Jharkhand University of Technology, Ranchi

Diploma 3rd Semester Examination, 2024 (NEP)

Subject : Mechanics of Materials **Subject Code : MEC 301**

Time Allowed : 3 Hours **Full Marks : 70**

Answer in your own words.

Answer any five *questions in which* Question No. 1 *is compulsory.*

The figures in the margin indicate full marks.

All questions carry equal marks.

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1. Choose the correct answer as applicable MCQs: 2×7=14

(i) In order to determine the effects of a force acting on a body, we must know

(a) its magnitude and direction of the line along which it acts.

(b) its nature (whether push or pull).

(c) point through which it acts on the body.

(d) All of the above

(ii) If a material returns to its original shape after the removal of load, it is said to be

(a) plastic (b) brittle

(c) elastic (d) hard

(iii) Modulus of elasticity is the ratio of

(a) stress to strain (b) stress to original length

(c) deformation to original length (d) All of these

(iv) Thermal stress is caused, when the temperature of a body

(a) is increased. (b) is decreased.

(c) remains constant. (d) is either increased or decreased.

(v) A beam fixed at one end and free at the other is called

(a) Simply supported beam (b) Cantilever beam

(c) Overhanging beam (d) Continuous beam

(vi) Shear force at a point in a beam represents

(a) bending moment at that point. (b) axial force at that point.

(c) lateral force at that point. (d) vertical force at that point.

(vii) If a simply supported beam carries a point load at its center, the maximum beading moment occurs

(a) at the supports. (b) at the center of the beam.

(c) at quarter-span points. (d) along the entire beam.

2. (a) Find the magnitude and direction of the resultant force if the following forces act at a point: 20 N inclined at 30° towards North of East, 25 N towards North, 30 N towards North-West and 35 N inclined at 40° towards South of West.

(b) Find the tensions T_{AC} and T_{BC} in strings AC and BC as shown in Fig. 1. 7+7

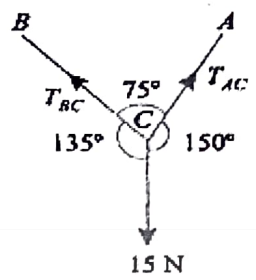

Fig. 1

3. (a) State Hooke's law and draw a typical stress-strain diagram for a mild steel material with all labeled points.

(b) What is factor of safety (FOS) and why is it important in engineering design? 7+7

4. (a) In an experiment, a steel specimen of 13 mm diameter was found to elongate 0.2 mm in a 200 mm gauge length when it was subjected to a tensile force of 26.8 kN. If the specimen was tested within the elastic range, what is the value of Young's modulus for the steel specimen?

(b) A steel bar 2 m long, 40 mm wide and 20 mm thick is subjected to an axial pull of 160 kN in the direction of its length. Find the changes in length, width and thickness of the bar. Take E = 200 GPa and Poisson's ratio = 0.3. 7+7

5. (a) What are the different types of beams? Explain each with diagrams.

(b) Draw shear force and bending moment diagrams for a cantilever beam of span 1.5 m carrying point loads as shown in Fig. 2. 7+7

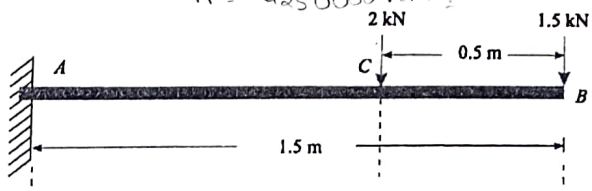

Fig. 2

6. (a) What are the assumptions in the theory of simple bending?

(b) A rectangular beam 60 mm wide and 150 mm deep is simply supported over a span of 6 m. If the beam is subjected to central point load of 12 kN, find the maximum bending stress induced in the beam section. 7+7

7. Write short notes on *any four* from the following: 3.5×4=14

(a) Finite element method

(b) Stiffness matrix of a bar element

(c) Bulk modulus and Modulus of rigidity

(d) Stress concentration

(e) Fatigue-Endurance Limit

Jharkhand University of Technology, Ranchi

Diploma 3rd Semester Examination, 2024 (NEP)

Subject : Fluid Power Engineering **Subject Code : MEC 304**

Time Allowed : 3 Hours **Full Marks : 70**

Answer in your own words.

