

**4TH SEM./AUTO/DIP IN MECH./MECH./MECH(IND.INTG)
/MECH(MAINT)/MECH(PROD)/MECH(SANDWICH)/ 2022(S)
Th1-Theory of Machines**

Full Marks: 80

Time- 03 Hrs

Answer any five Questions including Q No.01 & 02
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define kinematic link. Mention its types.
 - b. What is the difference between Brake and Dynamometer?
 - c. What is Amplitude and Time period related to vibration?
 - d. What is crowning of pulleys?
 - e. Write down the length of Open belt drive formula.
 - f. What is the function of Cam and Followers?
 - g. Define Co-efficient of friction.
 - h. What are the uses of Chain drive and Gear drive?
 - i. What is Vibration and Types of vibration?
 - j. What is the function of Clutch?

2. Answer **Any Six** Questions 6 x 5
 - a. What is the function of bearing? Describe the roller bearing with neat sketch.
 - b. Derive an expression for the height of Watt Governor with neat sketch.
 - c. Differentiate between Static and Dynamic balancing.
 - d. Define Velocity ratio of gear train. Derive velocity ratio of a Simple Gear train with neat sketch.
 - e. What is four bar chain? Explain any two inversion of four bar chain.
 - f. What are the causes and remedies of Vibration?
 - g. Comparison between Flywheel and Governor.

3. Derive the expressions for frictional torque in Pivot bearing considering uniform pressure. 10

4. A belt is running over a pulley of diameter 120 cm at 200rpm. The angle of contact is 165° and co-efficient of friction between the belt and pulley is 0.3. If the maximum tension in the belt is 3000N. Find power transmitted by the belt. 10

- 5 Describe the working of Absorption type of dynamometer. 10
- 6 Explain the terms: 10
- (i.)Sensitivity of Governor
 - (ii.)Stability of Governor
 - (iii.)Isochronisms of Governor
 - (iv.) Ratio of Belt tension
 - (v.)Co-efficient of fluctuation of speed.
- 7 With neat sketch describe the Longitudinal and Torsional vibration. 10

**4TH SEM./MECH(IND.INT.)/ MECH(SAND)/MECH(PROD.)/
MECH(MAINT)/AERO/DME/MECH/AUTO/2022(S)**

TH 2 Manufacturing Technology

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right-hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define superfinishing.
 - b. Explain grinding.
 - c. Define indexing.
 - d. Name four major parts of lathe machine.
 - e. What do you understand by quick return mechanism?
 - f. What is multiple holder?
 - g. Define lapping.
 - h. State the composition of 18-4-1 HSS tool.
 - i. Compare drilling with boring operation.
 - j. Define speed and feed of cut.

2. Answer **Any Six** Questions 6 x 5
 - a. Why ram is used in shaper?
 - b. Explain work holding attachment in milling machine.
 - c. Write different parts of a slotter and their function.
 - d. Explain tool geometry of a single point cutting tool.
 - e. State the advantages of broaching.
 - f. Discuss about the tooling layout of a hexagonal bolt.
 - g. Discuss about the functions of centreless grinder.

3. Name various cutting tool materials. Briefly describe one important tool material along with its characteristics and uses. 10

