



KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR, GUJARAT

(A university established under Gujarat State Act No.21 of 2007, UGC Recognized)

ADMISSION NOTIFICATION FOR M.Sc. BIOTECHNOLOGY

KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR invites applications for admission to M.Sc. Biotechnology for the academic year 2010-12 from eligible candidates.

Eligibility: M.Sc. Biotechnology candidates should have passed B.Sc. degree with at least 50% of marks in all the three optional subjects in aggregate and should have studied Biotechnology / Biochemistry/ Chemistry compulsorily along with at least one of the following optional subjects-Microbiology/Botany/Applied Zoology /Industrial Microbiology/Environmental Science /Genetics /Applied Genetics/Sericulture /Home science /Life Sciences/Biological Science/Dairy Science/Horticulture/Forestry/Fisheries.

Selection: Candidates shall be selected through an entrance examination followed by an interview.

Examination date: 30.05.2010 Result of Entrance Test: 01.06.2010

Date of interview: 03.06.2010

Note: The final year students awaiting the results are also eligible to apply for the above courses. However they should produce the proof of eligibility at the time of admission.

Application Procedure: Application forms for admission to M.Sc. Biotechnology can be obtained from PG Admission Cell, Sarva Vidyalaya Campus Sector-23 Gandhinagar, on payment of Rs200/- for Biotechnology

Last date for the submission of duly filled in Applications is 26.05.2010

**The Registrar,
Kadi Sarva Vishwavidyalaya,
Sector -15 /23 , Gandhinagar.
Phone-079-23222664**

**KADI SARVA VISHWAVIDYALAYA
GANDHINAGAR - GUJARAT
(UGC RECOGNISED)**



DEPARTMENT OF BIOTECHNOLOGY

**INFORMATION BROCHURE &
APPLICATION FORM FOR ADMISSION
TO M.Sc. BIOTECHNOLOGY**

ACADEMIC YEAR 2010-2011

About Sarva Vidyalaya and Kadi Sarva Vishwavidyalaya

Sarva Vidyalaya Kelvani Mandal has been established in the year 1919, by a Philanthropist “Pujya Chhaganbha”. The basic principle preached by him, “Kar Bhala Hoga Bhala” has been the driving force for the growth of education activities managed by the trust. Having started with just 6 students then, today the trust manages and runs various schools and colleges both at Kadi and Gandhinagar with more than 48,000 students being educated. Of these, around 6,500 students, both boys and girls stay in the hostels being managed by the trust.

The trust is being nourished and managed by its alumni who occupy respectable positions in the society. Many of its alumni have settled abroad and they shower in donations to benefit the existing as well as prospective students for providing them with better facilities for study as well as stay.

Initially started in 1919, the trust currently has land of around 165 acres together at Kadi and Gandhinagar. At Kadi, the trust has a land of 137 acres where in, various schools and colleges are being run and a Gaushala which helps in nourishing Children with milk with around 125 cows. At Gandhinagar, the trust has a total of 28 acres of land where in various schools, colleges (technical as well as non-technical), hostels and staff quarters exist.

The trust has always been in the forefront for provisions of value based education to all the students irrespective of Caste, Creed and Religion etc. Keeping in with the main motto “Kar Bhala Hoga Bhala” the trust has surrendered all its management quota seats in all courses being run by it and the admissions to the various courses strictly conducted on the basis of merit through centralized admission process. At present the trust runs various schools from preprimary to Higher Secondary level both at Kadi and Gandhinagar as well as Colleges both technical and nontechnical at Kadi and Gandhinagar.

Sarva Vidyalaya Kelvani Mandal – Kadi Campus at a glance

Having started in the year 1919, the trust slowly and steadily made its presence felt in the society and the efforts of “Chhaganbha” have not gone waste with the development of schools at Kadi. The campus grew from 9 acres in 1923 to 137 acres by 1934 with the acquisition of land for the purpose of establishing schools, hostels and Gaushala as well. In the year 1960 Sarva Vidyalaya Kelvani Mandal has set its foot into providing technical education with the establishment of an Industrial Training Institute at Kadi. The trust went on to establish the Science College,

Pramukh Swami Science College in the year 1965 which was later upgraded into Science and Arts College, Pramukh Swami Science and H.D.Patel Arts College. This has led to the growth of education activities in and around Kadi and the trust has also started various other colleges leading to the degree and postgraduate degrees like BBA, BCA, MBA, MCA, PGDCA, B.Ed., and PTC.

