

PART III

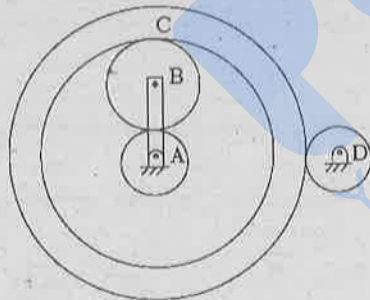
06 – AUTOMOBILE ENGINEERING

(Answer ALL questions)

56. For an Oldham coupling used between two shafts, which among the following statements are correct?

- I. Torsional load is transferred along shaft axis.
 - II. A velocity ratio of 1:2 between shafts is obtained without using gears.
 - III. Bending load is transferred transverse to shaft axis.
 - IV. Rotation is transferred along shaft axis.
- a. I and III
 - b. II and IV
 - c. II and III
 - d. I and IV

57. An epicyclic gear train is shown in the figure below. The number of teeth on the gears A, B and D are 20, 30 and 20, respectively. Gear C has 80 teeth on the inner surface and 100 teeth on the outer surface. If the carrier arm AB is fixed and the sun gear A rotates at 300 rpm in the clockwise direction, then the rpm of D in the clockwise direction is



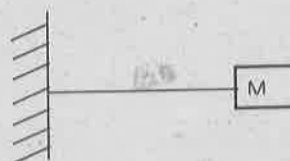
- a. 300
- b. 375
- c. -75
- d. -200

58. Pitch circle diameter of an involute gear is _____

- a. independent of any other element
- b. constant for a set of meshing gears
- c. dependent on pressure angle
- d. proportional to base diameter

59. A mass M of 20 kg is attached to the free end of a steel cantilever beam of length 1000 mm having a cross-section of 25×25 mm. Assume the mass of cantilever to be negligible and $E_{\text{steel}} = 200$ Gpa. If the lateral vibration of this system is critically damped using a viscous damper, then damping constant of the damper is

- a. 1250 Ns/m
- b. 625 Ns/m
- c. 312.50 Ns/m
- d. 156.25 Ns/m



60. Consider the following statements for a 4 cylinder in line engine whose cranks are arranged at regular intervals of 90°

- I. There are 8 possible firing orders for the engine.
- II. Primary force will remain unbalanced for some firing orders.

Which of the statements given above is correct?

- a. I only
- b. II only
- c. Both I and II
- d. Neither I nor II

61. A four bar mechanism is made up of links of length 100, 200, 300 and 350 mm. if the 350 mm link is fixed, the number of links that can rotate fully is

- a. 2
- b. 1
- c. 3
- d. 0

62. A cantilever beam of length 5m is subjected to an UDL of 2kN/m throughout the length of the beam. The maximum bending moment for the beam is

- a. -25 kNm
- b. -10 kNm
- c. 10 kNm
- d. 25 kNm

63. If the pressure angle of the rack is 20° , then force acting along the line of action between the rack and gear teeth is

a. 250 N
b. 342 N
c. 532 N
d. 600 N

64. In a cam-follower mechanism, the follower needs to rise through 20 mm during 60° of cam rotation, the first 30° with a constant acceleration and then with a deceleration of the same magnitude. The initial and the final speeds of the follower are zero. The cam rotates at a uniform speed of 300 rpm. The maximum speed of the follower is

a. 0.60 m/s
b. 1.20 m/s
c. 1.68 m/s
d. 2.40 m/s

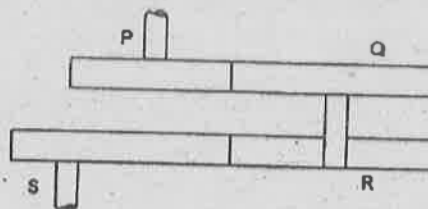
65. Two mating spur gears have 40 and 120 teeth respectively. The pinion rotates at 1200 rpm and transmits a torque of 20 Nm. The torque transmitted by the gear is

a. 6.6 Nm
b. 20 Nm
c. 40 Nm
d. 60 Nm

66. 100 kW power is supplied to the machine through a gear box which uses an epicyclic gear train. The power is supplied at 100 rad/s. The speed of the output shaft of the gear box is 10 rad/s in a sense opposite to the input speed. What is the holding torque on the fixed gear of the train?

a. 8 kNm
b. 9 kNm
c. 10 kNm
d. 11 kNm

67. In a reverted gear train, two gears P and Q are meshing, Q - R is a compound gear, and R and S are meshing. The modules of P and R are 4 mm and 5 mm respectively. The number of teeth in P, Q and R are 20, 40 and 25 respectively. The number of teeth in S is



a. 23
b. 35
c. 50
d. 53

68. The air standard efficiency of an Otto cycle is given by,

a. $\eta = 1 + \frac{1}{(r^{\gamma+1})}$
b. $\eta = 1 - \frac{1}{(r^{\gamma-1})}$
c. $\eta = 1 - \frac{1}{(r^{\gamma+1})}$
d. $\eta = 2 - \frac{1}{(r^{\gamma-1})}$

69. For the same compression ratio

a. Thermal efficiency of Otto cycle is greater than that of diesel cycle.
b. Thermal efficiency of Otto cycle is less than that of diesel cycle.
c. Thermal efficiency of Otto cycle is same as that of diesel cycle.
d. Thermal efficiency of Otto cycle cannot be predicted.

