in the heat exchanger whose effectiveness is 60%. The air from the heat exchanger is further cooled to 60oC in the regenerative heat exchanger. The cabin is to be maintained at a temperature of 25oC and pressure of 1 bar. If the isentropic efficiencies of compressor and turbine are 90% and 80% respectively, Find (1) Mass of air bled from cooling turbine to be used for regenerative cooling (2) Power required and (3) COP.	May 2019	7
16	A boot-strap system is used in an air-craft air-conditioning system. Ambient air temperature is 150C and pressure is 0.85 bar. Due to isentropic ramming action, pressure increases to 1 bar. The ram air is used in the heat exchangers. The ram air is further compressed to 3.25 bar in the primary compressor. Pressure after secondary compressor is 4.25 bar. The cabin pressure is maintained at 0.9 bar. The temperature of the air leaving the cabin is 220C. Isentropic efficiencies of the both compressors and turbine are 90% and 85% respectively. Effectiveness of both heat exchangers=.0.7. Assume secondary compressor driven solely by cooling turbine. Find a. COP of the system. b. Power required per ton of refrigeration	Dec 2022	7
17	A bootstrap cooling system of 9 TON refrigeration capacity is employed in an aeroplane. The ambient air temperature and pressure are 200 C and 0.86 bar respectively. The pressure of air increases from 0.86 bar to 1 bar due to ramming action of air. The pressure of air discharged from the main compressor is 3.2 bar. The discharge pressure of air from the auxiliary compressor is 4.2 bar. The isentropic efficiency of each compressor is 82 percent, while that of turbine is 86 percent. 45 percent of the enthalpy of air discharged from the main compressor is removed in the first heat exchanger and 32 percent of the enthalpy of the air discharged from the auxiliary compressor is removed in the second heat exchanger using rammed air. Assuming ramming action to be isentropic, the required cabin pressure of 0.92 bar and the temperature of air leaving the cabin not more than 210C, Find a. The power required to operate the system b. COP of the system.	Dec 2022	10
	Module II		
1	Explain the effect of operating parameters on COP	May 2020	3
2	Explain the significance of Liquid suction heat exchanger in VCRS	Dec 2022	3
3	Sketch and explain actual vapour compression cycle	May 2022	3
4	What is meant by Cascade system?	Dec 2021	3
5	Explain flash inetrcooling and flash gas remaoval	May 2022	3
6	Describe working of a simple air conditioning system used for aircrafts	KTU 2018	3
7	What are the relative advantage and disadvantage of Electrolux refrigeration system	Dec 2022	3
8	A simple saturated heat pump working with refrigerant 134a for space heating operates between temperature limits of 15o C and 50o C. The heat required to be pumped is 100MJ/hr. Calculate 1. Theoretical piston displacement of compressor 2. Theoretical power requirement 3. COP	KTU 2018	7
9	a) Explain any three methods of improving COP of simple vapour compression refrigeration cycle with P-h and T-s diagram		
10	b) A refrigerator works between -7 0C and 270C.The vapour is dry at the end of adiabatic compression. There is no under cooling before expansion.	May 2022	7