Sarva Vidyalaya Kelvani Mandal- Gandhinagar Campus at a glance

The trust has been striving hard for the development of education and related activities since 1919 and looking in to this, the Government of Gujarat invited Sarva Vidyalaya Kelvani Mandal to set up education facilities at Gandhinagar in 1976. At that time the trust was allotted a land of 13 acres for establishing schools for the benefit of the population staying in and around Gandhinagar. Since then the trust has set up many educational institutions and hostels which have proved to be the backbone of the development of education in the state of Gujarat and currently more than 36,000 students are being educated at Gandhinagar of which around 4,000 students both boys and girls are staying in the hostels.

With a need to spread education further and develop a kind of professionalism in the young generation of Gujarat, the trust has started the first self financed college, Kalupur Bank Institute of Pharmaceutical Education and Research (KBIPER) offering B. Pharmacy program with the approval of AICTE in the year 1995 for which Government of Gujarat allotted a land measuring 20,000 sq. meters i.e. 5 acres. Currently KBIPER is also offering post graduate and doctoral research programs besides B. Pharmacy. The journey of Sarva Vidyalaya continued further with the establishment of S. K. Patel Institute of Management and Computer Studies offering MBA and MCA programs in the year 1998. The trust went on to establish other institutes offering BBA, BCA, B.Com., B.Ed., PTC and other vocational courses.

In the year 2005, the trust has established an Engineering college for which Government of Gujarat has allotted a land of around 40,000 sq. Mts, in Sector 15 of Gandhinagar. In addition to this in the year 2006, the trust has also established a Polytechnic College, the VPMP Polytechnic College.

In addition to the above objectives the trust wishes to set up a State of Art Research Centre which would focus the attention upon the latest topics like nanotechnology, nano and material sciences and Biotechnology.

To achieve the above objectives the trust has setup a University. The University has been set up vide Gujarat Act No.21, dated 16.5.2007 and has been recognized by

University Grant Commission vide letter no.F-9-18-2008 (CPP-I) under the name and style “KADI SARVA VISHWAVIDYALAYA”.

The objectives of the university are-

- 1) To provide need based education and develop courses of contemporary relevance.
- 2) To be a University of excellence by providing research based activities which would foster higher economic growth.
- 3) To provide education to all irrespective of caste, creed and religion.

The Post Graduate courses and Research in Biotechnology got initiated parallel to the commencement of the University in 2007-08.

The trust set up a Nursing college and started imparting B.Sc. Nursing education since Session 2008-09. A number of new courses including CHOICE BASED COURSES are being currently planned.

M.Sc. BIOTECHNOLOGY:

Biotechnology is a multidisciplinary subject, where the biological principles are combined with the applications of science and engineering to deliver useful goods and services to the mankind. Biotechnology addresses several practical problems faced by human beings and has several important applications in various fields viz., agriculture, medicine, forensic science, pharmaceuticals and other biotechnology related industries and environment. Examples include commercial production of human insulin, development of transgenic organisms thereby expressing novel characters and increasing the yields, development of superior, quick and reliable diagnostic kits & therapeutic proteins etc. This application oriented field is one of the rapidly growing sectors of economy around the globe. There exist a variety of opportunities for the Biotechnologists in various industries and research oriented organizations worldwide.

In Gujarat, which has very large industrial belt, there is a scarcity of seats in this potent post graduate course- M.Sc. Biotechnology. To cater the needs of students in Gujarat region and to generate skilled manpower required by industry, KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR, has been imparting Post Graduate course in BIOTECHNOLOGY.

