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R-17

Code: 7G552

III B.Tech. I Semester Supplementary Examinations December 2020

Applied Thermodynamics-II

(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) Consider a steam power plant operating on the simple ideal Rankine cycle. The steam enters the turbine at 3 MPa & 350°C and leaves the turbine at pressure of 75 kPa. Determine the thermal efficiency of this cycle. 8M
- b) Explain the various process of Rankine cycle with regeneration with schematic and T-S diagram 6M

OR

2. a) Steam enters the turbine as 100% saturated vapour at 6 MPa and saturated liquid enters the pump at a pressure of 0.01 MPa. If the heat rate to boiler is 150 MW, determine
 - (i) Thermal efficiency
 - (ii) Mass flow rate of steam
 - (iii) Net rate of work transfer
 - (iv) Work ratio
 - (v) Specific steam consumption 10M
- b) Explain the various process of Rankine cycle with reheat with schematic and T-S diagram 4M

UNIT-II

3. a) Derive the condition for the maximum discharge of chimney 8M
- b) Differentiate water tube and fire tube boilers 6M

OR

4. a) Explain the working principle of Cochran boiler with neat sketch 10M
- b) List the advantages of high pressure boilers over the conventional boilers 4M

UNIT-III

5. a) Steam at a pressure of 10.5 bar and 0.95 dry is expanded through a convergent and divergent nozzle. The pressure of steam leaving the nozzle is 0.85 bar. Find the velocity of steam at throat for maximum discharge. Take $n=1.135$. Also find the area at the exit and the steam discharge if the throat area is 1.2 cm². Assume flow is isentropic and there are no friction losses. 10M
- b) Derive the exit velocity of nozzle from the steady flow energy equation. 4M

OR

6. a) A convergent-divergent nozzle supplies 120 kg of steam per minute. The steam is supplied at 7 bar and 180°C and discharge takes place against a back pressure of 1 bar. Expansion upto throat is isentropic and the frictional resistance between throat and exit is equivalent to 63 kJ/kg of steam. Considering inlet velocity of 75 m/s and throat pressure 4 bar, determine
i) areas at throat and exit and ii) overall efficiency of nozzle. 10M
- b) Define super saturated flow and list out the effect of supersaturation. 4M

UNIT-IV

7. a) Differentiate jet condenser and surface condenser 6M
- b) Explain the four methods to obtain maximum vacuum in condensers 8M

OR

8. a) Explain the effects of air leakage in condenser 6M
- b) Steam enters a condenser at 36°C and with barometer reading 760 mm. if the vacuum of 695 mm is produced find the vacuum efficiency. 8M

UNIT-V

9. a) Why is drum type construction preferred to disc type construction in reaction turbine? 4M
- b) In a 50% reaction turbine, the speed of rotation of a blade group is 3000 RPM with mean blade velocity of 120m/s. The velocity ratio is 0.8 and the exit angle of the blade is 20°. If the mean blade height is 30 mm, calculate the total steam flow rate through the turbine. Neglect the effect of blade edge thickness of the annular area but consider 10% of the total steam flow rate as the tip leakage loss. The mean condition of steam in that blade group is found to be 2.7 bar and 0.95 dry. 10M

OR

10. a) A single row impulse turbine develops 132.4 kW at a blade speed of 175 m/s, using 2 kg of steam per sec. Steam leaves the nozzle at 400 m/s and Velocity coefficient of the blades is 0.9. Steam leaves the turbine blades axially. Determine nozzle angle, blade angles at entry and exit, assuming no shock. 8M
- b) Explain the principle of nozzle governing used in steam turbines with neat sketch 6M

Code: 7G555

III B.Tech. I Semester Supplementary Examinations December 2020

Design of Machine Elements-I

(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 are the considerations in machine design process? Explain. 6M
 b) Define the terms: (i) Stiffness (ii) toughness (iii) Resilience (iv) malleability 8M

OR

2. a) Explain the basic modes of failure of mechanical components with examples. 6M
 b) 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 30kN-m. Determine the diameter of the shaft using 1. Maximum principal stress theory; 2. Maximum shear stress theory; 3. Maximum strain energy theory; assuming a factor of safety of 2. Take $E = 210 \text{ GPa}$ and poisson's ratio = 0.25. 8M

UNIT-II

3. a) What do you understand by stress concentration? Explain methods for reducing stress concentration. 7M
 b) A round shaft made of brittle material and subjected to a bending moment of 15 N-m is shown in **Fig.1**. The stress concentration factor at the fillet is 1.5 and the ultimate tensile strength of the shaft material is 200 N/mm². Determine the diameter d , the magnitude of stress at the fillet and the factor of safety.

