1) The maximum efficiency of spiral gears is (where θ = Shaft angle, and φ = Friction angle)

(A) $\sin(\theta + \varphi) + 1/ \cos(\theta - \varphi) + 1$

(B) $\cos(\theta - \varphi) + 1/ \sin(\theta + \varphi) + 1$

(C) $\cos(\theta + \varphi) + 1/ \cos(\theta - \varphi) + 1$

(D) $\cos(\theta - \varphi) + 1/ \cos(\theta + \varphi) + 1$

2) The steering of a ship means

(A) Movement of a complete ship up and down in vertical plane about transverse axis

(B) Turning of a complete ship in a curve towards right or left, while it moves forward

(C) Rolling of a complete ship sideways

(D) None of the above

3) The ratio of maximum fluctuation of energy to the work-done per cycle is called

(A) Fluctuation of energy

(B) Maximum fluctuation of energy

(C) Coefficient of fluctuation of energy

(D) None of these

4) A rigid body, under the action of external forces, can be replaced by two masses placed at a fixed distance apart. The two masses form an equivalent dynamical system, if

(A) The sum of the two masses is equal to the total mass of body

(B) The center of gravity of the two masses coincides with that of the body

(C) The sum of mass moment of inertia of the masses about their center of gravity is equal to the mass moment of inertia of the body

(D) All of the above

5) The velocity of piston in a reciprocating steam engine is given by (where ω = Angular velocity of crank, r = Radius of crank pin circle, θ = Angle turned by crank from inner dead center, and n = Ratio of length of connecting rod to the radius of crank)

(A) $\omega r [\sin \theta + (\sin 2\theta/n)]$

(B) $\omega r [\cos \theta + (\cos 2\theta/n)]$

(C) $\omega^2 r [\sin \theta + (\sin 2\theta/n)]$

(D) $\omega^2 r [\cos \theta + (\cos 2\theta/n)]$

6)Which one of the following can completely balance several masses revolving in different planes on a shaft?

(A) A single mass in different planes

(B) Two masses in any two planes

(C) A single mass in one of the planes of the revolving masses

(D) Two equal masses in any two planes

7)An involute pinion and gear are in mesh. If both have the same size of addendum, then there will be an interference between the

(A) Tip of the gear tooth and flank of pinion

(B) Tip of the pinion and flank of gear

(C) Flanks of both gear and pinion

(D) Tip of both gear and pinion

8)The dedendum circle diameter is equal to (where, φ = Pressure angle)

(A) Pitch circle dia. $\times \cos\varphi$

(B) Addendum circle dia. $\times \cos\varphi$

(C) Clearance circle dia. $\times \cos\varphi$

(D) Pitch circle dia. $\times \sin\varphi$

9) In involute gears, the pressure angle is

(A) Dependent on the size of teeth

(B) Dependent on the size of gears

(C) Always constant

(D) Always variable

10) When the pitching of a ship is upward, the effect of gyroscopic couple acting on it will be

(A) To move the ship towards starboard

(B) To move the ship towards port side

(C) To raise the bow and lower the stern

(D) To raise the stern and lower the bow

11)Balancing of rotating and reciprocating parts of an engine is necessary when it runs at

(A) Slow speed

(B) Moderate speed

(C) Highs peed

(D) Any one of these

12)The secondary unbalanced force is _____ the primary unbalanced force.

(A) One-half

(B) Two-third

(C) n times

(D) 1/n times

13)The unbalanced force due to reciprocating masses

(A) Varies in magnitude but constant in direction

(B) Varies in direction but constant in magnitude

(C) Varies in magnitude and direction both

(D) Constant in magnitude and direction both

14)Maximum fluctuation of energy in a flywheel is equal to [where I = Mass moment of inertia of the flywheel, E = Maximum fluctuation of energy, CS = Coefficient of fluctuation of speed, and ω = Mean angular speed = $(\omega_1 + \omega_2)/2$]

(A) $I.\omega.(\omega_1 - \omega_2)$

(B) $I.\omega^2.CS$

(C) 2.E.CS

(D) All of these

15.The rotor of a ship rotates in clockwise direction when viewed from stern and the ship takes a left turn. The effect of gyroscopic couple acting on it will be

(A) To raise the bow and stern

(B) To lower the bow and stern

(C) To raise the bow and lower the stern

(D) To raise the stern and lower the bow

16.The secondary unbalanced force due to inertia of reciprocating parts in a reciprocating engine is given by (where m = Mass of reciprocating parts, ω = Angular speed of crank, r = Radius of crank, θ = Angle of inclination of crank with the line of stroke, and n = Ratio of the length of connecting rod to radius of crank)

(A) $m.\omega^2.r \sin\theta$

(B) $m.\omega^2.r \cos\theta$

(C) $m.\omega^2.r (\sin 2\theta/n)$

(D) $m.\omega^2.r (\cos 2\theta/n)$

17.In a simple train of wheels, the velocity ratio _____ the intermediate wheels.

