UNIVERSITY OF MUMBAI
No. UG/145of 2016

CIRCULAR:-

A reference is invited to the Syllabi relating to the M.Sc.degree programme, **vide** this office Circular No. UG/23 of 2013-14, dated 9th May, 2013 and the Principals of affiliated Colleges in Science and the Head of the recognized Science Institutions concerned are hereby informed that the recommendation made by the Faculty of Science at its meeting held on 22nd June, 2015 has been accepted by the Academic Council at its meeting held on 31st August, 2015 **vide** item No. 4.30 and that in accordance therewith, revised syllabus as per Credit Based Semester and Grading System in the course of M.Sc. (Marine Botany) Sem. II & IV (in the specialization of Marine Botany) for Paper VII & VIII (Sindhu Swadhyay Sanstha), which is available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2015-16.Accordingly the syllabus for Paper I to VI is same as per M.Sc. Life Science.

MUMBAI – 400 032
31st March, 2016

31/3/16
REGISTRAR

To,

The Principals of affiliated Colleges in Science and the Head of the recognized Science Institutions concerned.

A.C/4.30/31/08/2015

****

No. UG/145-A of 2016 MUMBAI-400 032 31st March, 2016

Copy forwarded with compliments for information to :-

3) The Dean, Faculty of Science.
4) The Chairperson, Board of Studies in Botany.
3) The Director, Board of Colleges and University Development,
4) The Professor-cum-Director, Institute of Distance and Open Learning(IDOL),
5) The Controller of Examinations,
6) The Co- Ordinator, University Computerization Centre.

31/3/16
REGISTRAR

..PTO

AC 31/08/2015
Item No. 4.30

UNIVERSITY OF MUMBAI

Syllabus for M.Sc. Semester III &IV
(Part II)
Program: M.Sc.
Course : Botany
Specialization: Marine Botany

(Credit Based Semester and Grading System with effect from the academic year 2015–2016)

M.Sc. Part - II Botany, Specialization Marine Botany Syllabus CBGS
To be implemented from the Academic year 2015-2016

M.Sc. Part - II Botany, Specialization Marine Botany Syllabus CBGS
To be implemented from the Academic year 2015-2016

SEMESTER III

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSBOMB303	Paper Title: Marine Botany - General Aspects			
	I	Marine Plant Groups	4	1
	II	Micro and Macroalgae		1
	III	Biodiversity of Mangroves		1
	IV	Ecology of Mangroves		1

PSBOMB304	Paper Title:Physiology and Biochemistry of Marine Plants			
	I	Algal Physiology	4	1
	II	Mangroves - Physiology		1
	III	Mineral Nutrition		1
	IV	Regeneration in Mangroves, Research in India		1

PSBOMBP303	Marine Botany - General Aspects	2	4
PSBOMB304	Physiology and Biochemistry of Marine Plants	2	4

M.Sc. Part - II Botany, Specialization Marine Botany Syllabus CBGS
To be implemented from the Academic year 2015-2016
SEMESTER IV

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
PSBOMB403	Title of the Paper: Marine Ecology			
	I	Physical Oceanography and Biotic Factors	4	1
	II	Marine Chemistry		1
	III	Microbial Ecology		1
	IV	Marine Pollution and Conservation of Ecosystems.		1

PSBOMB404	Title of the Paper: Applied Marine Botany			
	I	Analytical Methods	4	1
	II	Collection and Cultivation		1
	III	Utilization of Marine Algae		1
	IV	Marine Bioresources		1

PSBOMBP401	Marine Ecology	2	4
PSBOMBP402	Applied Marine Botany	2	4

Semester III Detailed Syllabus

Theory

Course Code	Title	Credits
PSBOMB303	**Marine Botany: General Aspects**	4
	Unit I: Marine Plant Groups • **Introduction and classification**, brief idea of Plankton, Nekton, Benthos. Marine Phytoplankton- Dino -flagellates, Nano-plankton, Ultra-plankton, coccoliths. • **Marine Fungi**, A**ctinomycetes, Lichens and Bacteria in brief.** • **Fossil mangroves –** General account	**1**
	Unit II: Micro and Macroalgae • Taxonomy, cytology, ultrastructure, salient features of Cyanophyceae, Bacillariophyceae, Chlorophyceae, Rhodophyceae and Phaeophyceae. • Life cycles of *Pinnularia, Caulerpa, Sargassum, Fucus*	**1**
	Unit : III Biodiversity of Mangroves • Brief introduction to creek, estuary, lagoon and delta formations. Definition of 'Mangrove", distribution- biogeography of Indian Mangroves, east and west coast mangroves, Mangrove forests. • Salient features of important mangrove families such as Rhizophoraceae, Sonneratiaceae, Avicenniaceae, Myrsinaceae, Acanthaceae. • Salt marshes, sea grasses and sand dune vegetation.	**1**
	Unit : IV Ecology and Mangroves • Diversity, distribution, zonation structure. • Ecological significance. Anatomical, physiological, morphological adaptations, vivipary and its role	**1**

