# Classroom Test – 04 for GATE(AE) – 2014/15

## Space Dynamics – Part -01/06

| Q | Questions |
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| 1 | Which of the following quantites remains constant for a satellite in an elliptical orbit around the earth?<br>A. Kinetic energy<br>B. Product of speed and radial distance from the centre of the earth<br>C. Rate of area swept by the radial vector from the centre of the orbit.<br>D. Rate of area swept by the radial vector from the centre of the earth |
| 2 | If in a freely falling lift,a ball is dropped and you are also in this lift, the ball with respect to you wil be<br>A. remains stationary<br>B. seems having downward motion<br>C. seems having upward motion<br>D. will have simple harmonic motion |
| 3 | If Ra and Rp are distance of apogee and perigee respectively in an orbit and ( Rp = k * Ra ) where 0<k<1, then the eccentricity of the orbit is best fit of _____<br>A. 1-k B. 1-2k C. 1-0.5k D. (1-k)^2 |
| 4 | If two satellite of different masses are revolving in the same orbit, they have same<br>A. angular momentum B . energy C. Time period D. all |
| 5 | Suppose the gravitational force varies inversely as the $n^{th}$ power of the distance. Then the time period of a planet in circular orbit of radius R around the sun will be proportional to<br>A. R^(-n) B.) R^(n) C. ) R^((n-1)/2) D. R^((n+1)/2) |
| 6 | The largest and shortest distance of earth from the sun are $r_1$ and $r_2$. Its distance from the sun when it is perpendicular to the major axis of the orbit drawn form the sun is<br>A. $\frac{r_1+r_2}{4}$<br>B. $\frac{r_1+r_2}{r_1-r_2}$ |

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| | C. $\frac{2r_1r_2}{r_1+r_2}$<br>D. $\frac{r_1+r_2}{2}$ |
| **7** | A missile is launched with a velocity less then zero escape velocity. The sum of its kinetic energy and potential energy is<br>A. Positive B. Negative C. Zero<br>D. May be positive or negative depending upon its initial velocity. |
| **8** | what is the velocity change required to transfer a satellite from a circular 600 Km orbit with an indination of 28 degree to an orbit of equal size with an inclination of 20 degree.($R_e$=6378Km )<br>A. 1054 m/s B. 1554 m/s C. 554 m/s D. 2054 m/s |
| **9** | The velocity required for a spacecraft to escape earth's gravitational field depends on<br>A. The mass of the aircraft<br>B. distance between earth's center and the spacecraft.<br>C. The earth's rotational speed about its own axis.<br>D. The earth's orbital speed |
| **10** | A satellite in Earth orbit has a semi-major axis of 6,700Km and an eccentricity of 0.01. what is the satellite's altitude perigee?<br>A. 255 km B. 285 km C. 225 km D. 315 km |
| **11** | To transfer a satellite from an elliptical orbit to circular orbit having radius equal to apogee distance of elliptical orbit the speed of satellite should be_____<br>A. Increased at apogee<br>B. decreased at apogee<br>C. Increased at perigee<br>D. decreased at perigee |
| **12** | The escape velocity from the surface of the earth is $V_e$. The escape velocity from the surface of a planet whose mass and radius are 3 times those of the earth will be_____<br>A. $V_e$ B. $3V_e$ C. $9V_e$ D. $27V_e$ |

**13** If the gravitational force between two objects were proportional to (1/R)[and not $1/R^{\wedge 2}$]where R is the distance between them, then a particular in circular path would have its orbital speed V proportional to

A. R B. Const. C. R^(-1) D. R^(-2)

**14** Imagine a light planet revolving around a very massive star in circular orbit of radius R with a period of revolution T. If the gravitational force of attractive between the planet and the star is proportional to R proportional to $R^{\wedge(-5/2)}$, then_____

A. $T^2 \propto R^3$

B. $T^2 \propto R^{7/2}$

C. $T^2 \propto R^{3/2}$

D. $T^2 \propto R^{\wedge(3.75)}$

**15** A body is released at a distance r(r>R) from the center of the earth. The velocity of the body when it strikes the surface of earth is