(A) Depends upon

(B) Is independent of

(C) Either A or B

(D) None of these

18.There are six gears A, B, C, D, E and F in a compound train. The numbers of teeth in the gears are 20, 60, 30, 80, 25 and 75 respectively. The ratio of angular speeds of the driven (F) to the driver (A) of the drive is

(A) 1/24

(B) 1/8

(C) 4/15

(D) 12

19.The engine of an aeroplane rotates in clockwise direction when seen from the tail end and the aeroplane takes a turn to the left. The effect of gyroscopic couple on the aeroplane will be

(A) To dip the nose and tail

(B) To raise the nose and tail

(C) To raise the nose and dip the tail

(D) To dip the nose and raise the tail

20.The centre distance between two meshing involute gears is equal to

(A) Sum of base circle radii / cosφ

(B) Difference of base circle radii / cosφ

(C) Sum of pitch circle radii / cosφ

(D) Difference of pitch circle radii / cosφ

21.In a reciprocating steam engine, when the crank has turned from inner dead centre through an angle θ, the angular velocity of the connecting rod is given by

(A) $\omega \sin\theta/(n^2 - \sin^2\theta)1/2$

(B) $\omega \cos\theta/(n^2 - \cos^2\theta)1/2$

(C) $\omega \sin\theta/(n^2 - \cos^2\theta)1/2$

(D) $\omega \cos\theta/(n^2 - \sin^2\theta)1/2$

22.The unbalanced force due to revolving masses

(A) Varies in magnitude but constant in direction

(B) Varies in direction but constant in magnitude

(C) Varies in magnitude and direction both

(D) Constant in magnitude and direction both

23.The maximum fluctuation of energy is the

(A) Difference between the maximum and minimum energies

(B) Sum of the maximum and minimum energies

(C) Variations of energy above and below the mean resisting torque line

(D) Ratio of the mean resisting torque to the work-done per cycle

24.An imaginary circle which by pure rolling action, gives the same motion as the actual gear, is called

(A) Addendum circle

(B) Dedendum circle

(C) Pitch circle

(D) Clearance circle

25.Which type of gear train is used in clock mechanism to join hour hand and minute hand?

(A) Simple gear train

(B) Compound gear train

(C) Reverted gear train

(D) Epicyclic gear train

26.The velocity of sliding of meshing gear teeth is

(Where ω_1 and ω_2 are angular velocities of meshing gears and 'y' is distance between point of contact and the pitch point)

(A) $(\omega_1 + \omega_2)\, y$

(B) $(\omega_1/\omega_2)\, y$

(C) $(\omega_1 \times \omega_2)\, y$

(D) $(\omega_1 + \omega_2)/y$

27.Minimum number of teeth for involute rack and pinion arrangement for pressure angle of 20° is

(A) 10

(B) 20

(C) 30

(D) 34

28.When the pitching of a ship is _____ the effect of gyroscopic couple acting on it will be to move the ship towards port side.

(A) Upward

(B) Downward

(C) Forward

(D) Backward

29.The contact ratio is given by

(A) (Length of the path of approach)/(Circular pitch)

(B) (Length of path of recess)/(Circular pitch)

(C) (Length of the arc of contact)/(Circular pitch)

(D) (Length of the arc of approach)/cosφ

30.The partial balancing of reciprocating parts in locomotives produces

(A) Hammer blow

(B) Swaying couple

(C) Variation in tractive force along the line of stroke

(D) All of the above

31.When the axes of the first and last wheels are co-axial, then the train is known as
A.simple train of wheels
B.compound train of wheels
C.reverted gear train
D.epicyclic gear train

32.The primary unbalanced force is more than the secondary unbalanced force.
A.True
B.False

33.The primary unbalanced force due to inertia of reciprocating parts in a reciprocating engine is given by (where m = Mass of reciprocating parts, ω = Angular speed of crank,

r = Radius of crank, θ = Angle of inclination of crank with the line of stroke, and n = Ratio of the lengm of connecting rod to radius of crank)