References :-

1. Chapman VJ (1976). Coastal Vegetation. IIndedition.Pergamon Press. New York.
2. Desikachary, T.V. (1975). Marine Plants.N.C.E.R.T. New Delhi.
3. Kumar H.D. Introduction to Phycology.
4. Kumar H.D and Singh H.N. (1990).AlgaeAffiliated East West PressPvt.ltd.Publ. New Delhi.
5. McConnaughey,B.H. (1974). Introduction to Marine Biology.
6. Ranade,D.R. and Gadre,R.V. (1988). Microbial Aspects of Anaerobic Digestion.Laboratory Manual. M.A.C.S. Pune.
7. Sambamurthy, A.V.S.S.(2005). A Text Book of Algae.
8. Santhanam,R.; Ramnathan, N.;Venkataramanjan, K.andJegathanam,G.(1987). Phytoplankton of Indian Seas, and Aspects of Marine Botany. Daya Publication Home. Delhi.
9. Sen Neera and KumudranjanNaskar, (2003). Algal Flora of Sunderbans.
10. Sharma O. P. (1986) A Text Book of Algae Tata McGraw Hill Publication Publications
11. Stein, J.R.(1973). Handbook of Phycological Methods. Cambridge University Press.

12. Trainor, F.R.. Introductory Phycology.
13. Vashishta, B.R.(1995). Algae. S. Chand and Co.Ltd. New Delhi.

M.Sc. Part - II Botany, Specialization Marine Botany Syllabus CBGS
To be implemented from the Academic year 2015-2016

Course Code	Title	Credits
PSBOMB304	**Physiology and Biochemistry of Marine Plants**	4
	Unit I: Algal Physiology • **Photosynthesis in Marine Algae** – Fine structure and properties of algal plastids, photosynthetic pigments in different algal groups, carbon fixation, photosynthesis in marine macro-algae –light absorption, effect of low light condition, photosynthetic rate.C_3 versus C_4charateristics in marine algae. • **Storage and Structural Components in Algae** :- Seaweed polysaccharides, chemical structure, properties and extraction of agar, carrageenan and alginic acid. Low molecular weight compounds in algae.	**1**
	Unit II: Mangroves Physiology • **Photosynthesis in Mangroves** – Stomatal behaviour, carbon fixation, initial products of photosynthesis, enzymes, role of aspartate, accumulation of free amino acids, photorespiration. • **Bioactive Compounds in Mangroves** :- A brief idea of occurrence and importance of these compounds. • Effect of flooding on growth of halophytes. .	**1**
	Unit : III Mineral Nutrition • **Mineral Nutrition** – Nutrient requirement- essential elements, vitamins for growth of algae. Availability in sea water, uptake, factors affecting, metabolic role of essential nutrients. • **Salt Regulation in Halophytes** – Salt glands and salt secretion. Ultrastructure of salt glands. Sodium Pumps, selective ion absorption. • **Salinity and Metabolism –** Influence of salinity on photosynthesis, induction of CAM, membrane transport under salinity, effect of salinity on growth and phytohormones.	**1**
	Unit : IV Mangroves- Regeneration, Research in India • **Regeneration in Mangroves** – methods of natural and artificial regeneration in mangroves. • **Marine Algal Research in India** :- Important Research centres in India and their work. • **Mangrove Research in India** :- Major research centres in India and their	**1**

contribution. .	

References :-

1. Chapman, V.J. (1976) : Coastal Vegetation. IInd edition. Pergamon Press. New York.
2. Ring, M. (1982) : The biology of Marine Plants. Edward Arnold Publishers, London.
3. Gerald, E. Ecophysiology of Economic Plants in Arid and Semiarid Land.
4. Jackson, D.F. (1972) Algae and Man. Plenum Press.
5. Lobban, C.S. and Harrison, P.J. (1985) : Seaweed Ecology and Physiology. Cambridge University Press.
6. Sambamurthy,A.V.S.S.(2005) : A Text Book of Algae.
7. Stein, J.R. (1973) : Handbook of Phycology and Biochemistry.
8. Stewart, W.D. (1974) : Algal Physiology and Biochemistry.
9. Waisel,Y. (1972) : Biology of Halophytes. Academic Pres, London and New York.