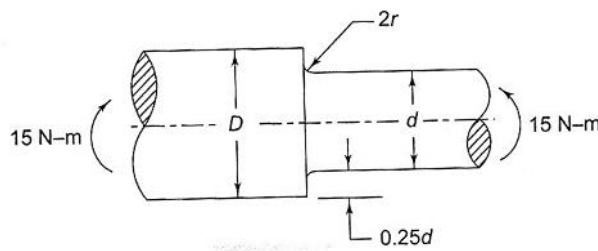


Fig.1

7M

OR

4. A solid circular shaft made of steel Fe620 ($S_{ut} = 620 \text{ N/mm}^2$ and $S_{yt} = 380 \text{ N/mm}^2$) is subjected to an alternating bending moment that varies from -200 N-m to +400 N-m. The shaft is ground and expected reliability is 90%. The theoretical stress concentration factor is 1.6 and the notch sensitivity factor is 0.9. Determine the shaft diameter for infinite life using (i) Soderberg method (ii) Goodman method. Assume size factor = 0.85. 14M

UNIT-III

5. a) Define the following terms in connection with external threads
 (i) Thread angle (ii) pitch (iii) major diameter (iv) lead 7M
 b) The inner diameter of cylindrical pressure vessel is 500 mm and is subjected to an internal pressure of 2 N/mm². The cylinder cover is fixed to the cylinder body by means of 16 bolts of M20 Size. Each bolt is initially tightened with a pre-load of 20 kN. The yield strength of the bolt material is 320 Mpa. Soft packing with through bolts is used for fixing the cover to the cylinder. Determine the factor of safety for the bolts. 7M

OR

6. a) Explain different types of welded joints with sketches. 4M
- b) A welded connection of steel plates is shown in **Fig 3**. It is subjected to an eccentric force of 50 kN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed 70 N/mm²

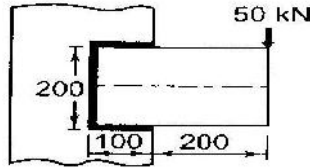


Fig 3.

10M

UNIT-IV

7. a) Prove that a square key is equally strong in shear and compression. 6M
- b) A shaft and key are made of same material and key width is $\frac{1}{3}$ rd of the shaft diameter. (i) Considering shear only determine the minimum length of the key (ii) Determine thickness of the key to make the key equally strong in shear and crushing taking the shear strength of the key material as 40% of crushing strength 8M

OR

8. Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6. 14M

UNIT-V

9. a) How do you classify shaft couplings? 4M
- b) A transmission shaft carries a pulley between two bearings. The bending moment at the pulley varies from 100 N-m to 400 N-m, as the torsional moment in the shaft varies from 50 N-m to 110 N-m. The shaft is made of steel ($S_{ut}=540\text{N/mm}^2$. $S_{yt}=400\text{ N/mm}^2$).The corrected endurance limit of the shaft is 200 N/mm^2 .Determine the diameter of the shaft using a factor of safety of 2. 10M

OR

10. Design a bushed pin type of flexible coupling for connecting the motor and centrifugal pump shafts for the following duty: power to be transmitted =15kW, speed in rpm=1000, diameter of motor and pump shafts=50mm and 40mm respectively, bearing pressure on rubber bush=0.3 N/mm² and allowable shear stress in pins=20 N/mm². 14M

Code: 7G553

III B.Tech. I Semester Supplementary Examinations December 2020

Dynamics of Machinery
(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 uniform wear theory? 4M
 b) A conical pivot with angle of cone as 100° supports a load of 18 KN. The external radius is 2.5 times the internal radius. The shaft rotates at 150 rpm. If the intensity of pressure is to be 300 KN/m^2 and coefficient of friction as 0.05, what is the power lost in working against the friction? 10M

OR

2. a) Explain the working of cone clutch. 4M
 b) Calculate the power transmitted by a single plate clutch at a speed of 2000r.p.m. If the outer and inner radii of friction surfaces are 150mm and 100mm respectively. The maximum intensity of pressure at any point of contact surface should not exceed $0.8 \times 10^5 \text{ N/m}^2$, take both sides of the plate as effective and coefficient of friction=0.3. Assume uniform wear. 10M