COURSE DETAILS:

M.Sc. Biotechnology at Kadi Sarva Vishwavidyalaya, Gandhinagar, is a two years course comprising of four semesters with English as medium of instruction. The curriculum has been developed with basic courses like Molecular Biology, Biophysical and Biochemical Techniques, Cell and Microbial Physiology, Biochemistry & Enzymology, Genetic Engineering Immunology, Bioprocessing and Biochemical Engineering, Computer Applications, Biostatistics and Bioinformatics, Microbial Technology, Plant Biotechnology, Animal Cell Science and Technology, Environmental Biotechnology and Pharmaceutical Biotechnology comprising of drug discovery and designing using Bioinformatics etc. More emphasis is being laid on Practical work enabling students to learn and gain hands on training and experience with techniques and latest equipments and instruments used in industries related to Biotechnology. As a part of curriculum, students of M.Sc. are put to exposure to Industry / Research Institutes through several visits to Biotechnology related Industries / Institutes, one month's Summer training after 2nd Semester and in Industry / Research Institute Dissertation work for around 8 weeks in the 4th Semester under the guidance of Industry / Research Institute Scientists and a Faculty member to enable the students to understand the recent Biotechnology trends and to plan, execute and present their work as "Thesis" thus developing their scientific, technical, language and communication capabilities and competence. Alternatively there is a provision for Elective Papers. The Thesis shall be permitted at our Department for a limited number of candidates based on overall CGPA at the end of Semester III (Top 20). The detailed syllabus and pattern of teaching and examinations are provided on www.ksvuniversity.org, the web site of KSV.

ELIGIBILITY:

The candidates seeking admission to **M.Sc. Biotechnology** at Kadi Sarva Vishwavidyalaya, Gandhinagar should have passed their B.Sc. Degree with at least 50% marks aggregate as well as individually in all the three optional subjects. The subjects studied at B.Sc. should include Biotechnology / Biochemistry / Microbiology / Industrial Microbiology / Biology compulsorily along with one of the optional subjects including: Botany / Applied Botany / Industrial Microbiology / Genetics / Environmental Sciences / Applied Genetics / Life Sciences / Biological Sciences / Zoology / Applied Zoology / Agriculture Sciences / Horticulture / Dairy Sciences / Forestry / Fisheries / Home Science / Sericulture. Students whose results are expected

can also apply. Provisional admission shall be provided subject to the clearance of examinations and eligibility.

APPLICATION PROCEDURE:

Application Forms for admission to **M.Sc. Biotechnology** can be obtained from **PG Admission Cell, Department of Biotechnology, Kadi Sarva Vishwavidyalaya, II Floor, K. B. Institute of Pharmaceutical Education and Research, Sarva Vidyalaya Campus Gate No. 1, Sector-23, near GH-6 Circle, Gandhinagar-382023**, on payment of Rs. **200/-** for Biotechnology by hand from 15.05.2010 to 26.05.2010.

Last date for the submission of duly filled in Application with requisite enclosures is 26. 05. 2010.

EXAMINATION CENTRE:

Examination centre for the Entrance Test shall be **S.K. Patel Institute of Management & Computer Studies Sarva Vidyalaya Campus Gate No. 2, Sector-23, near GH-6 Circle, Gandhinagar-382023.**

SELECTION:

The candidates shall be selected through an entrance examination followed by interview of short listed candidates. The **Entrance Test will be held on 30.05.2010 from 10.30 a.m. to 12.00 Noon.**

Results exhibiting short listed candidates shall be displayed on the 1.06.2010 by 4.00 p.m. at Department of Biotechnology, KSV as well as on the University website. No call letters shall be issued to candidates.

Interviews for the short listed candidates shall be held on 3rd June, 2010 from 10.30 a.m. at Department of Biotechnology, Kadi Sarva Vishwavidyalaya, II Floor, K. B. Institute of Pharmaceutical Education and Research, Sarva Vidyalaya Campus Gate No. 1, Sector-23, near GH-6 Circle, Gandhinagar-382023.

Weightage for marks obtained at B.Sc. Examination shall be considered in the interview.

IMPORTANT INFORMATION ABOUT ENTRANCE TEST:

- **The Entrance Test will be basically of the subject Biotechnology to judge the capability, knowledge and aptitude of the candidate in BIOTECHNOLOGY / MICROBIOLOGY and allied branches.**
- **The Test Paper will contain 50 multiple choice objective type questions.**
- **Medium of Examination shall be English only.**

INTAKE CAPACITY:

One Hundred Twenty (120) students will be admitted in M.Sc. Biotechnology

FEE:

All the students admitted to the courses shall have to pay a sum of Rs. **42,000/-** per annum (payable in two equal instalments). A library deposit of Rs. **1000/ -** (Refundable after the completion of course) should be paid along with first instalment of the Fee at the time of admission.