11	Determine a. The COP of system b. The power of the compressor to remove 180KJ/min.		
12	The properties of refrigerant as follows		
13	a) With the help of neat sketches explain working of steam jet refrigeration system		4
14	b) A freezer of 20 TR capacity has evaporator and condenser temperature of -30oC and 25oC respectively. The refrigerant R-12 is sub-cooled by 4oC before entering the expansion valve and is superheated by 5oC before entering the evaporator. If a six cylinder single acting compressor with stroke equal to bore running at 1000 rpm. is used. Determine 1. COP 2. Theoretical piston displacement per minute 3. Theoretical bore and stroke.	Dec 2019	7
15	1. a) With the help of neat sketches explain the working of a simple vapour compression refrigeration system.	May 2019	3

16	b) A food storage locker with R12 refrigerant requires a refrigeration of 2400kJ/min. capacity has an evaporator temperature of 263K and a condenser temperature of 303K.The refrigerant is sub cooled by 6oC before entering the expansion valve and vapour is superheated by 7oC before leaving the evaporator coil. The refrigeration compressor is a two cylinder single acting with stroke equal to 1.25 times the bore and operates at 1000rpm. Calculate 1. Mass of refrigerant circulated/min. 2. Heat removed by condenser/min 3.Theoretcal bore and stroke.	May 2019	7
17	A two stage vapour compression machine with a flash inter cooler is to produce 30 TR while working between -35oC and 45oC. The pressure in the flash cooler is the geometric mean of the upper and lower limits. The suction gas to the low pressure compressor is super heated by 5oC and the condenser liquid is sub cooled by 5oC. The working substance is R-12. Determine (i) COP (ii) power (iii) Fluid flow through LP and HP compressor	May 2019	10
18	Explain a three stage cascade refrigeration system with figure. Show the system on p-h diagram.	KTU 2018	10
19	Explain with a neat diagram working of a domestic refrigerator	KTU 2018	10
	Module III		
1	Compare vapour absorption system with vapour compression system?	May 2021	3
2	Compare steam jet refrigeration system with vapour compression system?	Dec 2019	3
3	Explain with the help of flow diagram and on p-h & T-S diagram multi compression refrigeration system with flash cooler and single evaporator compression refrigeration system with flash cooler and single evaporator.	KTU 2018	**10**
4	Explain the working of a refrigerationsystem with multiple evaporator of different capacity with fig	May 2019	7
5	a) Explain Lithium Bromide water absorption system. What are the advantages over ammonia absorption system?	Dec 2022	7
6	b) Explain Electrolux vapours absorption system of refrigeration with the help of line diagram	Dec 2022	7
7	a) Explains Steam jet refrigeration system with the help of line diagram what are the applications, relative advantages and disadvantages.	Dec 2022	7
8	b) With support of schematic diagram, describe the working of a simple ammonia water absorption refrigeration system.	May 2019	7
9	Explain one type of cooling tower with diagram		10
10	a) How a two stage multi pressure system with flash intercooling is different from	May 2019	7
11	the system with flash gas removal alone. Show the difference using the schematic and p-h diagrams	May 2019	7
	Module IV		
1	List any six desirable properties of refrigerant	Dec 2022	3
2	What is the purpose of expansion device in refrigeration system. List any three types of expansion devi	Dec 2022	3
3	What is selection of refrigerants for different applications	Dec 2021	3
4	What are Eco-friendly Refrigerants	Dec 2021	3
5	Explain charging of refrigerant	May 2022	3
6	Explain the method of detection of leakage of refrigerant?	May 2018	3
7	Explain ODP and GWP of a refrigerant?	Dec 2020	3
8	What is meant by Cryogenic temperature system,	Dec 2022	3
9	What are the drawbacks of simple ammonia water vapour absorption refrigeration system	May 2022	3
10	Compare vapour absorption system with vapour compression system?	May 2022	3
11	Compare steam jet refrigeration system with vapour compression system?	Dec 2021	
12	a) Describe the working of following compressors used in refrigeration system using neat sketch	Dec 2021	7
13	I. Reciprocating compressor II. Centrifugal compressor	Dec 2021	
14	b) Explain the principle, working and application of cooling tower using neat sketch	May 2019	7
15	a)m What is eco-friendly refrigerant? Which parameters significant for these properties.	May 2019	3
16	b) Describe the working of any two types of condensers used in refrigeration system	May 2019	7
	Module V		
1	Define specific humidity and absolute humidity	May 2022	3
2	What is dew point temperature and represent it in the psychrometric chart?	Dec 2021	3
3	What is the importance of comfort chart in air-conditioning?	Dec 2021	3
4	Comfort air conditioning- factors affecting human comfort.	Dec 2021	3
5	Explain comfort chart	Dec 2021	3
