Hall Ticket Number :										

R-15

Code: 5G552

III B.Tech. I Semester Supplementary Examinations February 2022

Dynamics of Machinery

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

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

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			Marks	CO	Blooms Level
		UNIT–I			
1.	a)	State the laws of static friction.	4M	CO1	L1
	b)	A body, resting on a rough horizontal plane required a pull of 180 N inclined at 30º to the plane just to move it. It was found that a push of 220 N inclined at 30º to the plane just moved the body. Determine the weight of the body and the coefficient of friction.	10M	CO1	L3
		OR			
2.	a)	Explain the friction circle and friction axis.	7M		L2
	b)	A 150 mm diameter valve, against which a steam pressure of 2 MN/m2 is acting, is closed by means of a square threaded screw 50 mm in external diameter with 6 mm pitch. If the coefficient of friction is 0.12 ; find the torque required to turn the handle.	7M	CO1	L3
		UNIT–II			
3.	a)	Describe the types of brakes	6M	CO2	L1
	b)	A bicycle and rider of mass 100 kg are travelling at the rate of 16 km/h on a level road. A brake is applied to the rear wheel which is 0.9 m in diameter and this is the only resistance acting. How far will the bicycle travel and how many turns will it make before it comes to rest? The pressure applied on the brake is 100 N and $\mu = 0.05$.	8M	CO2	L3
		OR			
4.	a)	Describe the construction and operation of a Prony brake dynamometer	8M	CO2	L1,L5
	b)	In a laboratory experiment, the following data were recorded with rope brake: Diameter of the flywheel 1.2 m; diameter of the rope 12.5 mm; speed of the engine 200 r.p.m.; dead load on the brake 600 N; spring balance reading 150 N. Evaluate the brake power of the engine.	6M	CO2	L6

UNIT–III

5.	a)	State the different types of governors.	6M	CO3	L1
	b)	Evaluate the vertical height of a Watt governor when it rotates at 60 r.p.m. Also find the change in vertical height when its speed increases to 61 r.p.m.	8M	CO3	L6

OR

6.	a)	Explain the turning moment diagram of a four stroke cycle internal combustion engine.	7M	CO3	L2
	b)	The mass of flywheel of an engine is 6.5 tonnes and the radius of gyration is 1.8 meters. It is found from the turning moment diagram that the fluctuation of energy is 56 kN-m. If the mean speed of the engine is 120 r.p.m., find the maximum and minimum speeds.	7M	CO3	L3

UNIT–IV

7.		Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.		CO4	L3

OR

8.		Describe the following: (a) Variation is tractive force (b) Swaying couple (c) Hammer blow.	14M	CO4	L1

UNIT–V

9.	a)	Explain briefly with neat sketches the longitudinal, transverse and torsional free vibrations.	7M	CO5	L2
	b)	Develop an expression for free longitudinal vibrations using energy method.	7M	CO5	L5

OR

10.		Describe the Free Torsional Vibrations of a Single Rotor System and Two Rotor System	14M	CO5	L1

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Hall Ticket Number :										

R-15

Code: 5G555

III B.Tech. I Semester Supplementary Examinations February 2022

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)

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UNIT–I

1. a) Explain Fourier's law of heat conduction. 6M

   b) Differentiate between thermodynamics and Heat transfer. 4M

   c) State Newton's law of cooling and Stefan Boltzman law of radiation. 4M

OR

2. a) Hot air at 80°C is blown over a 2-m by 4-m flat surface at 30°C. If the average convection heat transfer coefficient is 55 W/m^2 °C, determine the rate of heat transfer from the air to the plate, in kW. 8M

   b) Describe different types of boundary conditions applied to heat conduction problems. 6M

UNIT–II

3. a) Spherical shaped vessel of 1.5 m diameter is 75 mm thick. Find the rate of heat leakage, if the temperature difference between the inner and outer surfaces is 300^o C. Thermal conductivity of material is 0.3 kJ /mh^{o}C. 6M

   b) Derive the temperature distribution equation for a lumped system in terms of Fourier and Biot numbers. 8M