UNIT-II

3. The turbine rotor of a ship is of mass 3500 kg. It has a radius of gyration of 0.45 m. and a speed of 3000 r.p.m., clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship:
 (a) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/hr;
 (b) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12° . 14M

OR

4. A simple band brake is operated by a lever of length 500mm long. The brake drum has a diameter of 500mm and the brake band embraces $5/8$ of the circumference. One end of the band is attached to the fulcrum of the lever while the other is attached to a pin on the lever 100mm from the fulcrum. If the effort applied to the end of the lever is 2000N and the coefficient of the friction is 0.25, find the maximum braking torque on the drum. 14M

UNIT-III

5. The equation of the turning moment curve of a three crank engine is $5000 + 1500 \sin 3\theta$ N-m, where θ radians is the crank angle. The moment of inertia of the flywheel is 1000 kg m^2 , and the mean engine speed is 300 r.p.m. Determine:
 (a) The power of the engine; and
 (b) The total fluctuation of speed of the flywheel in percentage under the following conditions:
 i. When the resisting torque is constant.
 ii. When the resting torque is $5000 + 600 \sin \theta$ N-m. 14M

OR

6. A Hartnell governor having a central sleeve spring and two right-angled bell crank levers operates between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine:
- Loads on the spring at the lowest and the highest equilibrium speed
 - Stiffness of the spring.

14M

UNIT-IV

7. The following data refer to an inside cylinder locomotive:
 Mass of the reciprocating parts per cylinder 360 kg pitch of cylinders 70 cm;
 Angle between cranks 90° ; Length of each crank 32cm; Distance between planes of driving wheels 180 cm; Load on each wheel 5 tonnes; Diameter of tread of wheels 190 cm. If the driving wheels lift off the rails at a speed of 100kmph and if the whole of the revolving and a fraction of the reciprocating parts are balanced, what is the value of that fraction?

14M

OR

8. a) What is primary and secondary balancing?
 b) The four masses A, B, C and D are 100 kg, 150 kg, 120 kg and 130 kg attached to a shaft and revolve in the same plane. The corresponding radii of rotations are 22.5 cm, 17.5 cm, 25 cm and 30 cm and the angles measured from A are 45° , 120° and 255° . Find the position and magnitude of the balancing mass, if the radius of rotation is 60 cm.

4M

10M

UNIT-V

9. A single cylinder engine of total mass 200kg is to be mounted on an elastic support which permits vibratory movement in vertical direction only. The mass of the piston is 3.5 kg and has a vertical reciprocating motion which may be assumed simple harmonic with a stroke of 150 mm. It is desired that the maximum vibratory force transmitted through the elastic support to the foundation shall be 600 N when the engine speed is 800 r.p.m. and less than this at all higher speeds.
- Find the necessary stiffness of the elastic support, and the amplitude of vibration at 800 r.p.m, and
 - If the engine speed is reduced below 800 r.p.m. at what speed will the transmitted force again become 600N.

14M

OR

10. Find the frequency of the transverse vibrations of shaft which is simply supported at the ends and is of 40mm in diameter and 2.5m in length. The shaft carries three point loads of masses 30 kg, 70kg, 45kg at 0.5m, 1m and 1.7m respectively from the left support. The Young's modulus for the material of the shaft is 200GN/m^2 . Neglect the weight of the shaft.

14M

Code: 7G556

III B.Tech. I Semester Supplementary Examinations December 2020

Engineering Metrology
(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) Determine the dimensions and tolerances of shaft and hole having size of $30H_7/h_8$ fit. Also, determine the allowance and maximum clearance. 8M
- b) List various types of limit gauges and explain any three gauges. 6M

OR

2. a) A hole and mating shaft are to have a nominal assembly size of 55 mm. The assembly is to have a maximum clearance of 0.34 mm and a minimum clearance of 0.25 mm. The hole tolerance is 1.5 times the shaft tolerance. Determine the limits for both hole and shaft: By using
- i. Hole basis system
- ii. Shaft basis system. 10M
- b) Classify various types of fits 4M

UNIT-II

3. a) Distinguish between straightness and flatness. List out the methods of measuring each of these. 7M
- b) Define wringing? Explain the procedure for wringing of slip gauges 7M