6	a) Describe apparent dew point temperature of cooling coil.	May 2022	3
7	Differentiate Unitary and central system comparison.	Dec 2021	3
8	What is the importance of comfort chart in air-conditioning.	May 2022	3
9	It is required to maintain an air-conditioned hall at 280C DBT and 200C WBT. If has sensible heat load 45.4KW and latent heat load of 16.5 KW. The air supplied from outside atmosphere at 390C DBT and 280C WBT is 22 m3 /min, directly in to room through ventilation and infiltration. Outside air to be conditioned is passed through the cooling coil whose apparatus dew point is 140C, 60 percent of the re-circulated air from the hall is mixed with the conditioned air after the cooling coil.	May 2022	10
10	Determine a. Condition of the air after the coil and before the re-circulated air mixes with it b. Condition of air entering the hall i.e., after mixing with re-circulated air c. Mass of fresh air entering the cooler d. Refrigerating load in the cooling coil.	Dec 2021	

11	A hall is to be maintained at 240C DBT and RH 60%. When the following data is given. Outdoor conditions 380C DBT and 280C WBT, sensible heat load in the room 160000KJ/hr, latent heat load in the room 40000KJ/hr, total infiltration air 1200 m3 /hr, apparatus dew point temperature 100C, the quantity of re-circulated air from the hall 60%of total. If the quantity of re-circulated air is mixed with the conditioned air after the cooling coil, find the following a. Condition of the air after the coil and before the recirculated air mixes with it b. Condition of air entering the hall i.e., after mixing with recirculated air c. Mass of fresh air entering the cooler d. Refrigerating load in the cooling coil	May 2022	7
12	An Auditorium has seating capacity 800 people is to be maintained at 23°C DBTand50% RH. The outdoor conditions are 40°C DBT and 27°C WBT. The various loads in the office are: Solar heat gain 10KW, sensible heat gain per occupant 80W, Latent heat per occupant 70W, Lighting load 5KW, Sensible heating load from other sources 12KW, Infiltration load 0.3m3 /sec. Outdoor air and return air is mixed in the ratio of 1: 6 ,before cooling coil (processing unit) and then supplied to room. The supply temperature cannot be lower than 120C .find capacity of the plant required, mass flow rate of	Dec 2021	7
13	An office for seating 30 occupants is to be maintained at 22°C DBTand55% RH. The outdoor conditions are 36°C DBT and 27°C WBT. The various loads In the office are: Solar heat gain 8500W, Sensible heat gain per occupant 83W, Latent heat gain per occupant 100W, Lighting load 2500W,Sensible heat load from other sources 12000W, infiltration load 15 cubic meter/minute .Assuming 40% fresh air and 60% of re-circulated air passing through the evaporator coil and ADP of the coil is 8 0C. Find capacity of the plant and mass flow rate of air?	June 2018	7
14	Air at 10o C and 70% RH and 30o C and 80% RH are mixed in equal proportions by weight in an adiabatic chamber and is left for sufficient time to reach equilibrium. Find properties of mixed air	KTU 2018	6
15	b) Define (i) ADP, (ii) CSHF, (iii) DPT and (iv) Humidity ratio	KTU2018	4

CODE: MCN 401	COURSE NAME: INDUSTRIAL SAFETY AND ENGINEERING		L-T-P 2-1-0	Credit: 3

MODULE 1			
SL.NO	QUESTIONS	MARK	KTU/KU Month/Year
1	Write the importance of safety in organisations	3	MAY 23
2	How can you describe safety policy	3	MAY 23
3	What are the causes of industrial accidents	7	MAY 23
4	Explain the various theories of accident causation	7	MAY 23
5	With the help of a neat sketch explain safety organization structure. Also write the importance of safety organization structure.	14	MAY 23
6	Explain any three unsafe acts which are responsible for accidents in industries.	3	DEC 22
7	List any important six responsibilities of worker/workmen towards the safety measures in an organization.	3	DEC 22
8	With suitable schematics, describe the different types of safety organization.	6	DEC 22
9	Explain the responsibilities of safety officer in the implementation of safety in industries.	8	DEC 22
10	List the various accident causation theories and explain any two in detail with relevant schematics.	14	DEC 22
11	Differentiate Unsafe act and Unsafe conditions with suitable examples	3	MODEL
12	Discuss the significance of a safety committee in improving the safety performance of an industry	3	MODEL
13	List the various accident causation theories and explain any one in details.	14	MODEL
14	Discuss the significance of safety policy in reducing the accidents.	4	MODEL
15	Safety and productivity are the two sides of a coin'. Are you agreeing with this statement? Explain with your arguments.	10	MODEL
MODULE 2			
1	How do you monitor the safety performance in industries	3	MAY 23
2	Write the significance of work permit system	3	MAY 23
3	Classify personal protective equipment used in industries. List the suitability of at least seven types of PPEs.	14	MAY 23
