

**UNIVERSITY OF MUMBAI**  
No.UG/370 of 2008

**CIRCULAR:-**

A reference is invited to the Ordinances, Regulations and syllabi relating to the B.Sc. degree course vide pamphlet No.151 and the Principals of the affiliated colleges in Science are hereby informed that the recommendation made by the Board of Studies in Geology at its meeting held on 9<sup>th</sup> June, 2008 has been accepted by the Academic Council at its meeting held on 13<sup>th</sup> June, 2008 vide item No.4.14 and that, in accordance therewith, the syllabus in the subject of Geology prescribed under the Applied Component Group at the T.Y.B.Sc. examination has been revised as per Appendix and that the same has been brought into force with effect from the academic year 2008-2009.

MUMBAI-400 032

13<sup>th</sup> August, 2008

PRIN.K.VENKATARAMANI

REGISTRAR

To,

The Principals of the affiliated colleges in Science.

A.C./4.14/13.06.2008

No.UG/370- A of 2008,

MUMBAI-400 032

13<sup>th</sup> August, 2008

Copy forwarded with compliments for information to :-

- 1) The Dean Faculty of Science
- 2) The Chairman, Board of Studies in Geology
- 3) The Controller of Examinations,
- 4) The Co-Ordinator, University Computerization Centre,

(D.H. KATE)

DEPUTY REGISTRAR  
(U.G./P.G SECTION)

Copy to :-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar (PRO), the Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above Circular and that, no separate Action Taken Report will be sent in this connection. The Assistant Registrar Constituent Colleges Unit (2 copies), BUCT (1 copy), the Deputy Account, Unit V (1 copy), the In-charge Director, Centralize Computing Facility (1 copy), the Receptionist (1 copy), the Telephone Operator (1 copy), the Secretary MUASA (1 copy), the Superintendent Post-Graduate Section (2 copies), the Superintendent, Thesis Section (2 copies)

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# UNIVERSITY OF MUMBAI



## Revised Syllabus For the Gemmology (Applied Component Group)

at the  
T.Y.B.Sc. examination

**(With effect from the academic year 2008-2009)**

The syllabus in the subject of Gemmology prescribed under the applied Component Group at the T.Y.B.Sc. Examination under the revised pattern to be brought into force from the academic year 2008-09.

**Paper I**

60 lectures

(60 marks)

1. Nature of gemstones: 6 lectures  
Gems as inorganic and organic natural products possessing special qualities (beauty, rarity, durability). Formation of minerals and rocks.
2. Crystallography and crystal chemistry: 10 lectures  
Crystalline and amorphous materials.  
Crystals: Symmetry, systems, forms, habits, twinning, and growth patterns of crystals.  
Cryptocrystalline, massive and metamict states.  
Atoms, ions and chemical bonding  
Isomorphism, polymorphism, pseudomorphism and exsolution.
3. Physical Properties: 12 lectures  
Hardness: definition, Mohs' scale. selection of reference minerals. application in gemmology, limitation of use, differential hardness.  
Specific Gravity: definition, determination, hydrostatic weighing using two-pan and single-pan balance, construction and use of balance, heavy liquids (bromoform, methylene iodide, sodium polytungstate and Clerici solution), flotation and pycnometer method.  
Magnetic and electrical properties, thermal conductivity and thermal conductivity meter.  
Cleavage: definition, description, importance in gemmology and lapidary work.
4. Optical Properties: 30 lectures  
Nature of light: the electromagnetic spectrum.  
Reflection: laws of reflection, importance in gemmology.  
Lustre, sheen, chatoyancy and asterism in gemstones.  
Refraction: laws of refraction, refractive index, total internal reflection. use and design of refractometer, measurement of R.I. and birefringence by refractometer and other methods.  
Isotropism and Anisotropism in gemstones, anomalous double refraction, optic axes.  
Polarized light: nature and production of polarized light, design and construction of polariscope and its use in gemmology.  
Nature of colour: absorption of light, allochromatism, idiochromatism. differential absorption of light, pleochroism, dichroscope – construction and use.  
spectroscope – construction and use, absorption spectra, other spectroscopy versions, interference and diffraction, play of colour, dispersion, metamerism, use of Chelsea colour filter, cross filter test.  
Luminescence: applications of ultra-violet and X-rays to gem testing.  
Infrared reflectivity: principle and applications, reflectivity meter.