OR

4. a) What is critical thickness of insulation? Derive the expression to calculate critical thickness of insulation for a cylinder. 5M

   b) A long carbon steel rod length 40 cm and diameter 10 mm (K = 40 W/mK) is placed in such that one of its end is at 400^0Cand the ambient temperature is 30^0C. The film coefficient is 10 W/m^2K. Determine: (i) Temperature at mid length of the fin. (ii) Fin efficiency. (iii) Heat transfer rate form the fin. 9M

UNIT–III

5. a) Illustrate the development of hydrodynamic boundary layer inside a pipe. 4M

   b) List out the dimensionless numbers used in forced convection situation and their mathematical expressions. 6M

   c) What is the difference between free convection and forced convection? 4M

OR

6. a) Show that Nu=f (Re, Pr) for forced convection by the use of dimensional analysis. 7M

   b) Air at 25^{o}C flows past a flat plate at 2.5 m/s. the plate measures 600 mm X 300 mm and is maintained at a uniform temperature at 95^{o}C. Calculate the heat loss from the plate, if the air flows parallel to the 600 mm side. 7M

UNIT–IV

7. a) How the condensation and boiling phenomenon heat transfer takes place. 4M

   b) Two large parallel planes with emissivities of 0.3 and 0.5 are maintained at temperatures of 527^0 C and 127^0C respectively. A radiation shield having emissivities of 0.05 on both sides is placed between them. Calculate (i) Heat transfer rate between them without shield. (ii) Heat transfer rate between them with shield. 10M

OR

8. a) Write short notes on Black body radiation. 4M

   b) Calculate the net radiant heat exchange per m^2 area for two large parallel plates at temperatures of 427^0 C and 27^0C. Є (hot plate) = 0.9 and Є (cold plate) = 0.6.If a polished aluminum shield(Є=0.4) is placed between them, find the % reduction in the heat transfer. 10M

UNIT–V

9. a) What is a Heat exchanger? Classify the heat exchangers and its applications. 6M

   b) Obtain the expression for LMTD of a Parallel flow heat exchanger. 8M

OR

10. a) A counter flow heat exchanger is used to cool oil at a rate of 0.6 kg/s (C_P = 2.5 Kj/kgK) from 110^oC to 35^oC using water at 20 ^oC. The overall heat transfer coefficient is 1500 W/m^2K. Assuming cooling water outlet temperature 80 ^oC and using NTU method calculate: (i) Water flow rate. (ii) Surface area required. (iii) Effectiveness of heat exchanger 10M

    b) Outline the concept of overall heat transfer coefficient in heat exchangers 4M

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Hall Ticket Number :										

R-15

Code: 5G553

III B.Tech. I Semester Supplementary Examinations February 2022

Machine Tools

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

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

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			Marks	CO	Blooms Level
		UNIT–I			
1.	a)	What is meant by Orthogonal cutting and Oblique cutting? Explain with neat sketches	7M	CO1	L2
	b)	Discuss the various types of chips produced during metal cutting? Explain how built-up edge on a cutting tool is undesirable	7M	CO1	L2
		OR			
2.	a)	What are the various forces are acting between tool and work piece. Explain with neat sketch?	7M	CO1	L1
	b)	Summaries the various types of back rake angle included in a single point cutting tool. Explain with neat sketches?	7M	CO1	L1
		UNIT–II			
3.	a)	Explain the operations Turning, Facing, Chamfering with neat sketches?	14M	CO2	L2
		OR			
4.		Explain the Thread Cutting Operation with neat sketch.	14M	CO2	L2
		UNIT–III			
5.	a)	Explain the basic Operations that are done on a Shaper.	7M	CO3	L1
	b)	Distinguish between Shaper and Planer?	7M	CO3	L2
		OR			
6.	a)	Explain up Milling and down Milling with neat sketches	7M	CO3	L2
	b)	Define Indexing. Explain the following Indexing methods. **(i)** Direct Indexing **(ii)** Simple Indexing	7M	CO3	L2
		UNIT–IV			
7.	a)	What is the purpose of Lapping? Explain with neat sketch	7M	CO4	L1
	b)	What is honing process? Explain the methods of Honing process?	7M	CO4	L1
		OR			
8.	a)	How the Grinding wheel is selected? Outline various factors that influence its selection.	7M	CO4	L5
	b)	Write short notes on types of bond & designation of Grinding wheel	7M	CO4	L2
		UNIT–V			
9.		List out the various types of Clamps explain any two with neat sketch	14M	CO5	L1
		OR			
10.		Explain principles of design of Jigs and Fixtures? Write the difference between Jigs and Fixtures.	14M	CO5	L2