M.Sc. Part - II Botany, Specialization Marine Botany Syllabus CBGS
To be implemented from the Academic year 2015-2016

Practical

Code	Title	Credits
PSBOMBP301	**Marine Botany - General Aspects**	**2**
1. Study of characteristic features of members of Chlorophyceae – *Enteromorpha,Chaetomorpha, Ulva, Caulerpa, Bryopsis*etc 2. Study of characteristic features of Phaeophyceae – *Padina, Dictyota, Sargassum* etc. 3. Study of characteristic features of Rhodophyceae – *Gracilaria, Gelidium,Hypnea*etc. 4. Isolation of marine fungi and its identification 5. Sampling and identification of phytoplankton. 6. Demonstration of phytoplankton/algal culture technique. 7. Study of mangrove associates- *Aleuropus, Halophila*etc 8. Type study of mangroves from Rhizophoraceae. 9. Type study of mangroves from Avicenniaceae and Sonneratiaceae. 10. Type study of mangroves from Myrsinaceae and Acanthaceae. 11. Study of sand dune plants – *Spinifex, Ipomoea* etc.		
PSBOMBP302	**Physiology and Biochemistry of Marine Plants**	**2**
1. Estimation of pigments from marine algae – chl *a,b,c,d,* carotenoids, phycobilins 2. Isolation of agar agar from algal material. 3. Extraction and estimation of alginic acid and carrageenan from marine algae. 4. Estimation of total carbohydrates from marine algae. 5. Determination of organic matter content from sediment. 6. Determination of TAN of succulent marine plants like *Sessuvium, Lumnitzera* 7. Regeneration studies in some mangrove species. 8. Determination of free amino acid content in saline and non-saline plants. 9. Estimation of proline from saline and non-saline species. 10. Estimation of tannins from bark/stems of different mangroves		

M.Sc. Part - II Botany, Specialization Marine Botany Syllabus CBGS
To be implemented from the Academic year 2015-2016

Semester IV Detailed Syllabus

Theory

Course Code	Title	Credits
PSBOMB403	**Marine Ecology**	**4**
	Unit I: Physical Oceanography & Biotic Factors • **Physical Oceanography** : The role and observations in oceanography – oceans and seas, their dimension, physical properties of sea water – salinity, temperature-density in space and time, O_2, CO_2, nutrients, oceanic mixed layer and thermocline. Ocean currents and their movement, equatorial processes- El Nino, Indian ocean circulation. • **Biotic factors**- floral and faunal components. Role of phytoplanktons, water blooms and red tide phenomenon.	**1**
	Unit II: Marine Chemistry • **Major and minor elements in sea water, chlorinity, salinity** – Definition, significance and measurement. Solubility of gases in sea water – dissolved O2, CO2, pH, alkalinity, percentage composition of inorganic carbon, calcium carbonate precipitation. • **Micronutrient elements in sea water** (P,N,Si), N:P ratios, stoichiometry and uptake and regeneration of nutrient elements.	**1**
	Unit : III: Microbial Ecology • **Microbial Ecology of Coastal Ecosystem** – Mycorrhizal relations, coastal vegetation and nitrogen fixation, detritus based food chain. • **Microbial Ecology of Coral Reefs** – occurrence, distribution and types. Calcification, reef algae, natural and anthropogenic stress, restoration and conservation of coral ecosystem, concept of marine park.	**1**
	Unit : IV Marine Pollution & Conservation of Mangrove Ecosystem • **Marine Pollution**; types, sources and impact. Toxic metal pollution, oil, sewage, pesticide, radioactive pollution and effect of waste disposal on marine ecosystem. Biomagnification. • **Conservation of mangrove ecosystem**; need for conservation, human impact, role of global institutions and NGO's in India.	**1**

References:-

1. Svedrup,H.U., Johnson,M.W.andFlemming,R.H.(1962) The Ocean: Their Physics, Chemistry and Biology, Asia Publ.House, New Delhi.
2. Pierson,W.J.andNewmann,G.S (1966) Principles of Physical Oceanography, Prentice Hall,Inc., New Jersey. U.S.A.
3. Riley,J.P.and Chester,R (1981).Introduction to marine chemistry,.
4. Riley,J.P.and Skirrow,G. (1975) Chemical Oceanography (Vol.1,2.3&8),.
5. Martin,D.F)1970) Marine Chemistry Vol.2..
6. Daves,C.J.(1985). Marine Botany, Physiology and Ecology of Seaweeds.
7. Dawson (1960) Marine Botany.
8. Lobban,C.S. and Harrison,P.J. (1985) Seaweed ecology and physiology. Cambridge University Press.
9. Naskar, Kumundrajan and Rathindranath Mandal (1999). Ecology and Biodiversity of Indian Mangroves.
10. Pandey,B.P, (1994) Algae S.Chand New Delhi.
11. Current Trends in Life Sciences, Vol23: Agromicrobes, Today and Tomorrow. New Delhi.