Answer any five *questions in which* Question No. 1 *is compulsory.*

Each question carry equal marks.

1. Choose the correct alternative: 2×7=14

(i) Which of the following is true for a fluid flow if the Reynolds number is greater than 4000?

(a) The flow is laminar
(b) The flow is turbulent
(c) The flow is steady
(d) The flow is irrotational

(ii) The principle of conservation of mass in fluid flow is expressed by

(a) Bernoulli's Equation
(b) Continuity Equation
(c) Newton's Law of Viscosity
(d) Euler's Equation

(iii) What does a Venturi meter measure?

(a) Pressure difference
(b) Fluid velocity
(c) Fluid density
(d) Flow rate

(iv) For a fluid to be classified as ideal, which condition must be satisfied?

(a) The fluid is incompressible
(b) The fluid has no viscosity
(c) The flow is always steady
(d) The fluid has constant pressure

(v) Which of the following factors does NOT affect the viscosity of a fluid?

(a) Temperature
(b) Pressure
(c) Density
(d) Flow rate

(vi) A centrifugal pump increases the energy of a fluid by

(a) increasing its potential energy.
(b) increasing its kinetic energy.
(c) both kinetic and potential energy.
(d) decreasing the fluid's velocity.

(vii) A Pelton wheel is used in which type of turbine?

(a) Francis turbine
(b) Kaplan turbine
(c) Impulse turbine
(d) Reaction turbine

2. (a) What is the difference between ideal fluids and real fluids? 7

(b) A fluid flows through a pipe that has a diameter of 0.3 m at point A and 0.2 m at point B. The velocity of the fluid at point A is 2 m/s. The fluid density is 1000 kg/m^3. What is the pressure difference between point A and point B? 7

3. (a) How does the Venturi meter use Bernoulli's principle to measure flow rate? 7

(b) Derive the formula for discharge Q through a rectangular notch. Explain how the head of the water above the crest influences the discharge rate. 7

4. (a) Explain the working principle of a centrifugal pump. How does the impeller create pressure and flow? 7

(b) A single-acting reciprocating pump has a cylinder with a diameter of 0.15 m and a stroke length of 0.3 m. The pump operates at 60 strokes per minute and the suction head is 4 m while the delivery head is 16 m. The efficiency of the pump is 80%. Assume the density of water is 1000 kg/ m^3. Find the theoretical discharge of the pump and power required to run the pump. 7

5. (a) Describe the construction and function of the key components of a Pelton wheel turbine. Why is the shape of the bucket critical? 7

(b) What factors should be considered when selecting a hydraulic turbine for a hydroelectric power plant? 7

6. (a) Describe the major components of a hydraulic power plant and their functions. How do these components work together to generate electricity? 7

(b) Explain the working principle of a reaction turbine. How does it differ from an impulse turbine in terms of energy conversion and pressure changes? 7

7. Write short notes on *any four*: 3.5×4=14

(a) Pitot tube

(b) Air Drier

(c) Build a Fluid Power circuit for Automatic reciprocating motion of a double acting Cylinder

(d) Continuity equation

(e) Orifice meter

(f) Darcy's formulae

303

MECH

Jharkhand University of Technology, Ranchi

Diploma 3rd Semester Examination, 2024 (NEP)

Subject : Manufacturing Processes **Subject Code : MEC 303**

Time Allowed : 3 Hours **Full Marks : 70**

Answer in your own words.

Answer any five *questions in which* Question No. 1 *is compulsory.*

The figures in the margin indicate full marks.

All questions carry equal marks.

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1. Choose the correct alternative of the following: 2×7=14

(i) Draft on pattern for casting is provided for

(a) shrinkage allowance (b) identification

(c) taper to facilitate removal from mould (d) machining allowance

(ii) Core print are used for

(a) strengthen core

(b) form seat to support and hold the core in place

(c) fabricate core

(d) None of the above

(iii) In blanking process, clearance is provided

(a) both on punch and die. (b) neither on punch and die.

