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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: III - THEORY EXAMINATION (2021 - 2022) (ONLINE)

Subject: Engineering Mechanics

Time: 02:00 Hours

Max. Marks: 100

General Instructions:

1. All questions are compulsory. It comprises of two Sections A and B.
 - Section A - Question No- 1 has 35 objective type questions carrying 2 marks each.
 - Section B - Question No- 2 has 12 subjective type questions carrying 3 marks each. You have to attempt any 10 out of 12 question.
 - No sheet should be left blank. Any written material after a Blank sheet will not be evaluated/checked.

SECTION A

35 x 2 = 70

1. Attempt ALL parts:-

- 1.1.a All the vectors quantities obey: 1
- (a) Parallelogram law of addition
 - (b) Parallelogram law of multiplication
 - (c) Parallelogram law of addition of square root of their magnitudes
 - (d) Parallelogram law of addition of square of their magnitudes
- 1.1.b The magnitude of the resultant of the two vectors is always _____ 1
- (a) Greater than one of the vector's magnitude
 - (b) Smaller than one of the vector's magnitude
 - (c) Depends on the angle between them
 - (d) Axis we choose to calculate the magnitude
- 1.1.c Force vector R is having a _____ 1
- (a) Length of R and a specific direction
 - (b) Length of R
 - (c) A specific direction
 - (d) Length of magnitude equal to square root of R and a specific direction
- 1.1.d Every point on the force vector is having the same magnitude and the same direction as the whole force vector have. 1
- (a) TRUE
 - (b) FALSE
- 1.1.e $\sum F_x=0$, $\sum F_y=0$ and $\sum F_z=0$ are vector equations. 1
- (a) TRUE
 - (b) FALSE
- 1.1.f If anybody is tied to three or more ropes, and then is allowed to achieve its equilibrium. Then the equilibrium achieved is achieved w.r.t what? 1
- (a) The three axis of the body
 - (b) The ground
 - (c) The ropes direction
 - (d) The weight direction
- 1.1.g Which of the following is a vector quantity? 1

- (a) Energy
(b) Mass
(c) Momentum
(d) angle
- 1.2.a There are main two types of forces which are being stated in the free body diagram, they are generally the resultant forces which are being acted over the body. Which are they? 1
- (a) Normal and Frictional
(b) Normal and Vertical
(c) Vertical and Frictional
(d) Normal and Fractional
- 1.2.b The maximum value of the frictional force is called _____ 1
- (a) Limiting Friction
(b) Non-Limiting Friction
(c) Limiting Action Friction
(d) Non-Limiting Action Friction
- 1.2.c If five forces are acting on the single particle and having an angle of 72° between each and are collinear, then _____ 1
- (a) The net force acting on the body is zero and the net work done is also zero
(b) The net force acting on the body is horizontal
(c) The net force acting on the body is vertical but net work done is non-zero
(d) The net force acting on the body is at an angle of 45°
- 1.2.d If the body is in equilibrium, but it having a rotational curled ray shown in the free body diagram then: 1
- (a) The diagram is wrong
(b) Such rotations can't be shown in the fbds (free body diagrams)
(c) The ray shown may be correct, but the body is not said to be in equilibrium
(d) The body is said to be in equilibrium only, as the other forces will cancel out that rotation and the network done will be zero
- 1.2.e The supports in the 3D are having more than three reaction forces. Because they are having three axis on which the components of the work done need to be zero. 1
- (a) The first part of the statement is false and other part is true
(b) The first part of the statement is false and other part is false too
(c) The first part of the statement is true and other part is false
(d) The first part of the statement is true and other part is true too
- 1.2.f A machine raised a load of 360 N through a distance of 200 mm. The effort, a force of 60 N moved 1.8 m during the process. Calculate effect of friction 1
- (a) 10 N
(b) 20 N
(c) 30 N
(d) 40 N
- 1.2.g In a lifting machine, the effort required to lift loads of 200N and 300N were 50N and 60N respectively. If the velocity ratio of the machine is 20 determine effort loss in friction at 200 N. 1
- (a) 10 N
(b) 20 N
(c) 30 N
(d) 40 N
- 1.3.a A sudden jump anywhere on the Bending moment diagram of a beam is caused by 1