4	Explain the role of management & employees in housekeeping?	7	MAY 23
5	What procedures taken during confined space access to protect a worker's life	7	MAY 23
6	What is respiratory protective equipment (RPE)? Explain the features of any one type of RPE.	3	DEC 22
7	How does frequency rate and incidence rate support safety analysis?	3	DEC 22
8	Explain the benefits of good housekeeping? Also, explain the five 'S' (5 S) concept in housekeeping.	9	DEC 22

9	With suitable sketches explain the important functions of any two PPE used for eye protection.	5	DEC 22
10	What are the major objectives of a work permit system in a hazardous work site?	5	DEC 22
11	Discuss any five potential hazards associated with hot works. Hence, mention any eight safety measures referred to hot work permits.	9	DEC 22
12	Which are five 'S' used in housekeeping?	3	MODEL
13	Classify the personal protective equipment. List the suitability of at least fifteen types of PPEs.	10	MODEL
14	How will you calculate the frequency rate? Explain with an example.	4	MODEL
15	How will you compare the safety performance of two industries? Explain with suitable example	10	MODEL
MODULE 3			
1	How can workers' safety be ensured during underpinning work?	3	MAY 23
2	List the various hazards of underwater works	3	MAY 23
3	Identify various hazards that may arise during the various stages of building construction	7	MAY 23
4	Mention the safety precautions that will be implemented to avoid scaffolding related incidents	7	MAY 23
5	Discuss the important types of ergonomic hazards associated with industries. How can we reduce its impact?	14	MAY 23
6	List any important six safety practices used with ladders in construction sites.	3	DEC 22
7	Explain any important four safety practices in excavation works.	3	DEC 22
8	You are appointed as a safety manager for a demolition work of a 10-storey building in a congested residential area. What are the safety measures that you need to ensure for the completion of the work?	8	DEC 22
9	Discuss the major ergonomic hazards associated with construction industries.	6	DEC 22
10	What are the safety precautions to be taken before entering a confined space?	9	DEC 22
11	Discuss some important aspects of construction safety provisions in National Building Code.	5	DEC 22
13	Discuss the safety and fire protection facilities required for a high rise building as per National building code.	14	MODEL
14	Identify the various hazards during the different stages of building construction.	7	MODEL
15	Discuss the important types of ergonomic hazards associated with industries.	7	MODEL
MODULE 4			
1	What are the various objectives of Maintenance	3	MAY 23
2	List the safety precautions to be followed during grinding operation	3	MAY 23

3	Explain the safety precautions to be followed while doing various metal handling assessments and techniques in industries	14	MAY 23
4	Briefly explain the maintenance of chains sling	7	MAY 23
5	Briefly explain the maintenance of clam	7	MAY 23
6	Mention any four potential hazards associated with wire rope used for material handling.	3	DEC 22
7	Discuss the key elements of a hearing conservation program	3	DEC 22
8	With suitable sketches explain the operation of any two types of safety guards suitable for industrial applications.	8	DEC 22
9	Explain the potential hazards associated with grinding operations.	6	DEC 22
10	Discuss the safety issues associated with gas welding operations.	8	DEC 22
11	Discuss about the handling capacity assessment for lifting process associated with manual material handling.	6	DEC 22
12	What are the various types of Guards?	7	MODEL
13	Explain safety measures needed in turning and grinding.	14	MODEL
14	What are the various material handling equipment?	7	MODEL
15	Explain the safety needed in arc welding and gas welding.	14	MODEL
MODULE 5			
1	What do you meant by Hazard and Risk	3	MAY 23
2	What is meant by MSDS	3	MAY 23
3	What is meant by HAZOP? How do you conduct HAZOP analysis?	7	MAY 23
4	Briefly explain Criticality Analysis	7	MAY 23
5	How do you classify fires and explain various types of fire extinguishers used in industries	14	MAY 23
6	Explain the hierarchy of control of chemical hazards.	3	DEC 22
7	Why material safety data sheet is mandatory for chemical products?	3	DEC 22
8	Explain the need for a Preliminary Hazard Analysis in a hazardous industry	6	DEC 22
9	Explain the important features and functions of any four different types of fire extinguishers.	8	DEC 22
10	What is the significance of Hazard and Operability Analysis? How do you conduct a HAZOP analysis?	8	DEC 22
11	Discuss about different types of chemical hazards with suitable examples.	6	DEC 22
12	Why MSDS is mandatory for chemical products.	3	MODEL
13	Define objectives of dow fire and explotion index	3	MODEL
14	Define material factor for calculation of Dow F & EI	5	MODEL
15	What are the different types of hazards.	10	MODEL