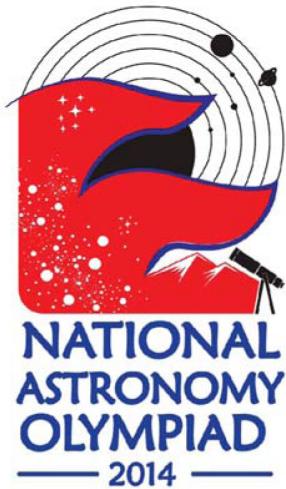


# Handbook

## National Astronomy Olympiad 2014 Nepal



Organized By:

Nepal Astronomical Society (NASO)



ESPRO Foundation



# **Introduction**

## **Nepal Astronomical Society (NASO):**

Nepal Astronomical Society (NASO) which was formed in 2007 is the leading astronomical society in Nepal. Since then it has been continuously working for the astronomy and space science outreach, education and research in Nepal. NASO experts on different areas especially outreach have been extensively taken astronomy to many parts of Nepal. With the celebrations of International HelioPhysical Year 2007 - 2008 and International Year of Astronomy 2009 with many exciting programmes in Nepal, NASO is now moving ahead with greater responsibilities and the human resources than before for the enhancement of astronomical community in Nepal. NASO is committed for the ProAm collaboration for enriching the astronomical community in Nepal and has been collaborating with Astrophysics and Cosmology Research Group along with other stake holders promoting outreach, education and research works in the fields of science and technology in Nepal.

## **ESPRO Foundation:**

ESPRO Foundation was established in 2009 by Mr. Probodh Rijal, Founder Principal of Eureka High School, Nepaltar, Kathmandu, Nepal. It promotes different educational activities at school level especially in science. The founder is also the organizer of the Young Scientist Fair, an event where schools students from different schools in Nepal exhibit their talents and get awarded for their best practices. ESPRO is actively working to establish a science city with interactive science museum and a planetarium for the students.

## **National Astronomy Olympiad (NAO)**

The National Astronomy Olympiad (NAO) Programme is jointly designed by Nepal Astronomical Society (NASO) and ESPRO Foundation to encourage Nepalese students with good foundations in Physics and Mathematics and an interest in Astronomy to pursue their further studies in this field.

**Vision:** *School students will be empowered to recognize and comprehend the celestial objects inhabiting our universe and their association with the evolution and preservation of our lives on earth*

*thereby dispelling superstitious beliefs of their influences prevailing in our society.*

**Mission:** *School students will be trained to be abundantly versed with astronomy for logically convincing and communicating with any member of local or international society on the importance and indispensability of cosmic entities dwelling in our universe.*

**Goal:** *Our goal is to impart school students with sufficient knowledge on basic astronomy to recognize and understand the heavenly entities for enabling them to participate in annual international astronomy Olympiad successfully.*

**Objective:** *School Students will be selected, prepared, facilitated and qualified for their successful participation in annual international astronomy Olympiad.*

It involves a four stages process leading to participation of Nepalese team in the International Olympiad in Astronomy and Astrophysics (IOAA). This year the IOAA is going to be held in Suceava, Romania, 1-10 August, 2014.

## **Stages of the NAO-2014**

### **Stage I (Entrance Exam)**

Entrance exam is the first stage of selection of students in the National Astronomy Olympiad Programme. Every student aspiring to go through successive stages of the programme must fill in a form to enroll for NAO-2014 and appear the entrance exam. It will be held at different centers throughout the country. Any interested and eligible candidate can file his/her application at our Application Centers at Nepal Astronomical Society (NASO), ESPRO Foundation, Pokhara Astronomical Society (PAS), Damak Astronomical Society (DASO) and Dang Astronomical Society (DAS). Further information will be available at our official website. Applicants can submit their application either at contact centers or send via email. Applicants are requested to check the official webpage: [www.nationalolympiad.org](http://www.nationalolympiad.org) for entrance exam date and venues. They can also inquire with our the contact persons.

This stage carries 100 marks: entrance exam question will include 45 objective questions each carrying 2 marks. The remaining 10 marks will be calculated on the basis of the marks obtained at School Leaving Certificate (SLC) or equivalent. The exam time will be of 2 hours. Students are not permitted to use calculator during the exam.