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Hall Ticket Number :										

R-15

Code: 5G551

III B.Tech. I Semester Supplementary Examinations February 2022

Applied Thermodynamics – II

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

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

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			Marks	CO	Blooms Level
		UNIT-I			
1.	a)	What are thermodynamic variables effecting efficiency and output of Rankine cycle.	6M	CO2	L1
	b)	A steam power plant operates on a theoretical reheat cycle. Steam at boiler at 150 bar, 550^{o}C expands through the high pressure turbine. It is reheated at the constant pressure of 40 bar to 550^{o}C and expands through the low pressure turbine to a condenser at 0.1 bar. Draw T-S and H-S diagram. Find: i) Quality of steam at turbine exhaust. ii) Cycle efficiency iii) Steam rate in kg/kWh	8M	CO2	L4
		OR			
2.	a)	Sketch and explain reheat cycle on Mollier chart	6M	CO2	L2
	b)	A steam turbine is supplied with dry saturated steam at 25 bar. The exhaust takes place at 0.2 bar. For a flow rate of 8 kg/s, calculate the (i) power required to drive the pump (ii) turbine power (iii) Rankine efficiency and quality of steam at the end of expansion	8M	CO2	L4
		UNIT-II			
3.	a)	What are Boiler accessories? Explain any two in detail.	7M	CO2	L1
	b)	Sketch and explain the working of Lamont boiler	7M	CO2	L3
		OR			
4.	a)	Give a broad classification of Boiler draught.	6M	CO2	L2
	b)	A boiler is having a chimney of height 35m. The draught produced in terms of water column is 20mm. The temperature of flue gases produced inside the chimney is 365^{0}C and that of air outside the chimney is 35^{0}C. Determine the mass of air used.	8M	CO2	L4
		UNIT-III			
5.	a)	What is steam nozzle? Why it is convergent divergent? What assumptions are adopted in analyzing flow through nozzle	6M	CO2	L1
	b)	Dry saturated steam at a pressure of 8 bar enters a convergent-divergent nozzle and leaves it at a Pressure of 1.5 bar, if the flow is isentropic and the corresponding expansion index is 1.135, find the ratio of cross-sectional area at exit and throat for maximum discharge	8M	CO2	L4
		OR			

6.	a)	Define critical pressure ratio for the nozzle of the steam turbine. Obtain analytically its value in terms of the index of expansion.	6M	CO2	L2
	b)	Steam at 10 bar and 0.98 dry expands through a convergent divergent nozzle to a back pressure of 0.1 bar. The discharge through the nozzle is 0.55 kg/s. The enthalpy drop used for reheating the steam by friction in the divergent portion is 10% of the overall enthalpy drop. Determine (i) the throat pressure (ii) number of nozzles required if the throat area of each nozzle is 0.5 cm2 (iii) exit diameter of each nozzle (iv) cone angle of divergent portion if its length is 10 cm.	8M	CO2	L4

UNIT-IV

7.	a)	Compare the merits and demerits of surface condenser over jet Condenser.	6M	CO2	L2
	b)	In surface condenser the vacuum maintained is 700 mm of Hg. The barometer reads 754 mm. If the temperature of condensate is 18^0C. Determine (i) mass of air per Kg of steam (ii) Vacuum Efficiency	8M	CO2	L4

OR

8.	a)	Define the terms Vacuum efficiency and Condenser efficiency	6M	CO2	L1
	b)	Explain briefly the following types of jet condensers: a) parallel-flow type b) counter flow type	8M	CO2	L2