OR

4. Describe the construction and working principle of a micro optic autocollimator with sketch. 14M

UNIT-III

5. a) Identify the symbols used for indicating the surface finish. 6M
- b) List the methods used for measurement of surface finish and explain how you use Talysurf for measurement of surface finish. 8M

OR

6. a) Explicate the working principle of electrical comparator 7M
- b) Differentiate between a gauge and comparator. 7M

UNIT-IV

7. a) Write a short notes on Tool maker's microscope 7M
- b) Elaborate and describe pitch measurement of internal and external screw threads by pitch measuring machine. 7M

OR

8. Explain the following methods of inspecting gear
- (a) Composite errors
- (b) Backlash.
- (c) Gear tooth thickness
- (d) Root radius. 14M

UNIT-V

9. a) Contrast inspection and testing in context to metrology 7M
- b) What is a sampling? Where do you implement single sampling and double sampling plans? 7M

OR

10. a) Explore the applications of CMM in details. 7M
- b) How are CMM machines classified? 7M

Code: 7G551

III B.Tech. I Semester Supplementary Examinations December 2020

Industrial Management

(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) Explain Taylor's principles of scientific management. 7M
 b) Discuss 14 principles of Henry Fayol. 7M

OR

2. a) What do you understand from decentralization? Explain its merits. 7M
 b) What is Line and Staff organization? List out its salient features. 7M

UNIT-II

3. a) Explain in brief factors affecting the decision of a plant location. 7M
 b) Compare process layout with product layout along with a simple example by a diagram of each layout. 7M

OR

4.

Activity on Arrow	Days	Preceded by
A	8	-
B	9	-
C	9	-
D	7	A
E	11	C
F	5	A
G	8	C
H	2	B,E,D
I	3	F
J	9	H
K	11	G,B,D,E
L	6	I,H
M	7	J,K

Construct the activity network using the above data of activity on arrow, estimate earliest start time and latest finish time of each event. Find the float on activities D and F.

14M

UNIT-III

5. a) Discuss following tools, with a simple diagram, used in method study:
 a) Operation Process chart
 b) Flow process chart 7M
 b) What is method study? List out the objectives of method study. 7M

OR

6. a) Discuss SIMO chart. 7M
b) What are the steps involved in method study? Discuss in brief. 7M

UNIT-IV

7. a) Discuss ABC Analysis of inventory classification. 7M
b) Calculate the economic order quantity when Annual requirement is 2,000 units, while Cost of materials per unit as Rs. 20. Consider Cost of placing and receiving one order equal to Rs. 40 and Annual carrying cost of inventory as 20% of inventory value. 7M

OR

8. a) Explain the significance of inventory in an industry. 7M
b) An enterprise requires 2,70,000 units of a certain item annually. The cost per unit is Rs. 3, the cost per purchase order Rs. 100 and the inventory carrying cost Rs.6 per unit per year. What is the economic order quantity? 7M

UNIT-V

9. a) Name different types of evaluation methods, discuss in brief any one method. 7M
b) What is merit rating? List different methods of merit rating. 7M

OR

10. a) List various functions of human resource management. 7M
b) Discuss
i. Job evaluation
ii. Job description
iii. Merit rating
iv. Wage incentive plan 7M

Hall Ticket Number :

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III B.Tech. I Semester Supplementary Examinations December 2020

Machine Tools

(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) Distinguish between orthogonal and oblique cutting? 7M
- b) Explain about cutting tool materials. 7M

OR

2. a) Describe about the forces in turning process 7M
- b) Write about types of cutting fluids? 7M

UNIT-II

3. Explain the types of operations to be performed on lathe machine with neat sketches. 14M

OR

4. a) Compare between Capstan and turret lathes? 7M
- b) Describe about automatic lathes with neat sketch? 7M

UNIT-III

5. Explain the working principle and types of operations to be performed on slotter. 14M

OR

6. a) Describe about jig boring machine with neat sketch? 7M
- b) State and explain methods of indexing in milling machine. 7M

UNIT-IV

7. a) Describe about micro finishing methods 7M
- b) Write about the selection and types of grinding process 7M

OR

8. Explain the construction of broaching machine with neat diagram. 14M

UNIT-V

9. a) State and explain machining parameters of grinding and lapping machines. 7M
- b) Classify fixtures in detail? 7M

OR

10. a) Explain the constructional features of honing machine. 7M
- b) Write about the types of clamping devices? 7M