(c) on the die. (d) on the punch.

(iv) Cold working of metal increases

(a) tensile strength (b) yield strength

(c) hardness (d) All of these

(v) Lathe machine cannot carry out

(a) facing (b) planning

(c) turning (d) drilling

(vi) Connecting rod is generally manufactured by

(a) casting (b) drop forging

(c) machining (d) upset forging

(vii) Dies for wire drawing are made of

(a) cast iron (b) wrought iron

(c) mild steel (d) carbides

2. (a) Explain the safety precautions to be taken in foundaries.

(b) What factors decide the selection of suitable core sand? 7+7

3. (a) Explain different types of defects in casting.

(b) Explain hot and cold working process with application. 7+7

4. (a) Explain the working principle of power hammer.

(b) Explain different sheet metal operations. 7+7

5. (a) Explain the development of prism and pyramid.

(b) What are common forging defects and what are they due to? 7+7

6. (a) Sketch and describe the different types of rolls used in rolling mills.

(b) Name the different tools used in hand moulding, stating their use. 7+7

7. Write short notes on *any four*: 3.5×4=14

(a) Embossing

(b) Shot Peening

(c) Roll Bending

(d) Misrun and Cold shuts

(e) Sand inclusion

(f) Sweep pattern

Jharkhand University of Technology, Ranchi

Diploma 3rd Semester Examination, 2024 (NEP)

Subject : Machine Tool Technology **Subject Code : MEC-302**

Time Allowed : 3 Hours **Full Marks : 70**

Answer in your own words.

Answer five *questions in which* Question No. 1 *is compulsory.*

All questions carry equal marks.

1. Choose the correct alternative: 2×7=14

(i) Lead of Nut is 2 mm and has double start threads. What is the pitch of the Nut?

(a) 1 (b) 2

(c) 3 (d) 6

(ii) Which of the following is mostly used for holding bored part of the job?

(a) Mendrals (b) Dogs

(c) Collet (d) Angle plate

(iii) Indexing Head in milling machine are generally used to

(a) hold cutters. (b) hold the workpiece on table.

(c) act as auxiliary spindle.

(iv) Which of the following can produce both external as well as internal threads?

(a) Thread tapping with taps

(b) Dia threading with self opening dia heads

(c) Thread milling and multiple-thread cutters

(d) Thread chasing with multiple-rip chasers

(v) Grinding wheel is specified C 8 K 5 B 17 is

(a) Very Fine (b) Fine

(c) Medium (d) Coarse

(vi) The surface of the single point cutting tool on which the chips formed in cutting operation slide is called

(a) Flank (b) Heel

(c) Face (d) Shank

(vii) In metal cutting operation maximum heat (80-85%) is generated in

(a) the shear zone. (b) the chip-tool interface zone.

(c) the tool work interface zone. (d) None of these

2. (a) What are the various methods of thread cutting? Explain any one of them.

(b) Describe different parts of the Grinding wheel and their functions. 7+7

3. (a) Why safety is necessary in machine shop? Explain your answer with suitable reasons.

(b) Classify Fire extinguisher and explain their functions with working principle. 7+7

4. (a) How Capstan Lathe is different from Turret Lathe? Differentiate between them.

(b) Explain Knurling, Chamfering, Plain turning and Step turning operations. 7+7

5. (a) To specify drilling machine completely what specification are considered?

(b) Explain different operations performed by using different tools in a drilling machine. 7+7

6. (a) Name different types of milling machine. Explain main parts column and knee type of milling machine.

(b) What do you understand by Abrasive? Explain different type of Abrasive with their characteristics and uses. 7+7

7. Write short notes on *any four*: 3.5×4=14

(a) Fasteners

(b) Capping and Honning

(c) Cutting Fluid and lubrication

(d) Tool signature

(e) Unilateral and Bilateral Tolerances