M.Sc. Part - II Botany, Specialization Marine Botany Syllabus CBGS
To be implemented from the Academic year 2015-2016

Course Code	Title	Credits
PSBOMB404	**Applied Marine Botany**	**4**
	Unit I: Analytical Methods • **Methods of Analysis** : Primary productivity measurement (biomass harvesting, litter fall, gas exchange, modelling technique). Standing crop, species diversity index, similarity index etc. • **Mangrove survey by Remote sensing** application. Use of remote sensing technique in mapping of mangrove vegetation use of GPS.	**1**
	Unit II: Collection, Cultivation, Applications and Uses • **Methods of Collection and Preservation of Marine Algae** – Collection, chemical preservation, herbarium technique, storage of specimens. • **Laboratory culture and cultivation of algae** ; Use of natural and synthetic culture media, difficulties in getting axenic culture. • **Commercial Cultivation of Seaweeds** ; Traditional and recent methods. Mariculture of *Porphyra, Laminaria,Undaria, Gracilaria* etc.	**1**
	Unit : III Utilization of Marine Algae • **Utilization of Seaweeds**, species used as food and fodder, application to soil as a fertilizer or manure, madeicinal uses, source for iodine. Industrial application of seaweeds. • **Utilization of Diatoms** : application and uses.	**1**
	Unit : IV Marine Bioresouces • **Coastal Bioresources** ;- Bioresource profile, wild bioresources – food, feed, fodder, fire wood, timber, medicinal products, potential genetic resources, ornamentals. • **Domestic Bioresources** – crops, cereals, pulses, oil crops, horticultural crops, livestock, aquaculture, apiculture.	**1**

References

1. Biotechnology of Microalgae. Beck
2. Bhosale,L.J.(2005). Mangroves of Maharashtra. (Field Guide). Shivaji University, Kolhapur.
3. Chapman, V.J.. Coastal Vegetation. IInd edition. PergamonPress.New York.

4. Jackson,D.F.(1972).Algae and Man. Plenum Press.
5. Kannupandi,T.(1998). Coral Reefs of India.State of Report.ENVIS Publication Series 2/98.
6. Krishnamurthy,V.(1985). Marine Plants, (A.G. Untawale, Asso. Editor), Seaweed research and Utilization Association, Madras.
7. Santhanam,R.; Ramnathan,N.; Venkataramanjan,K.andJegathanam,G.(1987). Phytoplankton of Indian Seas and Aspects of Marine Botany. Daya Publication Home. Delhi.
8. Tein,J.R.(1973). Handbook of Phycological Methods. Cambridge University Press.
9. Stoemer,E.F. and Smol, J.P. The Diatoms. Applications for Environment and Earth Sciences.
10. Swaminathan,M.S. Research Foundation (2003). Bioresources Status in Selected Coastal Location. National Bioresource Development Board(Dept of Biotechnology) Govt. of India.
11. Trainor,F.R. Introductory Phycology.

Practical

Code	Title	Credit
PSBOMBP403	**Marine Ecology**	**2**

1. Determination of EC, pH, salinity and chlorinity of sea water.
2. Determination of nitrates from sea water.
3. Determination of BOD of polluted sea water.
4. Determination of oil, grease/ hydrocarbon content of polluted sea water.
5. Determination of phosphates from sea water.
6. Study of zonation pattern in algae and mangroves.
7. Study of vivipary in mangroves.
8. Study of salt glands, trichomes, sclerides in mangroves.
9. Study of phonological events in different mangrove species.
10. Microbe analysis of sediments (Sulphur bacteria) from estuaries.

PSBOMBP404	**Applied Marine Botany**	**2**

1. Determination of primary productivity of estuarine ecosystem.
2. Study of herbarium technique in marine algae.
3. Study of diatoms (cleaning,preparation and observation).
4. Demonstration of phytoplankton/algal culture technique.
5. Determination of total ash/mineral content from seaweeds.
6. Effect of seaweed concentrate on seed germination and plant growth.
7. Study of economically important mangrove species used for food, fodder, timber, medicines.
8. Study of major faunal components from mangrove ecosystem.
9. Determination of S.D.I. and similarity index of mangroves.
10. Detection of bioactive compounds in some mangrove species by TLC.