4. Describe the function of different components of a shaper with schematics. 10

5. With neat sketch explain the function of pillar drilling machine. 10

6. Explain with a neat sketch, the working of an universal dividing head. 10

7. Describe in brief various parts of capstan and turret lathe. 10

**4TH SEM./MECH(SAND)/MECH(PROD)/MECH(IND.INT)/
MECH(MAINT)AERO/DME/MECHANICAL/ 2022(S)
TH-03 FLUID MECHANICS**

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
- a. Define Impact of jet.
 - b. What is the difference between Poise and stoke?
 - c. Explain Archimedes principle?
 - d. What is the difference between Notch and Weir?
 - e. Define discharge and its unit in S.I system.
 - f. State Darcy Weisbach and Chezy's formula.
 - g. What is the statement of Pascal's law?
 - h. Write down the relationship between Atmospheric pressure, Gauge pressure and Absolute pressure.
 - i. Define Density and its unit.
 - j. Write down the discharge formula for rectangular weir.
2. Answer **Any SIX** Questions 6 x 5
- a. State and derive the Continuity equation.
 - b. Define three Orifice coefficient and also derive the expression:
 $C_d = C_v \times C_c$
 - c. Describe Hydraulic Gradient Line and Total Energy Line.
 - d. Calculate the Specific weight, Specific mass, Specific volume and Specific gravity of a liquid having a volume of 6m^3 and weight of 44kN.
 - e. Derive an expressions for Total Pressure and Centre of Pressure for a vertically immersed surface.
 - f. Describe properties of fluid.

- g The diameter of a pipe at the sections 1-1 and 2-2 are 200mm and 300mm respectively. If the velocity of water flowing through the pipe at section 1-1 is 4m/sec. Find:
- (i) Discharge through the pipe and
 - (ii) Velocity of water at section 2-2
- 3 State and prove the Bernoulli's theorem. 10
- 4 The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20cm. 10
- 5 (a) Derive discharge formula for triangular notch. 10
(b) Find the discharge over a triangular notch of angle 60° when the head over the V-notch is 0.3m. Assume $C_d = 0.6$.
- 6 Derive force exerted & work done by the jet on a stationary (fixed) vertical force. 10
- 7 Water is flowing through a pipe 1500m long with a velocity of 0.8m/sec. What should be the diameter of the pipe, if the loss of head due to friction is 8.7m, take ' f ' for the pipe as 0.01. 10

**4TH SEM./MECH/MECH(IND INTG)/ MECH(MAINT)/
MECH(PROD)/ DME/MECH(SWICH)/ 2022(S)
Th4 Thermal Engineering-II**

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks
(Use of steam table and mollier chart are allowed)

1. Answer **All** questions 2 x 10
- a. What do you mean by calorific value of fuel?
 - b. Write four industrial uses of compressed air.
 - c. Define pressure ratio of air compressor.
 - d. Define Dryness fraction of steam.
 - e. State kirchoff's law.
 - f. Define Grate for boiler.
 - g. What are the function of boiler mountings with example?
 - h. Define steam and its uses.
 - i. Carnot cycle is not used as a standard reference cycle in any steam power plant, why?
 - j. Define air-fuel ratio.
2. Answer **Any Six** Questions 6 x 5
- a. The cylinder dimensions of a single stage single acting reciprocating compressor are 300mmx200mm. The compressor runs at 150r.p.m. The intake pressure and temperature of air are respectively 1 bar and 25⁰c and the discharge pressure is 10bar. Determine the work done per cycle when compression follows the law
 - (i) $PV^{1.25}=c$
 - (ii) $PV=c$
 - b. What are classification of air compressors?
 - c. State the modes of heat transfer and explain it.
 - d. Give a comparison between forced draught and induced draught.

- e. What is the difference between Reheat cycle and Regenerative cycle?
- f. The thermal efficiency of a Carnot heat engine is 60.5%. The minimum temperature of the cycle is 25°C . Find the maximum temperature of the cycle.
- g. Deduce a formula for work done by a single stage single acting reciprocating air compressor when the law of expansion is $PV^n = \text{constant}$ neglecting clearance.
3. Steam is being generated in a boiler under a pressure of 12 bar. Find the enthalpy of 5 kg of steam, when 10
- Steam is wet having dryness fraction of 0.75
 - Temperature of steam is 300°C . Take $C_p = 2.1 \text{ kJ/kg}$.
4. Describe Carnot cycle with vapour with the help of P-V, T-S and H-S diagrams and deduce a formula for its thermal efficiency. 10
5. Describe the construction and working of Cochran boiler. 10
6. An engine uses 6.5 kg of oil per hour of calorific value of 30,000 kJ/kg. 10
if the B.P of the engine is 22 kW and mechanical efficiency 85%.
Calculate
- Indicated thermal efficiency.
 - Brake thermal efficiency
 - Specific fuel consumption in kg/B.P/h.
7. Describe Rankine cycle with the help of P-V, T-S and H-S diagram and deduce a formula for its thermal efficiency considering feed pump work. 10