A. $m.\omega^2.r \sin\theta$

B. $m.\omega^2.r \cos\theta$

C. $m.\omega^2.r \left(\frac{\sin 2\theta}{n}\right)$

D. $m.\omega^2.r \left(\frac{\cos 2\theta}{n}\right)$

34.Calculate speed of driving shaft in compound gear train, if the drivers have 50, 60, 80 and 100 teeth and followers have 18, 40, 60 and 80 teeth. Speed of driven shaft is 150 rpm

a. 21.73 rpm
b. 30.23 rpm
c. 19.77 rpm
d. None of the above

35.Which type of gear box is used in automobiles?

a. Sliding mesh gear box
b. Differential gear box
c. Synchromesh gear box
d. All of the above

36.What is meant by an idle gear?

a. Gears between driver and driven gears
b. Gears used when driver and driven gears move in same direction
c. Both a. and b.
d. None of the above

37.In which type of gear trains, shaft axes which are mounted by gear wheels have relative motion between them?

a. Compounded gear train
b. Simple gear train
c. Epicyclic gear train
d. Reverted gear train

38.Which gear train is used for higher velocity ratios in a small space?
a) Simple gear train
b) Compound gear train
c) Reverted gear train

d) Epicyclic gear train

39.A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is
a) 2
b) 4
c) 3
d) none of the mentioned

40.A differential gear in automobilies is used to
a) reduce speed
b) assist in changing speed
c) provide jerk-free movement of vehicle
d) help in turning

41.Calculate gyroscopic couple acting on a disc which has radius of 135 mm. Angular and precessional velocities are 15 rad/sec and 7 rad/sec respectively.
Assume density = 7810 kg/m^3 and thickness of disc = 30 mm

a. 12.83 N-m
b. 10.99 N-m
c. 11 N-m
d. Incomplete data

42.Gyroscopic effect is not observed in which of the following actions performed by the ships?

a. Rolling
b. Pitching
c. Steering
d. All of the above

43.The engine of an aeroplane rotates in clockwise direction when seen from the tail end and the aeroplane takes a turn to the left. The effect of gyroscopic couple on the aeroplane will be
a) to dip the nose and tail
b) to raise the nose and tail
c) to raise the nose and dip of the tail
d) to dip the nose and raise the tail

44.Axis of rotation of wheel in gyroscope is called _____
a) Spin axis
b) Vertical axis
c) Horizontal axis

d) Angular axis
View Answer

45.The rotor of a ship rotates in clockwise direction when viewed from stern and the ship takes a right turn. The effect of gyroscopic couple acting on it will be to raise the stern and lower the bow.
a) True
b) False

46.A flywheel of mass moment of inertia 9.8 kg.m^2 fluctuates by 30 rpm. For a fluctuation of energy is 1936 Joule mean speed of flywheel rpm is
A)2940
B)900
C)600
D)968

47.Which of the following statements are correct?
A)Flywheel does not reduce speed fluctuations during a cycle for a constant load, but flywheel does control the mean speed of engines if the load changes.
B)Governor controls the speed of fluctuation during a cycle for a constant load, but governor does not control the mean speed of the engine if the load changes.
C)Governor control the speed fluctuation, during a cycle for a constant load & governor also controls the mean speed by the engine if the load changes.
D)Flywheel reduces fluctuation during a cycle for a constant load, but flywheel does not control the mean speed of the engine if the load changes.

48.Consider the following statements:

The flywheel in an IC engine

1. acts as a reservoir of energy

2. minimizes cyclic fluctuations in the engine speed

3. takes care of load fluctuations in the engine and controls speed variation

Of these statements
A)1 and 2 are correct
B)1 and 3 are correct
C)2 and 3 are correct
D)2 and 3 are correct

49. What is the condition for dynamic balancing of a shaft-rotor system?
A)$\sum M = 0$ and $\sum F = 0$
B)$\sum M = 0$
C)$\sum F = 0$
D)$\sum M + \sum F = 0$

50. Static balancing is satisfactory for low speed rotors but with increasing speeds, dynamic balancing becomes necessary. This is because, the
A)unbalanced couples are caused only at higher speeds
B)unbalanced forces are not dangerous at higher speeds
C)effect of unbalances are proportional to the square of the speed
D)effect of unbalances are proportional to the speed

51. Which of the following conditions should be satisfied for a two point mass statistically equivalent system?

1. $m = m_1 + m_2$
2. $m_1 l_2 = m_2 l_1$
3. $m_1 l_1 = m_2 l_2$
4. $I_G = I_{G1} + I_{G2}$

a. Condition 1 and condition 2
b. Condition 1 and condition 3
c. Condition 2 and condition 4
d. All the above conditions should be satisfied