A. $\sqrt{2gr}$

B. $\sqrt{2g(R+r)}$

C. $R\left[2g\left(\frac{1}{R}-\frac{1}{r}\right)\right]^{1/2}$

D. $\left[2g\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$

**16** A satellite is orbiting just above the surface of a planet of average density $\rho$ with period T. If G is the universal gravitational constant, the quantity $T^2\rho$ is equal to

A. $4\pi^2 G$

B. $\frac{4\pi^2}{G}$

C. $\frac{3\pi}{G}$

D. $\frac{1}{G}$

**17** **Common data for Question ( 17 and 18 )**

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| | A space craft is in circular parking orbit with an altitude of 200 Km and inclination 28 degree<br><br>Q. What is the velocity change required to perform Hohmann transfer to a circular orbit at an altitude of 35786.03 Km with no change in inclination given, (1) Re = 6378.14 Km (2) GM=3.486x10^(14) NM^2/Kg)<br><br>A. 4933 m/s B. 3933 m/s C. 5933 m/s D. 5233 m/s |
| **18** | Q. The total change in velocity required to change the inclination from $28^0$ to $0^0$ and from the parking orbit to circular orbit of at altitude 35786.03Km.<br><br>A. 4926 m/s<br><br>B. 5996 m/s<br><br>C. 4281 m/s<br><br>D. 6023 m/s |
| **19** | Common data question : ( 19 and 20 )<br>The weight of the object in the gold mine at depth (d), at sea level and at the mountain of height (h) are W1, W2,W3.<br>Q: If h=d then , which statement is true_____<br><br>A. W1 = W2 = W3 C. W3<W1<W2<br><br>B. W1<W3<W2 D. W1<W2<W3 |
| **20** | Q: If d=10h then , which statement is true_____<br><br>A. W1 = W2 = W3 C. W3<W1<W2<br><br>B. W1<W3<W2 D. W1<W2<W3 |
| **21** | Out of following, the only incorrect statement about satellite is__<br><br>A. A satellite can not move in stable orbit in a plane passing through the earth's centre.<br><br>B. Geostationary satellites are launched in equatorial plane.<br><br>C. We can use just one geostationary satellite for global communication around globe.<br><br>D. The speed of satellite increase with an increase in the radius of its orbit. |
| **22** | The change in potential energy, when a body of mass m is raised to height nR from earth's surface is (R=radius of earth) |

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| | A. $mgR\left(\frac{n}{n-1}\right)$<br>B. $nmgR$<br>C. $mgR\left(\frac{n^2}{n^2+1}\right)$<br>D. $mgR\left(\frac{n}{n+1}\right)$ |
| **23** | A satellite is revolving around the primary mass in an orbit then which statement is not true<br>A. The eccentricity of the orbit cant be 0.4<br>B. The apogee distance can be 1.7 time of the perigee distance<br>C. The eccentricity can be 1.1<br>D. The velocity at apogee is lower than velocity at perigee |
| **24** | The time period of Molniya orbits are _____<br>A. 9 hours B. 10 hours C. 11 hour D. 12 hours |
| **25** | If Ra and Va are the apogee distance and velocity and apogee in the orbit and similarly Rp and Vp are the perigee distance and velocity in the orbit then which statement is correct ?_____<br>A. Ra*Vp = Rp*Va<br>B. Ra*Vp /Rp= Rp*Va/Ra<br>C. Ra*Vp/Va = Rp*Va/Vp<br>D. Ra*Va = Rp*Vp |
| **26** | The identical earth satellites A and B are in circular orbits at altitude $h_A$ and $h_B$ above the earth's surface respectively. With $h_A > h_B$. If E denotes the total mechanical energy, T the kinetic energy and V the gravitational potential energy of a satellite, then:<br>A. $E_A > E_B \; and \; V_A < V_B$ |

B. $E_A > E_B \; and \; T_A > T_B$

C. $E_A < E_B \; and \; T_A > T_B$

D. $E_A > E_B \; and \; T_A < T_B$

**27** The earth's radius is 6.37 x $10^6$m and the acceleration due to gravity on its surface is 9.81m/$s^2$. A satellite is in a circular orbit at a height of 6.30 x 10^5 m above the earth's surface. The minimum additional speed its needs to escape from the earth's gravitational field is