4TH SEM./AUTO/DIP.MECH./MECH(MAIN)/ MECH(PROD) /MECH(SAND)/
MECH(IND.INT) MECHANICAL / 2023(S)

TH-1 Theory of Machine

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. What is degree of freedom?
 - b. Define inversion.
 - c. What is limiting friction?
 - d. What is the function of clutch?
 - e. Define coefficient of fluctuation of speed?
 - f. What are the advantages of gear drive?
 - g. What is the difference between governor and flywheel?
 - h. State different types of vibration.
 - i. What is the need of balancing in machine?
 - j. Define resonance.
2. Answer **Any Six** Questions 6 x 5
 - a. Explain different type of cam follower mechanism.
 - b. Explain sensitiveness, stability and isochronisms of a governor.
 - c. Derive the expression for torque transmitted in case of flat collar bearing assuming uniform pressure theory.
 - d. Explain the causes of vibration and Remedies.
 - e. Find the power lost in friction assuming i) UPT and ii) UWT when a vertical shaft of 100mm diameter rotating at 150 rpm rest on a flat foot step bearing, coefficient of friction is ,0.05. Shaft carries a load 15 KN.
 - f. Differentiate between static And dynamic balancing
 - g. Derive the expression for height for a centrifugal governor.
3. Explain the construction and working of a centrifugal governor with the neat sketch. 10
4. What is four bar chain mechanism? Explain its inversion. 10
5. A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 KW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between shafts is 4 m. The smaller pulley is 0.5 in diameter. Calculate the stress in the belt for both open and closed belt drive condition. 10
6. Drive the expression for length of belt for an open belt drive. 10
7. Explain the working of prony brake dynamometer with neat sketch. 10

**4TH SEM./ AERO/AIR. MAIN.ENG./DIP IN MECH/ AUTO./ MECH./
MECH(MAINT.)/ MECH(PROD.)/ MECH(SAND.)/ MECH(IND.INT.)/ 2023(S)**

TH-2 Manufacturing Technology

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. State the properties of cemented carbide cutting tool.
 - b. Define rake angle.
 - c. List the operations carried out in a lathe.
 - d. How the material is removed in a shaper?
 - e. State the application area of a planer.
 - f. Write the functions of dividing heads in Milling operations.
 - g. How boring operation differs from drilling?
 - h. How do you classify the slotting machines?
 - i. Name the types of bond used in manufacturing of grinding wheel.
 - j. List out various surface finishing operations.

2. Answer **Any Six** Questions 6 x 5
 - a. Write down the desirable properties of coolants and lubricants. Give two example of cutting fluids.
 - b. Draw a neat sketch of a single point cutting tool indicating its complete geometry.
 - c. What are the differences between Capstan and Turret lathe?
 - d. Compare between planer and shaper.
 - e. With a neat sketch explain quick return mechanism of shaper machine.
 - f. Explain the term 'Grain', 'Grit', 'Structure' and 'Grade' of a grinding wheel.
 - g. Discuss hand lapping operation in brief.

3. What are the desirable properties of cutting tool materials? Describe any four with its principal characteristics and applications. 10
4. Describe various methods of taper turning carried out on a lathe. 10
5. With a neat sketch, explain the automatic table feed mechanism of a shaper machine. 10
6. Explain with example the procedures of simple and compound indexing. 10
7. With a block diagram, describe the function and working of Radial drilling machine. 10