UNIT-V

9.	a)	Explain differences between impulse and reaction turbines.	6M	CO2	L2
	b)	In a reaction turbine, the blade tips are inclined at 35^0 and 20^0 in the direction of motion. The guides blades are of the same shape as the moving blades, but reversed in direction. At a certain place in the turbine, the drum diameter is 1 meter and the blades are 10cm high. At this place, the steam has a pressure of 1.75 bar and dryness 0.935. If the speed of this turbine is 250 rpm and the steam passes through the blades without shock, find the mass of steam flow and power developed in the ring of moving blades.	8M	CO2	L4

OR

10.	a)	Explain with the help of neat sketch a single stage impulse turbine. Also explain the pressure and velocity variation along the axial direction.	6M	CO2	L2
	b)	In a simple impulse turbine the nozzles are inclined at 20^0 to the direction of motion of the moving blades. The steam leaves the nozzle at 375m/s. The blade velocity is 165m/s. Calculate suitable inlet and outlet angles for the blades in order that the axial thrust is zero. The relative velocity of steam as it flows over the blades is reduced by 15% by friction. Also determine the power developed for a flow rate of 10kg/s.	8M	CO2	L4

END

Hall Ticket Number :										

R-15

Code: 5G554

III B.Tech. I Semester Supplementary Examinations February 2022

Design of Machine Elements-I

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

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

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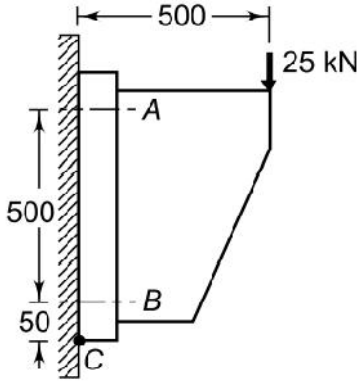
			Marks	CO	Blooms Level
		UNIT–I			
1.	a)	Explain the design procedure of machine elements.	8M	CO1	L2
	b)	Discuss the stress and stain relation. Draw a neat sketch of stress-strain Diagram and explain various stress points.	6M	CO1	L2
		OR			
2.		A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN-m and a torsional moment 30 kN-m. Determine the diameter of the shaft using two different theories of failure, and assuming a factor of safety of 2. Take E = 210 GPa and poisson's ratio = 0.25.	14M	CO2	L3
		UNIT–II			
3.	a)	What are the principal causes of stress concentration? Explain with suitable sketches?	7M	CO2	L1,L2
	b)	Write Soderberg's equation and state its application to different type of loadings.	7M	CO2	L1
		OR			
4.		A machine member is made of plain carbon steel of ultimate strength 650 N/mm^2 and endurance limit of $300N/mm^2$. The member is subjected to a fluctuating torsional moment which varies from -200 Nm to 400 Nm. Design the member using (i) modified Goodman's equation and (ii) Soderberg equation.	14M	CO2	L3
		UNIT–III			
5.	a)	What are the advantages and disadvantages of welded joints over riveted joints?	7M	CO3	L3
	b)	A plate 100 mm wide and10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55 MPa.	7M	CO3	L2
		OR			

6. A wall bracket is attached to the wall by means of four identical bolts, two at A and two at B, as shown in Fig. Assuming that the bracket is held against the wall and prevented from tipping about the point C by all four bolts and using an allowable tensile stress in the bolts as 35N/mm2, determine the size of the bolts on the basis of maximum principal stress theory.



14M CO3 L4

UNIT–IV

7. With simple sketch discuss the design procedure of Socket and spigot joint. 14M CO4 L3

OR

8. a) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. 8M CO4 L1

   b) Draw neat sketches of different types of keys and state their applications. 6M CO4 L1

UNIT–V

9. a). Explain briefly a design of shafts subjected to combined bending and torsion. 7M CO5 L2

   b). A shaft is required to transmit 1 MW power at 240 rpm. The shaft must not twist more than 1^0 on a length of 15 diameters. If the modulus of rigidity for material of the shaft is 80 GPa, find the diameter of the shaft and shear stress induced. 7M CO5 L3

OR

10. Design a muff coupling which is used to connect two steel shafts transmitting 40 KW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. 14M CO5 L3

END