### **Stage II (Orientation Cum Selection Camp - OCSC)**

From Stage I, 15 students will be selected on the basis of their scores. The dates of OCSC - 2014 will be announced along with the Entrance exam result. Applicants are requested to make a follow-up at NAO2014 official website ([www.nationalolympiad.org](http://www.nationalolympiad.org)) or the Contact Office/Application centers for updates.

The camp includes several theoretical and experimental classes and tests based on IOAA syllabus. Orientation is provided to students especially in experiments. Resource persons include professionals from Tribhuvan University, Nepal Physical Society, Research Group of Astronomy and Astrophysics and Nepal Astronomical Society (NASO), ESPRO Foundation and other concerned institutions in Nepal. The camp will conclude with a valedictory function where distinguished scientists address the students.

The top 5 outstanding students in the OCSC will be members of the Nepalese team for IOAA.

All the selected students will become part of the Nepalese team if only they satisfy the eligibility criteria of age, class, holding valid Nepalese passport, medical fitness and parental consent.

### **Stage III (Pre-Departure Training camp PDT for IOAA)**

The selected Nepalese team for IOAA will undergo a rigorous training programme in theory, data analysis and observational astronomy in Kathmandu, Nepal. The duration of the training will be subjected to IOAA regulations.

### **Stage IV (International Olympiad on Astronomy and Astrophysics IOAA)**

Two leaders and one observer for IOAA will accompany the Nepalese team. The IOAA is organized annually in different host countries. The 8<sup>th</sup> IOAA will be held in Suceava, Romania from 1-10 August 2014. The students will participate in international forum and can win various medals showing their best performance and team spirit.

## **Basic Requirements**

- Nepalese student **born on or after January 1, 1995** and, in addition, are enrolled at Science Faculty of Higher Secondary Level or equivalent is eligible to appear for NAO2014.
- Should be a Nepalese citizenship holder.

It is the student's responsibility to ensure that the eligibility criteria are satisfied. In case, at any stage of the programme it is found that the student does not meet the eligibility criteria, s/he may be disqualified from the programme.

### **How can you be a part of NAO-2014?**

- Visit one of our collection/application centers nearby you to collect the application form. The application form and Handbook are also available at our official website: [www.nationalolympiad.org](http://www.nationalolympiad.org)
- Fill in the application form and get endorsed by the college authority
- Submit the filled in application form along with mark-sheet of the School Leaving Certificate (SLC) or equivalent with application fee of 300 NRs to the collection/application centers or via email.
- Appear the entrance exam at one of the exam centers.

# **Registration**

Please visit one of our contact offices/application centers listed below to complete your application or further details related to NAO2014.

*Contact Person: Suresh Bhattarai*

*Cell: +977-9841 48 58 67*

*Nepal Astronomical Society (NASO)*

*H.B. Complex, Ekantakuna, Lalitpur, Nepal*



*Contact Person: Prabodh Rijal*

*Cell: +977-9851070048*

*ESPRO Foundation*

*C/o*

*Eureka High School, Nepaltar, Kathmandu, Nepal*



*Contact Person: Sujan Regmi*

*Cell: +977-9846 17 48 57*

*Pokhara Astronomical Society (PAS)*

*C/o*

*Chhunumunu Publication Ltd.*

*Newroad, Pokhara-08, Kaski, Nepal*



*Contact Person: Dev Raj Sapkota*

*Cell: +977-9841 52 12 81*

*Damak Astronomical Society (DASO)*

*C/o*

*Department of Physics,*

*Damak Multiple Campus, Damak-14, Jhapa, Nepal*



*Contact Person: Ajay Neupane*

*Cell: +977-9849 14 99 61*

*Dang Astronomical Society (DAS)*

*C/o*

*Siddhartha Academy Higher Secondary School*

*Ratanpur, Ghorahi-11, Dang, Nepal*



*Please check our official website [www.nationalolympiad.org](http://www.nationalolympiad.org) for additional application centre.*

Reg. No.



# National Astronomy Olympiad 2014

(NAO 2014)

## Registration Form

Photo

Name (Block Letters) : ..... Date of Birth : ..... Sex : .....

