FIZIKA za študente FRI, š.l. 2025/26

Vprašanja za izpit iz teorije (ustni del):

MEHANIKA:

1) S pomočjo vektorskega zapisa opiši kroženje točkastega telesa. Razloži, vektorje hitrosti, kotne hitrosti in vseh vrst pospeškov in vektorske zveze med njimi.

2) Razloži Newtonove zakone za točkasto telo; posebej razloži razliko med prvim in drugim zakonom v primeru ničelne vsote sil. Opiši razliko v pojmu inercialne in gravitacijske mase.

3) Pojasni sile, ki nastopajo pri kroženju in poševnem metu. Navedi primer laboratorijskega eksperimenta (ali analize pojava v naravi) za ponazoritev zakonitosti pri kroženju in poševnem metu.

4) Razloži izrek o delu in kinetični energiji za točkasto telo. Posebej obravnavaj ta izrek za primer dela zunanje sile trenja na gibajoče se telo in kako se ta izrek uporabi pri enakomernem kroženju točkastega telesa okrog nepremične osi (kakšno je delo zun. sil?).

5) Razloži izrek o gibalni količini za sistem točkastih teles. Navedi primer laboratorijskega eksperimenta (ali analize pojava v naravi) za ponazoritev tega izreka.

6) Opiši gravitacijsko silo (interakcijo) med dvema telesoma. Kakšna je v primeru dveh točkastih teles potencialna energija med njima? Kako se to manifestira v našem osončju?

7) Razloži pojem težnostne potencialne energije ter povezavo med delom sile teže in potencialno energijo ter ilustriraj na primeru nošnje tovora z vznožja gore do vrha po različnih poteh. Posebej zapiši gravitacijsko potencialno energijo na primeru gibanja planetov okrog sonca.

8) Razloži Newtonove zakone za togo telo za primer premega gibanja in vrtenja. Razloži izrek o gibanju masnega središča in pokaži, kako enačbe za togo telo preidejo v Newtonove zakone za točkasto telo.

9) Opiši nihanje vzmetnega in matematičnega nihala. Zapiši, kako se s časom spreminjajo prispevki v njuni energiji?

10) Razloži izrek o kinetični energiji za togo telo, ki se vrti okoli nepremične osi, ne pozabi izraza za delo! Opiši primer kotaljenja polnega in praznega valja na klancu, ki smo ga pokazali na predavanjih.

ELEKTRIKA IN MAGNETIZEM:

11) Opiši električno silo (interakcijo) med dvema naelektrenima telesoma. Navedi primer laboratorijskega eksperimenta (ali analize pojava v naravi) za ponazoritev te interakcije.

12) Opiši pojem električnega polja ter razloži, kako ponazorimo silnice električnega polja v okolici naelektrenih teles. Opiši primer električnega dipolnega polja ter napiši izraz za navor na električni dipol v zunanjem električnem polju.

13) Razloži pojem električne potencialne energije, električnega potenciala in električne napetosti ter njihovo povezavo z delom pri premikanju naboja v električnem polju. Navedi primer laboratorijskega eksperimenta (ali analize pojava v naravi) za ponazoritev te povezave.

14) Opiši pojem električnega toka ter povezavo med tokom, napetostjo in električno energijo. Razloži Ohmov zakon na nivoju gibanja nosilcev naboja.

15) Napiši izpeljavo magnetnega dipolnega momenta tokovne zanke in navor nanjo v zunanjem magnetnem polju. Opiši magnetno polje v okolici točkastega magnetnega dipola (majhnega permanentnega magneta).

16) Opiši značilnosti magnetnega polja v okolici tokovnih vodnikov različnih oblik (ravni vodnik, tuljava ...). Zapiši učinek mag. polja na majhen magnetni dipol. Navedi primer laboratorijskega eksperimenta za ponazoritev tega pojava.

17) Opiši sile, ki delujejo na vodnik z električnim tokom in na gibajoč se električni naboj, ko ga postavimo v zunanje magnetno polje. Navedi primer laboratorijskega eksperimenta (ali analize pojava v naravi) za ponazoritev opisanih vplivov.

