**华南理工大学第十一届物理学术竞赛**

**组队要求与竞赛题目**

**(2022.10.04制定)**

**1.1 组队要求**

一支队伍由2-4人组成，且需要安排1名学生作为联络人（队长）。成员具体要求如下：

①成员必须是具有华南理工大学全日制学籍的本科生；

②允许并鼓励跨年级、跨学院组队；

③原则上最好为4人1组，工作人员会根据大家意愿进行适度调整；

④各成员应遵守学术研究基本行为准则，对出现以下行为者，物理与光电学院有权做出禁赛处分：

1）刻意隐瞒自己的年级、真实姓名等信息；

2）存在学术不端或学术造假行为；

3）在比赛过程中辱骂裁判、比赛成员、观众行为的；

4）其他未指明的容易造成不良后果的不良行为。

⑤如果在比赛中的任一阶段，出现队伍成员退赛的情况，请及时与工作人员联系，若队伍成员仅剩1人，工作人员将强制将其与其余成员组队。

⑥一个队伍应该完成的题目总数需要≥$max\left\{3,队伍人数\right\}$，若存在一人负责多道题目的情况，请在报名时间指明。

**2.1 比赛赛题**

考虑到竞赛实际难度，华南理工大学第十一届物理学术竞赛从2023 IYPT的17道题中选出14道作为比赛可选赛题，由于参赛选手各自对题意的理解有所不同，故只提供原题，不提供中文翻译。

比赛赛题如下：

2.Oscillating Sphere

A light sphere with a conducting surface is suspended from a thin wire. When the sphere is rotated about its vertical axis (thereby twisting the wire) and then released, it starts to oscillate. Investigate how the presence of a magnetic field affects the motion.

3.Siren

If you direct an air flow onto a rotating disk with holes, a sound may be heard. Explain this phenomenon and investigate how the sound characteristics depend on the relevant parameters.

4. Coloured Line

When a compact disc or DVD is illuminated with light coming from a filament lamp in such a way that only rays with large angles of incidence are selected, a clear green line can be observed. The colour varies upon slightly changing the angle of the disc. Explain and investigate this phenomenon.

5. Whistling Mesh

When a stream of water hits a rigid metal mesh within a range of angles, a whistling tone may be heard. Investigate how the properties of the mesh, stream and angle affect the characteristics of the sound produced.

6. Magnetic-Mechanical Oscillator

Secure the lower ends of two identical leaf springs to a non-magnetic base and attach magnets to the upper ends such that they repel and are free to move. Investigate how the movement of the springs depends on relevant parameters.

8.Euler’s Pendulum

Take a thick plate of non-magnetic material and fix a neodymium magnet on top of it. Suspend a magnetic rod (which can be assembled from cylindrical neodymium magnets) underneath it. Deflect the rod so that it touches the plate only with highest edge and release it. Study the motion of such a pendulum under various conditions.

9.Oscillating Screw

When placed on its side on a ramp and released, a screw may experience growing oscillations as it travels down the ramp. Investigate how the motion of the screw, as well as the growth of these oscillations depend on the relevant parameters.

10. Upstream Flow

Sprinkle light particles on a water surface. Then allow a water stream to be incident on the surface from a small height. Under certain conditions, the particles may begin to move up the stream. Investigate and explain this phenomenon.

11. Ball on Ferrite Rod

A ferrite rod is placed at the bottom end of a vertical tube. Apply an ac voltage, of a frequency of the same order as the natural frequency of the rod, to a fine wire coil wrapped around its lower end. When a ball is placed on top of the rod, it will start to bounce. Explain and investigate this phenomenon.

12. Rice Kettlebells

Take a vessel and pour some granular material into it, for example, rice. If you dip e.g. a spoon into it, then at a certain depth of immersion, you can lift the vessel and contents by holding the spoon. Explain this phenomenon and explore the relevant parameters of the system.

13. Ponyo’s Heat Tube

A glass tube with a sealed top is filled with water and mounted vertically. The bottom end of the tube is immersed in a beaker of water and a short segment of the tube is heated. Investigate and explain the periodic motion of the water and any vapour bubbles observed.

14. Jet Refraction

A vertical jet can be refracted when passing through an inclined sieve with a fine mesh. Propose a law for such refraction and investigate relevant parameters.

15. Pancake Rotation

Place a few balls in a round container. If you move the container around a vertical axis, the balls can move codirectionally with the movement of the container, or they can move in the opposite direction. Explain this phenomenon and investigate how the direction of movement depends on relevant parameters.

17. Arrester Bed

A sand-filled lane results in the dissipation of the kinetic energy of a moving vehicle. What length is necessary for such an arrester bed to entirely stop a passively moving object (e.g. a ball)? What parameters does the length depend on?