70. The efficiency of a Carnot engine using an ideal gas as the working substance is

a. $\frac{T_1 - T_2}{T_1}$
b. $\frac{T_1}{T_1 - T_2}$
c. $\frac{T_1 T_2}{T_1 - T_2}$
d. $\frac{T_1 - T_2}{T_1 T_2}$

71. The entropy may be expressed as a function of
 a. Pressure and temperature
 b. Temperature and volume
 c. Heat and work
 d. All of the above
72. Stefan- Boltzmann law is expressed as
 a. $Q = \sigma AT^4$
 b. $Q = \sigma A^2 T^4$
 c. $Q = \sigma AT^2$
 d. $Q = AT^4$
73. The refrigerant, commonly used in vapour absorption refrigeration system is
 a. Sulphur-di-oxide
 b. Ammonia
 c. Freon
 d. Aqua ammonia
74. The following table shows the various casting defects and its causes. Identify the most appropriate cause for each defect.
- | Defect | Cause |
|-----------------------|------------------------------------|
| A. Gas defect | i. Two stream do not fuse |
| B. Shrinkage cavities | ii. Incomplete mold cavity filling |
| C. Cold shut | iii. Lower venting |
| D. Misrun | iv. Liquid shrinkage |
- a. A - iii, B - i, C - iv, D - ii
 b. A - iv, B - iii, C - ii, D - i
 c. A - iii, B - iv, C - i, D - ii
 d. A - ii, B - iii, C - iv, D - i
75. The following are true for rolling, except
 a. velocity of metal at exit is same as that at the entry
 b. grains are elongated in the direction of rolling
 c. after crossing the stress zone the grain starts refining
 d. the greater the coefficient of friction more the possible reduction
76. Which of the following is not a type of resistance welding?
 a. Seam
 b. Projection
 c. Electro-slag
 d. Spot
77. The thickness of the chip in upmilling is _____ when the cut terminates.
 a. minimum
 b. maximum
 c. zero
 d. depends on feed rate
78. Which of the following lathe part serves as a housing for the back gear, driving pulley etc?
 a. tailstock
 b. headstock
 c. bed
 d. toolpost
79. Point-to-point system is not suitable for
 a. reaming
 b. drilling
 c. tapping
 d. facing
80. In Reversed - Elliot type stub axle configuration the _____ prevents axial movement of stub axle.
 a. Thrust washer
 b. Pitman arm
 c. Relay rod
 d. U joints
81. When the teeth have worn out, the eccentric bush is rotated by certain angle for compensation in _____ steering gearbox?
 a. Recirculating ball type
 b. Worm and nut type
 c. Rack and pinion type
 d. Worm and wheel type

82. In modern passenger cars with live rear axle, the central tunnel may be avoided by using _____ type arrangement.
- Straight bevel gear
 - Spiral bevel gear
 - Hypoid bevel gear
 - Worm and worm wheel
83. Which of the following is NOT taken by Torque tube in Torque tube type rear drive?
- Side thrust
 - Torque reaction
 - Driving thrust
 - Braking torque
84. The brake foot pedal has a leverage of 5 is applied with a force of 200N. Calculate the force on the master cylinder piston.
- 40 N
 - 205 N
 - 1000 N
 - 195 N
85. Which one of the following statements is/are true?
Statements:
- Longer leaf springs gives a hard suspension
 - Rear leaf springs are kept longer than the front leaf springs
 - Shackle gives a flexible connection
- i only
 - i and ii only
 - ii and iii only
 - i and iii only
86. Which one of the following is not related to fluid coupling?
- Impeller
 - Turbine
 - Over running clutch
 - Drag torque
87. Calculate the force (tractive effort) that is required to overcome the gradient resistance of a vehicle weighing 3.5 tonnes on a gradient of 30° . Take $g = 9.81 \text{ m/s}^2$
- 17.167 kN
 - 17.167 N
 - 16 N
 - 106 N
88. Automatic transmission is a combination of _____
- Fluid coupling and torque converter
 - Fluid coupling and ORC
 - ORC and Torque converter
 - Epicycle gear train and torque converter
89. Double declutching is a problem related to _____
- Constant mesh gear box
 - Synchromesh gear box
 - Epicycle gear box
 - Sliding mesh gear box
90. To achieve reverse in simple epicycle gear box, reaction member is
- Sun gear
 - Ring gear
 - Planed carrier
 - None of the above
91. Which of the following vehicle is pick-up or Truck as per body shape?
- Vehicle with a separate cabin and rear load area or compartment
 - Vehicle having a passenger cabin with two rows of seats and integrated cargo space
 - A car body style with a folding or retracting roof(soft roof)
 - Vehicle with two rows of seats and a separate truck for luggage, at the rear
92. Quarter light is _____
- The window directly above the quarter panel.
 - The side panel extending from door to the rear end of the body.
 - A raised floor panel section for driver shaft clearance.
 - The front lamp.
93. Spoilers on the front of a vehicle are often called _____
- Air dam
 - Air cutter
 - Front wings
 - Aerofoil