UNDERTAKINGS BY ADMITTED STUDENTS:

The parents of the students granted admissions as well as the students shall have to give undertakings on Non Judicial Stamp Papers that their ward shall not participate in Ragging or any other undesirable activities otherwise he shall stand a chance of disciplinary action including expulsion.

LABORATORY:

The Department has a well equipped laboratory comprising of equipments and instruments like Spectrophotometers, HPLC, HPTLC, Electrophoresis units, High speed cooling centrifuge, Ovens, Incubators, Autoclave, Incubator room, Rotary Shaker, Plant Tissue culture laboratory, Research Microscopes, Water Baths, Electronic Balances, heating equipments, pH meters vortex mixers, Computers with internet facility, Microfiltration assemblies, Extra Large Laminar Air Flow Unit etc Distilled Water unit and RO water Unit etc. The students are having the liberty of independent and unrestricted but accountable use of all the instruments, a facility rarely provided by University departments.

LIBRARY:

The University has an excellent Centralized Library with large numbers and multiple copies of important titles, reference books and national and international Journals.

Additionally the Libraries of **K. B. Institute of Pharmaceutical Education and Research (KBIPER)** and the **Department of Biotechnology**, KSV, have excellent collection of latest books of Microbiology, Biotechnology and Pharmaceuticals apart from their Journals.

E-Books and Internet facility with access to electronic Journal and Books is added facility provided to every student.

ASSESSMENT:

The students are continuously evaluated through Mid Term assessments, Assignments, Seminars, End Term examinations, Group discussions, Article writing, Quiz competitions and Poster presentations. The University has adopted Grade System as desired by U.G.C. w. e. f. 2009-2011 Session. The minimum passing marks for each paper (Theory as well as practical is 50%). The details of assessment and examination systems are provided on www.ksvuniversity.org , the web site of KSV.

CAREER OPPORTUNITIES:

After the completion of M.Sc. candidates can look for Research in various Institutes/Universities all over the world including Kadi Sarva Vishwavidyalaya, or they can attempt to join industries including Pharmaceuticals, Food Processing, Agricultural Biotechnology, (Biofertilizers / Biopesticides / Tissue culture / Seeds), Enzymes or Bio-fuels industries. The Department provides help to students in upgrading of C. V., providing help in preparations for Interviews and helping in exploring opportunities through continuous interactions with Industries & Institutions and also supporting in the preparations for NET Examinations etc. About 75 % students of the 1st M.Sc. Biotechnology batch passed out in 2009 have been able to secure jobs within Gujarat.

PLACEMENT CELL:

The University has been interacting with various Industries and Institutions to provide them information on the analytical & research oriented capabilities being imparted and developed in our students. The Dissertation work has been designed for an opportunity of close interaction of prospective candidates (our students) and employers (Industries and Institutions). The University is setting up a placement Cell to help students in finding employment.

SYLLABUS: Please see the website www.ksvuniversity.org for Course contents, weightage, pattern of teaching and pattern of Examinations and Grades.


Ph. D. Courses: The University has registered so far 12 Ph. D students in various Biotechnology areas including Microbial Diversity, Enzymology, Microbial Physiology, Bio-Energy, Biofuels, Plant Tissue Culture, Agriculture Biotechnology (Biopesticides & Biofertilizers), Immunology & Tumor Biology, Bioinformatics, Drug Discovery, Stem Cells, Phytopharmaceuticals and Medicinal Biotechnology.

OTHER FACILITIES: The University has provisions for the following

1. Separate Hostels for Boys and Girls with subsidized Boarding and lodging (Mess)
2. Hygienic and subsidized Canteen
3. Sports facilities
4. Centrally Air conditioned Auditoria
5. Bus Facilities

SCHEDULE FOR ENTRANCE:

Examination Date & Time:	30.05.2010 from 10.30 A.M. to 12.00 Noon.
Venue:	S.K. Patel Institute of Management and Computer Studies, Sarva Vidyalaya Campus Gate No. 2, Sector-23, near GH-6 Circle, Gandhinagar-382023.
Results:	01.06.2010 at 4.00 P.M
Interviews:	3rd June, 2010 from 10.30 a.m. at Department of Biotechnology, Kadi Sarva Vishwavidyalaya, II Floor, K. B. Institute of Pharmaceutical Education and Research, Sarva Vidyalaya Campus Gate No. 1, Sector-23, near GH-6 Circle, Gandhinagar-382023.
Start of Academic Session:	1st July, 2010