- (a) Couple acting at that point
 (b) Couple acting at some other point
 (c) Concentrated load at the point
 (d) u.d.l or u.v.l on the beam
- 1.3.b In a roof supporting truss the load is transmitted when _____ 1
 (a) First to the truss then the joints through purlins
 (b) First to the purlins then the joints through trusses
 (c) First to the truss then the purlins through joints
 (d) First to the joints then the trusses through purlins
- 1.3.c In a roof supporting truss the load is transmitted when 1
 (a) First to the truss then the joints through purlins
 (b) First to the purlins then the joints through trusses
 (c) First to the truss then the purlins through joints
 (d) First to the joints then the trusses through purlins
- 1.3.d Which trusses are traditionally used for short spans in industrial workshop-type buildings? 1
 (a) North light
 (b) Saw-tooth truss
 (c) Fink truss
 (d) Pratt truss
- 1.3.e Which of the following is correct? 1
 (a) To know the direction of the unknown force we take the assumption of it
 (b) The direction of the unknown force is known to us already
 (c) The direction of the unknown can't be determined
 (d) The direction of the unknown is of no use, it is not founded
- 1.3.f Which of the following statements is false about frame/truss? 1
 (a) Bent member is never used in a truss
 (b) Internal hinges are used to connect members in a truss
 (c) All members in the truss are two force members
 (d) Multi force members can be used in a frame
- 1.3.g Redundant truss is a type of 1
 (a) perfect truss
 (b) imperfect truss
 (c) stable truss
 (d) none of the above
- 1.4.a Mass moment of inertia of a thin rod about its one end is the mass moment of inertia of the same rod about its mid point 1
 (a) Same as
 (b) Twice
 (c) Thrice
 (d) Four times
- 1.4.b Polar moment of inertia is 1
 (a) Same as moment of inertia
 (b) Applicable to masses whereas moment of inertia is applicable to area only
 (c) The moment of inertia for an area relative to a linear or axis perpendicular to the plane of the area
 (d) The moment of inertia for an area relative to a line or axis parallel to the centroidal axis
- 1.4.c The moment of inertia of a body is always minimum with respect to its 1

- (a) Base
(b) Centroidal axis
(c) Vertical axis
(d) Horizontal axis
- 1.4.d The moment of inertia of a circular section about an axis perpendicular to the section is 1
(a) $\pi d^4/32$
(b) $\pi d^4/64$
(c) $\pi d^4/4$
(d) $\pi d^4/8$
- 1.4.e The point through which the whole weight of the body acts is called 1
(a) Inertial point
(b) Center of gravity
(c) Centroid
(d) Central point
- 1.4.f What is the formula of radius of gyration? 1
(a) $k^2 = I/A$
(b) $k^2 = I^2/A$
(c) $k^2 = I^2/A^2$
(d) $k^2 = (I/A)^{1/2}$
- 1.4.g What is the formula of theorem of parallel axis? 1
(a) $I_{AD} = I_G + Ah$
(b) $I_{AB} = Ah^2 + I_G$
(c) $I_{AB} = I_G - Ah^2$
(d) $I_{AB} = I_G + I_{xx}$
- 1.5.a In order to increase the acceleration of a mass rolling down on a rough inclined plane (without slipping), we have to 1
(a) Increase the mass of the rolling body
(b) Increase the inclination of the plane
(c) Both of them
(d) None
- 1.5.b A circular object of radius r rolls without slipping on a horizontal level floor with center having velocity V . The velocity at the point of contact between the object and floor is 1
(a) Zero
(b) V in the direction of motion
(c) V opposite to the direction of motion
(d) V vertically upward from the floor
- 1.5.c If we differentiate an equation in terms of acceleration and time, it will give velocity 1
(a) velocity
(b) distance traversed
(c) none of these two
(d) both (a) and (b)
- 1.5.d ships will be closest together depends upon 1
(a) velocity of one of the ships
(b) velocity of both the ships
(c) angle between the two directions
(d) all of the above

- 1.5.e The velocity of a piston in a reciprocating pump mechanism is maximum when the obliquity is 1
- (a) zero
 - (b) maximum
 - (c) average
 - (d) minimum
- 1.5.f Which of the following statement is wrong? 1
- (a) The matter contained in a body is called mass.
 - (b) The force with which a body is attracted towards the centre of the earth is called weight.
 - (c) The total motion possessed by a moving body is called impulsive force
 - (d) none of them
- 1.5.g D-Alembert's principle is used for which of the following? 1
- (a) Change static problem into a dynamic problem
 - (b) Change dynamic problem to static problem
 - (c) To calculate moment of inertia of rigid bodies
 - (d) To calculate angular momentum of a system of masses

SECTION B

10 X 3 = 30

2. Answer any TEN of the following:-

- 2.1.a Compare and contrast between particle and rigid body 2
- 2.1.b Define a force. State the effects which a force may produce when it acts on the body. 2
- 2.2.a Define angle of repose. 2
- 2.2.b Explain rules for shear force and bending moment diagram. 2
- 2.2.c What do you understand by the term 'Point of contraflexure'? 2
- 2.3.a What is the Bending moment and bending moment Diagram? 2
- 2.3.b Differentiate between statically determinate and indeterminate truss. 2
- 2.3.c how beams are classified. 2
- 2.4.a Locate the centroid and solve the moment of inertia about centroidal axes of a semicircular lamina of radius 'r' 2
- 2.4.b Define Radius of gyration 2
- 2.5.a Compare the rectilinear and curvilinear motion. 2
- 2.5.b explain second law of motion. 2