52. Match the following Group 1 items with Group 2 items

1. Piston effort (F_P) ---------- A. $F_Q \sin(\theta + \Phi)$
2. Thrust in connecting rod (F_Q) ---------- B. $F_Q \cos(\theta + \Phi)$
3. Tangential force on crank shaft (F_T) ---------- C. $F_g - F_1 + F_F + W_R$
4. Radial force along crank shaft (F_R) ---------- D. $F_P / \cos \Phi$

a. 1 – A, 2 – C, 3 – D, 4 – B
b. 1 – B, 2 – D, 3 – C, 4 – A
c. 1 – C, 2 – D, 3 – A, 4 – B
d. 1 – B, 2 – A, 3 – D, 4 – C

53. What is the equivalent length of simple pendulum, when compound pendulum is converted into simple pendulum?

a. $l_e = (k + l) / l$
b. $l_e = l^2 / (k^2 + l^2)$
c. $l_e = (k^2 + l^2) / l$
d. none of the above

54. A connecting rod has periodic time of 1.5 sec/cycle for one oscillation. Calculate radius of gyration, when centre of gravity is at a distance of 500 mm from the small end.

a. 0.1325 m
b. 0.1719 m
c. 0.0295 m
d. 0.555 m

55. According to D' Alembert's principle, the body is in equilibrium position if

a. inertia force is applied in the direction opposite to the resultant force
b. inertia force is applied in the same direction of the resultant force
c. both a. and b.
d. none of the above

56. Which of the following statements is/are true?

1. Static force analysis does not consider inertia forces along with static forces
2. The SI unit of mass moment of inertia is kg/m^2
3. Mass moment of inertia of a thin disc about its diameter is given by $(mr^2) / 2$

a. Only 1
b. Only 2
c. Only 3
d. All the above statements are true

57. Maximum efficiency of spiral gears is given as

a. $[\cos (\theta + \Phi) + 1] / [\cos (\theta - \Phi) + 1]$
b. $[\cos (\theta + \Phi) - 1] / [\cos (\theta - \Phi) - 1]$
c. $[\sin (\theta + \Phi) - 1] / [\cos (\theta - \Phi) - 1]$
d. $[\sin (\theta + \Phi) - 1] / [\sin (\theta - \Phi) - 1]$

58) Which type of gears have point contact between two mating gears?

a. Helical gears
b. Spiral gears
c. Both a. and b.
d. None of the above

59) What is meant by pitching of ship?

a. up and down motion of bow and stern along transverse axis
b. up and down motion of bow and stern along longitudinal axis
c. up and down motion of port and starboard along transverse axis
d. none of the above

60. Gyroscopic effect is not observed in which of the following actions performed by the ships?

a. Rolling
b. Pitching
c. Steering
d. All of the above

61) What is the effect of reactive gyroscopic couple when aeroplane takes right turn and propeller rotates in clockwise direction when looking from rear end ?

a. The tail of the aeroplane is dipped and nose is raised
b. The tail of the aeroplane is raised and nose is dipped
c. Reactive gyroscopic couple has no effect when propeller rotates in clockwise direction
d. None of the above

62) For a simple gear train, velocity ratio is the ratio of

a. Speed of driving shaft and speed of driven shaft
b. Speed of driven shaft and speed of driving shaft
c. Speed of driven shaft and (speed of driving shaft + speed of idler gears)
d. Speed of driving shaft and (speed of driven shaft + speed of idler gears)

63) In spiral gears if normal circular pitch is 13 mm. What is the normal module?

a. 40.84 mm
b. 2.06 mm
c. 4.13 mm
d. None of the above

64) If friction angle $\Phi = 5.43^{o}$, calculate maximum efficiency of worm gearing

a. 82.71 %
b. 90.53 %
c. 80.23 %
d. None of the above

65) Which of the following conditions specify maximum efficiency of spiral gears?

a. $(\theta + \alpha) / 2$
b. $(\theta - \alpha) / 2$
c. Both a. and b.
d. None of the above

66) Calculate the number of teeth on wheel, when number of teeth on pinion and wheel are equal. Pressure angle is 25^{o}

a. 11
b. 12
c. 7
d. 9

67) What is meant by contact ratio in gears?

a. Ratio of length of arc of approach and circular pitch

b. Ratio of circular pitch and length of arc of contact
c. Ratio of length of arc of recess and circular pitch
d. Ratio of length of arc of contact and circular pitch

68) In involute gears what is the effect of center distance variation on velocity ratio?

a. Velocity ratio increases
b. Velocity ratio decreases
c. It has no effect on velocity ratio
d. None of the above

69) Interference in gear tooth profiles can be avoided by

a. modifying tooth profile
b. modifying center distance between pinion and wheel
c. both a. and b.
d. none of the above