	DEPARTMENT OF BIOTECHNOLOGY, KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR	
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Admit Card

1. Name (Block letters): _____

2. Date of Birth: _____ Gender : Male/ Female

3. Marital Status : Single / Married

4. Father's name : _____

Self Attested
Photograph

5. Address for Correspondence

6. Permanent Address

Mobile/Phone No.	Email id:

7. Examination Center:



**S.K. PATEL INSTITUTE OF MANAGEMENT & COMPUTER STUDIES,
SECTOR-23, NR GH-6 CIRCLE, GANDHINAGAR**

8. Examination Schedule:

Name of examination	Date	Day	Time
M.Sc. BIOTECHNOLOGY Entrance test	30-05-2010	Sunday	10:30 AM to 12:00 PM

**Last Date for the submission of duly filled in Application with requisite enclosures is
26.05.2010**

**Head,
Department of Biotechnology
KADI SARVA VISHWAVIDYALAYA,
GANDHINAGAR**

	DEPARTMENT OF BIOTECHNOLOGY, KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR	
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Application form for admission to M.Sc. Biotechnology

Last date for submission of filled in Application with requisite enclosures 26.05.2010

1. Name (Block letters): _____

2. Date of Birth: _____ Gender : Male/ Female

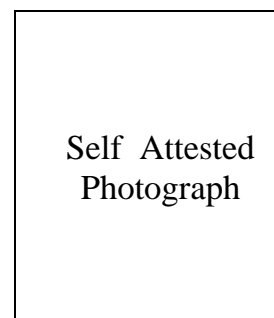
3. Marital Status : Single / Married

4. Father's name: _____

5. Mother's name : _____

6. Address for Correspondence

7. Permanent Address



Mobile/Phone No.	Email id:

8. Details of Academic Qualifications*: (Attach photocopies of academic qualification)

Examination	Year	University	Subject	Div.	Marks (%)
B.Sc.					

(Attach attested photocopies of University Marks sheets of B. Sc. F.Y., S.Y. and T.Y. issued.)

I solemnly declare that the information given in the form is true to best of my knowledge.

Date:

Place:

(Signature of the Candidate)

*To be filled in examination hall only

Name of the Examination	Signature of the Candidate*	Date & Day	Signature of the Invigilator with date*
Entrance Test for Admission to M.Sc. BIOTECHNOLOGY			

**KADI SARVA VISHWAVIDYALAYA
GANDHINAGAR**



M.Sc. BIOTECHNOLOGY

20010-12

ADMISSION & EVALUATION RULES

Rules of M.Sc Biotechnology

1. Eligibility for admission to M.Sc. Biotechnology - The candidate should have passed B.Sc. degree with at least 50% of marks in all the three optional subjects in aggregate and should have studied Biotechnology/ Biochemistry/ Chemistry compulsorily along with at least one of the following optional subjects - Microbiology/Botany/Applied Botany/Zoology/Applied Zoology/ Industrial Microbiology/Environmental Science/Genetics/Applied Genetics/Sericulture/Home Science/ Life Sciences/Biological Science/Agricultural Science/Dairy Science/ Forestry/Horticulture/ Fisheries.
2. Selection of candidates - An entrance examination and a personal interview will be conducted to select the candidates for admission to I semester of M.Sc. Biotechnology. The candidates are short listed through an entrance examination and are selected based on their performance in the entrance examination/ B.Sc. Examination and personal interview.
3. Attendance – A candidate to be eligible for appearing in the end semester examinations should have at least 75 % attendance in total theory lectures and 90 % attendance in practicals classes. In exceptional cases, on medical grounds, a 10 % grace in the above mentioned attendance may be considered by the Head of the Department. A candidate who fails to secure the above mentioned attendance should repeat the semester.
4. Promotion Criteria for M. Sc. Biotechnology for various Semesters shall be as follows:

Semester	Condition(s) For Promotion
II	Clearing OR not clearing of all Papers (Theory & Practicals) of Semester – I
III	Complete Clearing of all Papers (Theory & Practicals) of Semester I and Semester II OR Clearing of all Papers (Theory & Practicals) of Semester I but not clearing of Semester II OR Clearing of all Papers (Theory & Practicals) of Semester II but not clearing of only one subject of Semester I
IV	Clearing of all Papers (Theory & Practicals) of Semesters I to III OR Clearing of all Papers (Theory & Practicals) of Semesters I and II but not clearing Semester III OR Clearing of all Papers (Theory & Practicals) of Semesters I and III but not clearing of only one subject of Semester II