A. 3660 m/s C. 3270 m/s

B. 3120 m/s D. 3460 m/s

**28** For an elliptic orbit of satellite, let the smallest distance from centre of primary be $r_{min}$ and greatest distance $r_{max}$. Then $\left(\frac{dA}{dt}\right)$ (sectorial velocity) for the satellite in terms of $r_{min} \; and \; r_{max}$ is

Where you assume primary is earth and K= $\sqrt{GM}, \rho = eccentricity \; of \; elliptic \; orbit$

a= $\frac{r_{min} + r_{max}}{2}$

A. $\frac{(K^2(1-e)a)^{\frac{1}{2}}}{2}$

B. $\frac{(K^2(1-e^2)a)^{\frac{1}{2}}}{4}$

C. $\frac{(K^2(1-e)a)^{\frac{1}{2}}}{4}$

D. $\frac{(K^2(1-e^2)a)^{\frac{1}{2}}}{2}$

**29** A satellite of earth is revolving is a circular orbit with a uniform speed V. If the gravitational force suddenly disappears,the satellite will

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| | A. Continue to move with velocity V along the original orbit,.<br>B. Move with a velocity V tangentially to the original orbit<br>C. Fall down with increasing velocity<br>D. Ultimately come to rest somewhere. |
| **30** | Common Data Questions : ( 30 and 31 )<br>A satellite is launched into Earth orbit where its launch vehicle burns out at an altitude of 250 km. At burnout the satellite's velocity is 7,900 m/s with the zenith angle equal to 89 degrees.<br>Q: then the satellite's altitude at perigee and apogee are ?_____<br>A. 223,797 C. 415,917<br>B. 312,819 D. 417,1012 |
| **31** | Q : The eccentricity of the orbit is ?_____<br>A. 0.031 B. 0.041 C. 0.051 D. 0.061 |
| **32** | Common Data Questions : ( 32 and 33 )<br>A satellite is launched into Earth orbit where its launch vehicle burns out at an altitude of 250 km. At burnout the satellite's velocity is 7,900 m/s with the zenith angle equal to 89 degrees.<br>Q: the angle from perigee point to launch point for the satellite ?.<br>A. 20.4 degee B. 22.3 degree C. 25.8 degree D. 31.7 degree |
| **33** | Q: The semi major axis of the orbit is ?_____<br>A. 6888 km B. 7842 km C. 9642 km D. 8642 km |
| **34** | Which of the following is the evidence to show that their must be force acting on earth and directed towards the Sun ?_____<br>A. deviation of falling bodies towards east<br>B. revolution of earth around the sun<br>C. phenomenon of night and day<br>D. apparent motion of sun around the earth |
| **35** | The motion of a satellite in circular orbit around the earth can be described by__<br>A. constant speed zero acceleration<br>B. constant velocity constant acceleration |

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| | C. variable velocity and zero acceraleration<br>D. constant speed and variable acceleration |
| **36** | What do you understand by true anamoly in the orbits ? _____<br>A. It is the angle between the direction of periapsis and the current position of the body<br>B. It is the angle between the direction of apopsis and the current position of the body<br>C. It is the angle between the direction of periapsis and the vernox of the orbit<br>D. It is the angle between the direction of apopsis and the vernox of the orbit |
| **37** | The sudden fall of atmoshperic pressure indicates_____<br>A. fair weather B. rain C. Storm D. Cold wave |
| **38** | The two spheres of radius R and of same density and material are placed on the table touching each other, then the force between them is proportional to _<br>A. R^(-4) B. R^(-2) C. R^(4) D. R^(2) |
| **39** | If the earth stops rotating, the value of 'g' at the equator will_____<br>A. Increase C. decrease<br>B. remains same D. none of the above |
| **40** | The time period of Geo - Stationary satellite is _____<br>A. 1 year B. 1 month C. 1 day D. Depends on its altitude above surface of earth |
| **41** | If the change in value of 'g' at a height 'h' above the surface of earth is same as at a depth 'x' below it, then ( both x and h are much smaller than the radius of earth )<br>A. x = h B. x = 2h C. x = h/2 D. x = 4h |
| **42** | If the iron ball and wodden ball dropped from the same height and T1 and T2 are time taken by them respectively to the ground then _____<br>A. T1 >T2 B. T1 < T2 C. T1 = T2 D. T1 </> T2 |