Thermal conductance and thermal inertia: thermal conductance tester  
Electrical properties  
Internal features of gemstones: inclusions, colour zoning, X10 lens, construction and use of microscope and its other optical applications.

5. Units of Measurement: 2 lectures

Metric carat, pearl grain, kilogram, gram, milligram, meter, millimeter, micrometer, nanometer, Angstrom, litre, millilitre.

**Paper II**

60 lectures

(60 marks)

1. Synthesis of gemstones: 20 lectures

Methods of manufacture: flame-fusion (Vernueil), flux-melt, hydrothermal, crystal-pulling (Czochralski), skull-crucible method, zone melting, diamond synthesis, thin diamond films, carbon vapour deposition (CVD), ceramic technique for Gilson processed turquoise, lapis lazuli and coral. Manufacture and identification of synthetic diamond, corundum, spinels, emeralds, alexandrite, quartz, opal, rutile, turquoise, coral, lapis lazuli, strontium titanate, Y.A.G. Moissanite, G.G.G. and cubic zirconia.

2. Artificial alteration of gemstones: 15 lectures

Methods of staining, heat treatment, atomic irradiation and their detection.

3. Imitation gemstones: 4 lectures

Manufacture, properties and detection of paste (glass) and plastics. Imitation pearls.

4. Composite stones: 2 lectures

Principle types of doublets and triplets (old, new and rare types).

5. Fashioning of gemstone: 4 lectures

Illustrated descriptions of the principal types of cuts introducing brilliant, step, mixed, rose, cabochon, scissors (cross). Ideal proportions for diamond brilliant cut. Outlines of methods used by diamond-cutters and lapidaries.

6. Description of gem materials: 15 lectures

Colour, chemical composition, crystal system, habit, cleavage, hardness, specific gravity, refractive indices, pleochroism, lustre, enhancement, occurrence and localities of gem varieties of the following and methods of detection of these gems and their simulants: Diamond, corundum's, beryl's, chrysoberyl, garnets, spinel, topaz, tourmaline, zircon, peridot, jadeite, nephrite, opals, quartz, idocrase, chalcedony, orthoclase, moonstone, labradorite, turquoise, lapis lazuli, apatite, calcite, fluorite, andalusite, cordierite, zoisite, malachite, bowenite.

danburite, diopside, enstatite, serpentine, steatite, natural glasses (obsidian and moldavite).

Organic products: Pearls – native and cultured (nucleated and non-nucleated), their formation, structure, and identification with the help of pearl microscope, endoscope, x-ray photography and diffractometry (lauegrams).

Other organic products including amber, coral, jet, ivory, tortoise-shell, operculum and fossils.

### Practical I

1. Study of crystal forms, habits; and growth features of various gemstones
2. Specific gravity problems.  
a) Hydrostatic method, b) heavy liquid method, c) comparison of specific gravity of gemstones.
3. Problems on design, gemstone cuts.  
a) Light ray path through a profile of cut; b) facet patterns and facet tally of various types of cuts; c) cabochon cuts.
4. Drawings of various types of composite gemstones.

### Practical II

5. Problems on identification of gemstones on the basis of following data of the properties of gemstones. A) specific gravity; b) R.I.; c) dichroism; d) anisotropism; e) Chelsea filter effect; f) spectrum; g) luminescence; h) inclusions.
6. Procedures of distinguishing, different gemstones (Garnet, Topaz, Iolite, Moonstones, synthetic gemstones, etc.) using a dichroscope, polariscope and a loupe, on the basis of their various physical and optical characters.
7. (a) Identification of natural, cultured, and imitation pearls on the basis of structural data.  
(b) Drawings of part of light beam from endoscope through natural and imitation pearls.
8. Appraising gemstones

### Books recommended:

1. Gemmology (3<sup>rd</sup> edition) 2005 by P.G. Read.
2. Practical Gemmology (6<sup>th</sup> edition) 1976 by R. Webster.
3. Gem Testing (10<sup>th</sup> edition) 1990 by B. W. Anderson.
4. Gemstones of the world (3<sup>rd</sup> edition) 2001 by W. Schumann.

5. Gemology (2<sup>nd</sup> edition) 1991 by Cornelius S. Huribut, Jr. and Robert C. Kammerling
6. Gems(5<sup>th</sup> edition) by Robert Webster (revised by B.W. Anderson)
7. Identification of gemstones (2003) by Michael O'Donoghue and Louise J
8. The Jeweller's Directory of Gemstones (2006) by Judith Crowe

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