School/College : ..... Personal Contact No. : .....

Parent's Name : ..... Parent's Contact No. : .....

Zone : ..... District : ..... Municipality/VDC : ..... Ward : .....

Endorsed by :  
(College Authority)

Signature: \_\_\_\_\_

Official Stamp

Please kindly answer the following questions:

- How did you first find about National Astronomy Olympiad (NAO)?

.....  
.....  
.....  
.....

Additional Contacts:

Contact Person ..... Relation : .....

Occupation ..... E-mail : ..... Contact Number : .....

Contact Address .....

For Official Use Only:

Received By:

Date:

-----  
Reg. No.

Name : .....

Photo

Parent/Guardian's Name : .....

Exam Date : ..... Exam Centre : .....

# **Syllabus (Entrance exam)**

The syllabus for entrance exam of NAO-2014 is broadly equivalent to the senior secondary level (up to Class XII) of Higher Secondary Education Board (HSEB) Nepal. There will be greater emphasis on Physics and Mathematics and Elementary Astronomy. The syllabus is as follows:

- 1. Mechanics**  
Newton's Laws of Motion; Gravitation; Circular Motion; Rotational Motion; Simple Harmonic Motion
- 2. Heat and Thermodynamics**  
Thermodynamic Equilibrium; Ideal Gas; Energy Transfer; Black Body Radiation
- 3. Nuclear Physics**  
Atom; Hydrogen Spectrum; Nucleus and Radioactivity; X-Rays
- 4. Wave and Optics**  
Light; Interference, Diffraction, Polarization; Microwave, Infrared, Ultraviolet, Gamma Rays, Visible Wavelength Bands; Optical Instruments; Doppler's Effect
- 5. Electricity and Magnetism**  
Electromagnetic Theory; Magnetic Properties and Behavior
- 6. The Sun**  
Solar Structure; Sun-Earth Relation; Solar Wind and Radiation; Eclipse
- 7. The Earth**  
Atmosphere; Longitude and Latitude; Tides; Seasons; Meteor Shower; Aurorae
- 8. The Solar System**  
Earth-Moon System; Planets introduction
- 9. The Stars**  
Life Cycle; Neutron Star; Black Hole; Supernova; Constellation
- 10. Universe**  
Galaxy; Dark Matter; Hubble's law
- 11. Space Exploration:**  
Satellites; Human exploration and missions
- 12. Mathematics:**  
3-D figures (Sphere, Cone, Prism, Cylinder, Cuboid, Cube); 2-D figures (Triangle, Quadrilateral, Circle)

**Note:** Above mentioned sections are as per the syllabus of HSEB, students are encouraged to explore reference materials.

# **Objective Questions (NAO-2014) “Sample Paper”**

*(Students are requested to encircle the correct answer)*

F.M.: 90

Time: 2 Hours

*Each question carries 2 marks*

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- 1) The moment of linear momentum is called
  - a) torque
  - b) force
  - c) linear momentum
  - d) centripetal momentum.
- 2) A transverse wave of amplitude 0.5 m, wavelength 1m and frequency 2c/s is propagating in a string along negative X-direction. The equation for the wave is
  - a)  $y = 0.5\cos 2\pi(x+t)$
  - b)  $y = 0.5\cos 2\pi(x+2t)$
  - c)  $y = 0.5\sin 2\pi(x-t)$
  - d)  $y = 0.5\cos 2\pi(x-2t)$
- 3) A machine gun is mounted on a 2000kg car on a horizontal frictionless surface. At some instant the gun fires bullet of mass 10g with a velocity of 500m/s with respect to the car. The number of bullets fired per second is 10. The average thrust due to ejected bullet on the system is
  - a)  $2.5 \times 10^{-3}$  N
  - b) 50N
  - c) 250N
  - d) 550N
- 4) At what height from the earth's surface the value of g will become one-fourth of its value at earth's surface? ( $R_e$ =Radius of earth).
  - a)  $R_e$
  - b)  $R_e/2$
  - c)  $R_e/4$
  - d)  $2R_e$
- 5) A car sometimes overturns while taking a turn. When it overturns
  - a) its inner wheel leaves the ground first
  - b) its outer wheel leaves the ground first
  - c) Both wheels leave the ground simultaneously
  - d) Either wheel leaves the ground first
- 6) In an isothermal process
  - a) Pressure remains constant
  - b) Thermal energy remains constant
  - c) Volume remains constant
  - d) Temperature remains constant