18) Razloži pojav električne indukcije. Navedi primer laboratorijskega eksperimenta (ali analize pojava v naravi) za ponazoritev tega pojava.

19) Opiši elektromagnetno valovanje in pojasni vsaj eno izmed značilnih valovnih lastnosti vidne svetlobe. Navedi primer laboratorijskega eksperimenta (ali analize pojava v naravi) za ponazoritev te lastnosti.

20) Opiši in razloži pojav fotoefekta: kako je eksperimentalno očitna delčna narava svetlobe in kako je razložena?

PHYSICS for students of FRI, school year 2024/25

Questions for exam on theory (oral exam):

MECHANICS:

1) Using vector notation, describe the circular motion of a point mass. Explain the vectors of velocity, angular velocity, and all types of acceleration, as well as the vector relationships between them.2) Describe Newton's laws for a point-like object; explain the difference between the first law and the second law in the case of zero sum of external forces. Describe the difference in definitions of inertial and gravitational mass.

3) Describe circular motion of a point-like object using the vector formalism and explain the forces that appear during such motion. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this type of motion.

3) Explain the forces that occur in circular motion and projectile motion (fired under an angle on Earth). Give an example of a laboratory experiment (or analysis of a natural phenomenon) to illustrate the laws of circular motion and projectile motion.

4) Explain the work-kinetic energy theorem for a point-like object. Describe the application of this theorem to the case of external friction force acting on a moving object and its application in the case of uniform rotation of a point-like body around a fixed axis (what is the work of external forces ?).

5) Explain the theorem on linear momentum for a system of point-like objects. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this theorem.

6) Describe the gravitational force (interaction) between two bodies. What is the potential energy between two point masses? How does this manifest itself in our solar system?

7) Describe the concept of gravitational potential energy and explain a relationship between the work of a gravitational force and this energy on the example of carrying a load from the bottom of a mountain to its peak using different paths. State the equations describing the gravitational potential energy for the motion of planets around the sun.

8) Describe Newton's laws for a macroscopic solid body for the cases of linear motion and rotation. Explain the theorem of the motion of the center-of-mass and show, how the solid-body formulae transform to the Newton's equations for point-like objects.

9) Describe the oscillation of a spring pendulum and a mathematical pendulum. Write down how the contributions to their energy change over time.

10) Describe the work-kinetic energy theorem for rotation of a solid body around a fixed axis, don't forget the expression for the work involved! Describe the example of rolling of the solid and hollow cylinder down a slope, as was shown in the lectures. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this theorem.

ELECTRICITY AND MAGNETISM

11) Describe electric force (interaction) between two charged objects. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this interaction.

12) Explain the concept of electric field and describe construction of field-lines in the vicinity of charged objects. Describe the field of an electric dipole and write down the expression for the torque acting on an electric dipole in an external electric field.

13) Explain the concepts of electric potential energy, electric potential and electric voltage and their relationship with the work associated with motion of a point-like charged object in electric field. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this relationship.

14) Describe a concept of electric current and a relationship between current, voltage and electric energy. Explain the Ohm's law on the level of the motion of charged current carriers.

15) Derive the expression for the dipole moment of a current loop and the torque acting on it in an external magnetic field. Describe the magnetic field in vicinity of a point-like magnetic dipole (small permanent magnet).

16) Explain the properties of magnetic field in vicinity of guides carrying electric current of different shapes (straight wire, solenoid...). Describe the effect of mag. field on a small magnetic dipole. Give an example of a lab experiment that demonstrates this case.

17) Explain forces athat act on a current-carrying wire and on a moving electrical charge that is placed into a magnetic field. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this effect.

18) Describe the phenomenon of electric induction. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this effect.

19) Describe electromagnetic waves and explain at least one characteristic wave-related property (effect) of visible light. Give an example of a lab experiment (or a natural phenomenon) that demonstrates this effect.

20) Describe and explain the photoelectric effect: how is the particle nature of light experimentally evident and how is it explained?