94. Which one of the following is not a part of wind tunnel?
- Multiple axis force transducer
 - Test section
 - Blower
 - Car model
95. Sill panel is _____
- Panel directly below the bottom of the door.
 - The side panel extending from the door to the rear end of the body.
 - A raised floor panel section for drive shaft clearance.
 - Panel between the bonnet and wind screen.
96. The drag coefficient of a passenger car will be in the range of _____
- 0.7 – 0.9
 - 0.5 – 0.6
 - 0.3 – 0.4
 - 0.1 – 0.3
97. The rolling resistance is because of the friction between the
- Wheel rim and tyre
 - Tyre and the road surface
 - Mating gears in the gear box
 - Bearings and the crankshaft
98. What is the main purpose of the field coils in a DC motor?
- Create a stationary magnetic field
 - Create a magnetic field in the armature
 - Create a CEMF
 - Reverse the polarity in the armature winding just as commutation occurs
99. A waveform repeats itself 60 times per second. What is the frequency of the waveform?
- 120 hertz
 - 1 hertz
 - 60 hertz
 - 3600 hertz
100. Why are slip rings in an alternator necessary?
- They permit the stator to rotate.
 - They provide a high resistance connection to the stator windings.
 - They prevent a delta from forming.
 - They permit current to flow through a rotating component called the rotor
101. A rectifier diode bridge is used to perform which operation in an alternator?
- Convert DC into AC
 - Regulate voltage output
 - Bridge the gap between the stator and the rotor
 - Convert or rectify the negative half of a sine wave into the positive half of a sine wave
102. A lead acid battery is completely discharged. What can be said about the plate material and the electrolyte?
- Positive and negative plates have transformed into nearly the same lead material and the electrolyte has become mostly water.
 - Positive and negative plates have transformed into sulfur and the electrolyte has become pure sulfuric acid.
 - The electrolyte has become pure sulfuric acid and the plates have transformed into different compounds of lead.
 - The plates have transformed into different compounds of lead and the electrolyte has become a mixture of water and sulfuric acid
103. Integral control has the advantage of :
- reducing steady state offsets
 - reducing overshoot
 - increasing stability
 - all of the above
104. Overmixing in CI engines increases _____
- NOx emission
 - HC emission
 - Aldehyde emission
 - Smoke emission

105. _____ is the reason for the black smoke in diesel engine
- Unburned HC
 - CO
 - Soot
 - NO_x
106. When EGR rate is increased, causes _____
- Decreases the NO_x emission
 - Increases the HC emission
 - PM emission decreased
- i, ii only
 - ii, iii only
 - i, iii only
 - i, ii and iii
107. The NDIR analyzer works based on the principle of _____
- Kirchhoff's law
 - Dalton's law
 - Beer-Lambert's law
 - Newton's law
108. By increasing exhaust gas temperature, catalytic converter efficiency _____
- Increases
 - Decreases
 - No effect
 - Increases first and then decreases
109. Diesel oxidation catalyst is used for controlling _____
- Hydrocarbon
 - Carbon mono oxide
 - Particulate matter
- i, ii only
 - ii, iii only
 - i, iii only
 - i, ii and iii
110. The flammability limit of hydrogen in air (by volume) is
- 4 : 1 – 75 : 1
 - 10 : 1 – 50 : 1
 - 5 : 1 – 15 : 1
 - 15 : 1 – 60 : 1
111. Smoke formation in the vegetable oil fuelled diesel engine is in the
- Ignition delay period
 - Premixed combustion phase
 - Diffusion combustion phase
 - None of the above
112. Presence of oxygen in vegetable oil results in
- Increasing the Calorific Value of the fuel
 - Reducing the calorific value of fuel
 - Increasing the viscosity of the fuel
 - Reducing the cetane number of the fuel
113. In dual fuel engine the combustion is controlled by the
- Spark timing
 - Pilot fuel ignition
 - Primary fuel ignition
 - None of the above
114. The ignition energy required for hydrogen is
- Higher than gasoline
 - Lower than gasoline
 - Equal to gasoline
 - Equal to diesel
115. The density of LPG as compared to air is
- 0.5 to 1.5 times heavier
 - 1.5 to 2.0 times heavier
 - 2.0 to 2.5 times heavier
 - 2.5 to 3.0 times heavier