**4TH SEM / AERO/AIR. MAIN.ENG./DIP IN MECH/MECH./MECH(MAINT.)/
MECH(PROD.)/ MECH(SAND.)/ MECH(IND.INT.)/ 2023(s)**

Th3 Fluid Mechanics

Full Marks: 80

Time- 3 Hrs

**Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks**

1. Answer **All** questions 2 x 10
- a. Define meta centre and meta centric height.
 - b. Write the assumptions made in the derivation of Bernoulli's equation.
 - c. Write and explain Archimedes Principle.
 - d. Define Buoyancy and centre of Buoyancy.
 - e. Differentiate between laminar and turbulent flow.
 - f. Define notch and weir.
 - g. What is Pitot tube? Describe the use of it.
 - h. What is impact of jet?
 - i. Write the statement of Pascal's law.
 - j. Define capillarity.
2. Answer **Any Six** Questions 6 x 5
- a. Derive the formula of force exerted by a fluid jet on a stationary flat plate placed normal to the jet.
 - b. Define Absolute pressure, gauge pressure, vacuum pressure and atmospheric pressure. Write the relation between them.
 - c. What is Newton's Law of viscosity? Write the relation between Dynamic viscosity and kinematic viscosity.
 - d. The diameter of the pipe at section 1 & 2 are 10cm and 30cm respectively. The velocity at section 1 is 5 m/s. calculate
 - (a) the velocity at section 2
 - (b) discharge through the pipe

- e. What are the different losses of energy in pipes? Write the expression for the head loss due to friction using
 (a) Darcy's formula
 (b) Chezy's formula
- f. Define pressure and pressure head.
 Calculate the pressure due to a column of 0.4 m of
 (i) water
 (ii) an oil of specific gravity 0.9
- g. Define density, Specific weight, specific gravity of a fluid. Write the relation between them.

3 A horizontal venturimeter with inlet diameter 30cm and throat 15cm respectively is used to measure the flow of water. The reading of differential manometer connected to inlet and throat is 10 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. 10

4 A rectangular plane surface is 2.5 m wide and 4m deep. It lies in vertical plane in water. Determine the total pressure and position of the centre of pressure on the plane surface when its upper edge is horizontal and (a) coincides with water surface (b) 2m below the free water surface 10

5 The right limb of a simple U-tube manometer containing mercury is open to atmosphere while the left limb is connected to a pipe in which oil of specific gravity 0.8 is flowing. The center of pipe is 11cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe of difference of Hg level in the two limbs is 21cm. 10

6 Define orifice. What are the different types of orifices. Write in detail about the flow through an orifice. 10

7 Write short notes on 2 x 5
 (a) Surface tension
 (b) HGL & TEL

**4TH SEM / MECH./DIP. IN MECH./ MECH(MAINT.)/
MECH.(PROD.)/MECH(SAND.)/MECH(IND.INT.) / 2023(S)**

TH-4 Thermal Engineering -II

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define specific fuel consumption?
 - b. Define wet steam and dry saturated steam?
 - c. Explain Newton's law of cooling?
 - d. Define FAD?
 - e. Write the mountings of boiler?
 - f. What is thermal conductivity and state its SI unit?
 - g. Define brake thermal efficiency?
 - h. Define mechanical efficiency of air compressor?
 - i. What are the various modes of heat transfer?
 - j. Differentiate between gas and vapour?

2. Answer **Any Six** Questions 6 x 5
 - a. Briefly explain different powers developed in IC engine?
 - b. Explain the construction of single acting reciprocating air compressor?
 - c. Differentiate between fire tube and water tube boiler?
 - d. Derive the efficiency of Rankine cycle?
 - e. Briefly explain the working of Cochran boiler?
 - f. State and explain Fourier's law of heat conduction?
 - g. A power plant is supplied with dry saturated steam at a pressure of 16 bar and exhaust at 0.3 bar.using the steam table find the efficiency of Carnot cycle?

- 3 A two stroke diesel engine develops a brake power of 420KW.the engine consumes 195kg/h of fuel and air fuel ratio is 22:1.calorific value of fuel is 42000KJ/Kg. If 76 KW power is required to overcome the frictional losses, calculate
1.mechanical efficiency
2.air consumption
3.brake thermal efficiency 10
- 4 Derive the expression of work input for a single acting air compressor without clearance volume? 10
- 5 The steam power plant operates on Rankine cycle has a boiler and condenser pressure of 60 bar and 0.1 bar respectively.steam coming out of the boiler is dry and saturated. Calculate thermal efficiency of the plant? 10
- 6 Explain different boiler draughts? 10
- 7 Write short notes. 4 x 2.5
(a)air fuel ratio
(b)dryness fraction
(c)Kirchhoff's law
(d)Volumetric efficiency