- 7) 110 J of heat is added to a gaseous system whose energy increases by 40 J, then the amount of external work done is  
a) 40J                          b) 70J  
c) 110J                          d) 150J
- 8) The rate of radiation of a black body at 0 degree C is E Joules/sec. The rate of radiation of the black body at 273 degree C will be  
a) E                              b) 4E  
c) 8E                            d) 16E
- 9) What is the ratio of the orbital electron in 4<sup>th</sup> and 5<sup>th</sup> orbit of the hydrogen atom?  
a) 4:5                           b) 5:4  
c) 16:25                        d) 25:16
- 10) The ionization power is maximum for  
a) X-Rays                      b) Beta Rays  
c) An Alpha Rays              d) Gamma Rays
- 11) What is the diameter of Sun in terms of radius of Earth ( $R_e$ )?  
a) 50  $R_e$                       b) 118  $R_e$   
c) 218  $R_e$                       d) 318  $R_e$
- 12) The last manned moon flight was made in what year?  
a) 1971                         b) 1972  
c) 1973                         d) 1974
- 13) According to Kepler's Laws, all orbits of the planets are:  
a) Ellipses                      b) Parabolas  
c) Hyperbolas                   d) Square
- 14) A conic section is the locus of the point in a plane which moves in such a way that the ratio of its distance from a fixed point (called a focus) to its perpendicular distance from a fixed straight line (called a directrix) is a constant  $e$  (called eccentricity). The conic section is an ellipse if  
a)  $e=1$                            b)  $e>1$   
c)  $e<1$                            d)  $e>0$
- 15) The largest moon in our solar system has an atmosphere that is denser than the atmosphere of Mars. The name of this moon is:  
a) Titan                         b) Ganymede

- c) Triton                          d) Io
- 16) Where are most asteroids located? Is it between  
a) Jupiter and Saturn      b) Mars and Venus  
c) Earth and Mars            d) Mars and Jupiter
- 17) Data from Voyager II indicates that previous estimates of Triton's size were in error. It is now known that Neptune's largest moon is  
a) nearly the size of Mars  
b) half the size of Mercury  
c) twice the size of the Earth's moon  
d) even larger than previously thought
- 18) A monoatomic gas at atmospheric pressure has a volume V. Now the gas is expanded adiabatically to the volume 8V; if gamma ( $\gamma$ ) = $5/3$ , the new pressure is  
a) 1 atm                            b)  $1/32$  atm  
c) 32 atm                         d)  $1/8$  atm
- 19) 0.93 Watt hour energy is supplied to a block of ice weighting 10g. It is found that  
a) Half of the block melts                          b) The entire block melts  
c) The entire blocks melt and the water attains a temperature of  $4^{\circ}\text{C}$   
d) The block remains unmelted
- 20) The relative emissive power of a black body is  
a) 0                                    b) 0.5  
c) 1.0                                d) Infinity
- 21) The ionization energy of the hydrogen atom from ground state is equal to  
a) 13.6eV                            b) 13.6 joule  
c) 13.6erg                         d)  $13.6 \times 10^{-19}$  joule
- 22) What percentage of mass does the Sun alone account in solar system?  
a) 50 %                            b) 70%  
c) 90%                             d) 99%