70) How is the direction of precession vector decided by right hand rule?

a. Thumb denotes direction of precession vector
b. Curled fingers denote direction of precession vector
c. both a&b
d. None of above

71) What is meant by an idle gear?

a. Gears between driver and driven gears
b. Gears used when driver and driven gears move in same direction
c. Both a. and b.
d. None of the above

72) In which type of gear trains, shaft axes which are mounted by gear wheels have relative motion between them?

a. Compounded gear train
b. Simple gear train
c. Epicyclic gear train
d. Reverted gear train

73) Calculate center distance between two helical gears which has helix angle of 20^{o}, when normal module is 10. Pinion and gear have 30 and 70 teeth respectively

a. 532.02 mm
b. 212.78 mm
c. 500 mm
d. None of the above

74) Which among the following relations is used to relate transverse pressure angle and normal pressure angle for helical gears?

where Φ_n = normal pressure angle & Φ_t = transverse pressure angle

a. $\cos \alpha = \tan \Phi_n / \tan \Phi_t$
b. $\cos \alpha = \tan \Phi_n \times \tan \Phi_t$
c. $\cos \alpha = \tan \Phi_t / \tan \Phi_n$
d. None of the above

75) What is meant by interference?

a. Mating of conjugate profiles of a tooth
b. Mating of involute profiles of a tooth
c. Mating of non-involute profiles of a tooth
d. All of the above

76) Calculate torque acting on the crank, if tangential force acting on the engine is 150 kN and 300 mm is the crank radius.

a. 45 kN.m
b. 500 kN/m
c. 2 kN/m
d. none of the above

77) Calculate the thrust in connecting rod, if piston effort is 200 kN and crank makes an angle of 45^o from TDC. Assume obliquity ratio = 3.5

a. 900.80 kN
b. 204.20 kN
c. 195.87 kN
d. 970.02 kN

78) The difference between which two factors denotes the correction couple?

a. Difference between force required to accelerate non dynamically equivalent system and dynamically equivalent system
b. Difference between torque required to accelerate non dynamically equivalent system and dynamically equivalent system
c. Difference between torque required to decelerate dynamically equivalent system and non dynamically equivalent system
d. none of the above

79) A connecting rod has periodic time of 1.5 sec/cycle for one oscillation. Calculate radius of gyration, when centre of gravity is at a distance of 500 mm from the small end.

a. 0.1325 m
b. 0.1719 m

c. 0.0295 m
d. 0.555 m

80) Trifilar suspension system is used to determine mass moment of inertia of

a. disc
b. flywheel
c. both a. and b.
d. none of the above

81)Which of the following statement is correct for gears?
(A) The addendum is less than the dedendum
(B) The pitch circle diameter is the product of module and number of teeth
(C) The contact ratio means the number of pairs of teeth in contact
(D) All of the above

82) The pitching of a ship produces forces on the bearings which act _____ to the motion of the ship.
(A) Vertically and parallel
(B) Vertically and perpendicular
(C) Horizontally and parallel
(D) Horizontally and perpendicular

83)The radial distance from the top of a tooth to the bottom of a tooth in a meshing gear, is called
(A) Dedendum
(B) Addendum
(C) Clearance
(D) Working depth

83) The radial distance of a tooth from the pitch circle to the bottom of the tooth is called
(A) Dedendum
(B) Addendum
(C) Clearance
(D) Working depth

84) The balancing weights are introduced in planes parallel to the plane of rotation of the disturbing mass. To obtain complete dynamic balance, the minimum number of balancing weights to be introduced in different planes is
(A) 1
(B) 2
(C) 3
(D) 4

85)Which type of gearing is used in steering system of an automobile?
(A) Rack and pinion

(B) Worm and wheel
(C) Spiral gears
(D) None of the above

86) In full depth involute system, the smallest number of teeth in a pinion which meshes with rack without interference is
(A) 12
(B) 16
(C) 25
(D) 32

87)Which gear is used for connecting two coplanar and intersecting shafts?

(A) Spur gear

(B) Helical gear

(C) Bevel gear

(D) None of the above

88)A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is
(A) 2
(B) 3
(C) 4
(D) 5

89)The primary unbalanced force is maximum when the angle of inclination of the crank with the line of stroke is
(A) 0° and 90°
(B) 0° and 180°
(C) 90° and 180°
(D) 180° and 360°

90)In order to balance the reciprocating masses,

(A) Primary forces and couples must be balanced

(B) Secondary forces and couples must be balanced

(C) Both (A) and (b)

(D) None of these