Jharkhand University of Technology, Ranchi

Diploma 1st Semester Examination, 2024 (NEP-2024)

Subject : Mechanical Science & Engg.   Subject Code : MEC-101

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.

Choose the correct answer from the four alternatives: 2×7=14

1. (A) Which type of cast iron has graphite in the form of flakes?

   (a) White cast iron   (b) Grey cast iron

   (c) Ductile cast iron   (d) Malleable cast iron

   (B) Which material is commonly used for manufacturing transmission shafts?

   (a) Cast iron   (b) High-carbon steel

   (c) Low-carbon steel   (d) Brass

   (C) The material commonly used for belts in belt drives is:

   (a) Nylon   (b) Leather

   (c) Rubber   (d) All of these

   (D) What is the main feature of a riveted joint?

   (a) It can be easily disassembled.   (b) It is a temporary joint.

   (c) It is a permanent joint.   (d) It requires no special tools for assembly.

   (E) Which of the following is not a type of gear?

   (a) Spur gear   (b) Worm and worm wheel

   (c) Compound gear   (d) Rack and pinion

   (F) Which of the following is an example of an IC engine?

   (a) Steam turbine   (b) Gasoline engine

   (c) Steam engine   (d) None of these

   (G) Friction power is the difference between

   (a) Indicated power and brake power   (b) Brake power and thermal power

   (c) Indicated power and mean effective power   (d) Brake power and torque

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2. (A) Describe the different types of steels and their uses in engineering. What are the effects of impurities on steel?

(B) Describe the different types of shaft couplings and explain their respective applications in mechanical systems. 7+7

3. (A) What is the difference between slip and creep in a belt drive? 4

(B) In a simple gear train, the driving gear has 20 teeth and rotates at 1000 RPM. It drives a second gear with 40 teeth, which is mounted on the same shaft as a third gear with 30 teeth. The third gear drives a fourth gear with 60 teeth. Calculate:

   (a) The speed of the fourth gear

   (b) The overall velocity ratio of the gear train 10

4. (A) Explain the lap joint with neat sketches. 5

(B) A screwed joint is subjected to a tensile load of 30 kN. The screw is made of steel with an ultimate tensile strength of 400 MPa and a factor of safety of 4. Determine:

   (a) The nominal diameter of the screw, assuming the core diameter is 80% of the nominal diameter.

   (b) The shear stress in the screw if the thread is single-start. 9

5. (A) Define swept volume and total volume of an engine and explain their significance in engine performance. 7

(B) A single-cylinder, four-stroke engine has a bore of 100 mm, a stroke of 120 mm and runs at 1500 RPM. The indicated power is measured to be 5 kW. Calculate:

   (a) The mean effective pressure (MEP)

   (b) The engine's cycle frequency 7

6. (A) What are the advantages of CI engines over SI engines in heavy-duty applications?

(B) A four-stroke diesel engine operates at 2000 RPM, and its brake power is 20 kW. If the specific fuel consumption (SFC) is 0.25 kg/kWh, calculate the total fuel consumed in one hour. 7+4

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

   (A) Compression ratio

   (B) Ceramic

   (C) Sunk key

   (D) Brake Thermal Efficiency

   (E) Riveted joints

   (F) Gear trains