- 23) The aurora consists of luminous arcs, rays or bands in the night sky, usually confined to high latitudes and located in the:
- a) troposphere                    b) stratosphere  
c) ozonosphere                    d) ionosphere
- 24) If you were watching a star collapsing to form a black hole, the light would disappear because it:
- a) is strongly redshifted                    b) is strongly blueshifted  
c) its color suddenly becomes black                    d) none of the above
- 25) The equation for parabola is
- a)  $x^2+y^2=r^2$                     b)  $y=ax^2$   
c)  $y=mx+c$                     d)  $y=ax^3+bx^2+cx+d$
- 26) Who wrote the book entitled "On the Revolutions of the Heavenly Spheres"?
- a) Kepler                    b) Euclid  
c) Copernicus                    d) Newton
- 27) On one of the moon landings, astronauts left an object on the moon. Scientists periodically bounce a laser beam off of this object to measure the distance between the earth and the moon. What is this object?
- a) Lens                    b) Mirror  
c) Compass                    d) Watch
- 28) What is the most distant object in the sky that the human eyes can see without optical instruments?
- a) The Horsehead Nebula                    b) The Andromeda Galaxy  
c) The Sagittarius Constellation                    d) The Aurora Borealis
- 29) A star like object with a very large redshift is a
- a) neutron star                    b) nova  
c) quasar                    d) supernova
- 30) When two sound waves of same frequency and constant initial phase travelling in the same direction in the same line at the same instant, superpose to give maxima and minima. The phenomena is called
- a) Refraction                    c) Diffraction  
b) Interference                    d) Beats

- 31) With increase in stretching force of the wire, its frequency
- a) increases
  - b) decreases
  - c) remains unchanged
  - d) may increase or decrease
- 32) An observer is approaching a stationary source. The observer will hear sound of frequency
- a) lower than actual frequency
  - b) higher than actual frequency
  - c) same as actual frequency
  - d) lower or higher frequency depending on the speed of observer
- 33) The image of an object formed by device is always virtual and small. The device may be
- a) concave lens
  - b) concave mirror
  - c) a glass plate
  - d) convex lens
- 34) The focal length of concave mirror is
- a) maximum for red color
  - b) maximum for yellow color
  - c) maximum for violet color
  - d) same for all colors mirror
- 35) The speed of light in vacuum depends on
- a) wavelength
  - b) frequency
  - c) intensity
  - d) none
- 36) At what angle does a diver see the setting sun
- a) at 49 degree to the horizon
  - b) at 90 degree to the horizon
  - c) at 41 degree to the horizon
  - d) at 60 degree to the horizon
- 37) If monochromatic red light is used instead of blue light then focal length of a lens
- a) increases
  - b) decreases
  - c) remains same
  - d) may decrease or increase depending on material lens
- 38) Chromatic and spherical aberration are absent in
- a) reflecting telescope
  - b) refracting telescope
  - c) Galilean telescope
  - d) any astronomical telescope

- 39) The light is falling normally on the surface. If the surface is tilted, then the illuminance on the surface would

  - a) increased
  - b) decreased
  - c) remains unchanged
  - d) none of above

40) The electric field intensity at the surface of a charged conductor is

  - a) Zero
  - b) directed normally to the surface
  - c) directed tangent to the surface
  - d) directed along 45degree to the surface

41) Electric potential of the Earth is taken to be zero because Earth is good

  - a) insulator
  - b) conductor
  - c) dielectric
  - d) semiconductor

42) When a difference of temperature is maintained across the same conductor and the current is absorbed. The effect is said

  - a) Joule's effect
  - b) Seebeck effect
  - c) Peltier effect
  - d) Thomson effect

43) Two parallel wires carrying current in apposite direction

  - a) attract each other
  - b) repel each other
  - c) cancel each other
  - d) none of above

44) What is the mean distance between the Sun and Earth?

  - a) 93 million km
  - b) 150 million miles
  - c) 150 million km
  - d) 150 AU

45) About how many light years across is the Milky Way?

  - a) 1,000
  - b) 10,000
  - c) 100,000
  - d) 1,000,000

# Organizing Committee

## **Er. Rishi Shah (Chair Person)**

Rishi Shah, academician at Nepal Academy of Science and Technology (NAST), has been promoting astronomy outreach in Nepal since 1980s. He has been actively promoting astronomy outreach working with youths during the decades. He has been acting as president of Nepal Astronomical Society (NASO), one of the pioneer groups, working for astronomy and space science outreach, education and research in Nepal since 2007. Not only is he a regular astronomical columnist at The Rising Nepal, but also has his own weekly radio talk at Radio Sagarmatha FM.



## **Mr. Prabodh Rijal (Co-Chair Person)**

Prabodh Rijal has been working in the field of school education for almost two and half decades. He has been promoting science education in Nepal since early 1990s with the First Astronomical Exhibition in Nepal, 1995 and inter-school Young Scientists' Fairs, inter-school competitive/exhibitions, where students get an opportunity to showcase their talents. He is the president of the Eskygazers, a pioneer astronomical club in Nepal established in 1996, ESPRO Foundation and Director of Eureka High School, Nepaltar, Kathmandu, Nepal.



## **Mr. Suresh Bhattarai (Programme Coordinator)**

Suresh Bhattarai is co-founder and secretary of Nepal Astronomical Society (NASO) and Asia Pacific Regional Coordinator of Space Generation Advisory Council in Support of United Nations Programme on Space Applications (SGAC), global non-governmental organization and network which aims to represent university students and young space professionals to the United Nations, space agencies, industry, and academia.



### **Ms. Manisha Dwa (Member)**

Manisha Dwa is currently pursuing her M.Sc. in Physics with majors: Astrophysics and Plasma Physics at Department of Physics, Prithvi Narayan Campus, Pokhra, Nepal. She is working as the Project Coordinator at Nepal Astronomical Society (NASO).



### **Mr. Kishor Acharya (Member)**

Kishor Acharya is currently studying M.Sc. Physics at St. Xavier's College, Maitighar, Kathmandu, Nepal. He is working as Programme Coordinator at Nepal Astronomical Society (NASO). He is also National Point of Contact (NPoC) of Space Generation Advisory Council (SGAC) to Nepal. He is also an Immediate Past President of Rotaract Club of Kathmandu Mid-Town, RI District 3292, Nepal and Bhutan and acting as Partner in Service Officer for Rotaract District Committee, RID District 3292.



### **Mr. Devraj Sapkota (Member)**

Devraj Sapkota, M.Sc. Physics, is Coordinator of Department of Physics, Damak multiple Campus, Damak, Jhapa. He is also a coordinator of Damak Astronomical Society (DASO), eastern chapter of Nepal Astronomical Society (NASO) to promote astronomy and space science outreach, education and research in Eastern Development Region of Nepal.



### **Mr. Sujan Regmi (Member)**

Sujan Regmi is a founder and current President of Pokhara Astronomical Society (PAS). He is a graduate student of Physics from Prithvi Narayan Campus, Pokhara affiliated to Tribhuvan University. He has an experience of teaching secondary level science. He is currently working in Chhunumunu Publication Limited in Pokhara as an administrative officer.



### **Mr. Mahesh Thakuri (Member)**

Mahesh Thakuri received Bachelor degree in physics from Prithvi Narayan Campus, Pokhara. He is currently studying M.Sc. Physics at Tribhuvan University. He is the founder vice-president of Pokhara Astronomical Society (PAS). His interest lies in telescope operation, observational astronomy and outreach.



### **Mr. Jeevan Lamsal (Member)**

Jeevan Lamsal is a graduate student of Physics from Prithvi Narayan Campus, Pokhara affiliated to Tribhuvan University. He is a science educator for last three years in Pokhara. He has an experience of three years teaching science and astronomy in high school. He is a founder and secretary of Pokhara Astronomical Society (PAS). He currently works in Chhunumunu Publication Limited in Pokhara and writes science and space articles in the Monthly Chhunumunu Child Magazine.



### **Ms. Pritisha Shrestha (Member)**

Pritisha Shrestha is attending M. Phil. studies in English literature at Trihibuvan University, Kathmandu, she participates in workshops and seminars on subjects related to literature and astronomy. She is a prolific writer in news media manifesting her journalistic talent.



### **Prof. Dr. Binil Aryal (Advisor)**

Prof. Dr. Binil Aryal is Head of Department at the Central Department of Physics, Tribhuvan University, Kathmandu, Nepal. He is pioneer in introducing Astrophysics in Nepal and working in the field of Galaxy orientation and Evolution. He did his PhD and the post Doctorate from Institute of Astrophysics, Innsbruck University, Austria in 2002 and 2005 respectively. His field of research includes Evolution of Galaxy in Cluster, Clusters of Galaxy, Interaction in the ISM, Dust Structures around PNe, White Dwarfs and Pulsars, Chirality of the Large Scale Structure, Dark Energy. He is also the co-ordinator of Astrophysics and Cosmology Research Group Nepal.



## **Contact Details**

NAO2014 Secretariat

C/o

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