5. The performance of M.Sc. Biotechnology students, Kadi Sarva Vishwavidyalaya, Gandhinagar is continuously monitored and evaluated by their respective faculty members through internal examinations, assignments, seminars and group discussions.
6. Each theory paper is evaluated for a maximum of 100 marks out of which, 30 marks shall be for Mid Term Exams (Based on Average of 2 Mid Term Examinations each of 2 hours duration carrying 30 Marks). An end semester examination shall be of 3 hours duration carrying 70 marks to be held at the end of each semester.
7. In Semesters I, II & III, 2 practical examination will be conducted, each for a maximum of 100 marks.
8. In the final Semester (IV) there will be written examinations / Thesis and Viva as detailed in the Examination Scheme.
9. The marks obtained by the students in all the theory papers as well as in practicals in the Mid Term as well as Final assessments will be sent to “The controller of Examinations, Kadi Sarva Vishwavidyalaya, Gandhinagar”, within a fortnight from the close of the semester.
10. To pass in each paper the student should obtain 50% of total marks in a subject.
11. No class/ division will be awarded to the students in the first 3 semesters.
12. Students shall have to appear in all the exams unless Medically bed ridden at the advice of a Doctor recognized by the University. Absence shall mean 0 Marks. Medically advised students shall have to re-appear at a later date to be decided by the Department.
13. Each end semester examination is of three hour duration and is for a maximum of 70 marks. The paper comprises of two sections each carrying 35 marks. In both first and second sections there will be three questions all of which are compulsory. In question 1(section 1) and 4(section 2) there will be 10 multiple choice questions or very short answer questions, each question carries 1 mark and all of them should be answered (10 X1=10 marks). In question 2 (section 1) and 5(section 2) 7 short answer questions out of which 5 should be answered and each question carries 3 marks (5 X 3 =15 marks). In the In question 3 (section 1) and 6 (section 2) there will be 2 essay questions out of which one should be answered and each question carries 10 marks (1 X10 = 10 marks).
14. No candidate is allowed to re-appear for the Semester examinations already cleared.
15. An examination in which the candidate was absent/ failed, he/ she should re-appear.
16. If a candidate passes in all the subjects within the two year course duration, then he/ she will be awarded Division according his/ her CPI. If a candidate fails to pass in all the subject in the two years of course duration but passes in re-attempts later then he/ she will be awarded only a pass class irrespective of his/ her Grade. However if the candidate is absent for the examination in the course duration but passes the exam later

but within the same number of attempts as the regulars then he/ she will be awarded a Division corresponding to his CPI.

17. The results of the examinations will be declared usually within 30 working days after the final examination. For awarding the degree at the end of the course all the Mid Term and Final exams Cumulative Performance Index (CPI) are taken in to consideration.

S.N.	CPI	Corresponding Division
1	7.50 to 10.00	First Division with distinction
2	6.50 to 7.49	First Division
3	6.00 to 6.49	Second Division

**TEACHING & EXAMINATION SCHEME EFFECTIVE FOR
M.Sc. BIOTECHNOLOGY FROM 2009-2011**

I SEMESTER

Paper Code	Paper Title	Credits	Teaching Scheme (Hrs.)		Exam. Scheme					Total Marks	Pass %
			Theory	Practical	Theory			Practical			
					Hrs.	Marks		Hrs.	Marks		
					Mid Term	End Term					
BT 101	Molecular Biology	4	4	-	3	30	70	-	-	100	50
BT 102	Biophysical and Biochemical Techniques	4	4	-	3	30	70	-	-	100	50
BT 103	Cell Biology and Microbial Physiology	4	4	-	3	30	70	-	-	100	50
BT 104	Biochemistry and Enzymology	4	4	-	3	30	70	-	-	100	50
BT 105	Laboratory 1	6	-	6	-	-		6	100	100	50
BT 106	Laboratory 2	6	-	6	-	-		6	100	100	50
	Total	28								600	50

II SEMESTER

Paper Code	Paper Title	Credits	Teaching Scheme		Exam. Scheme				Total Marks	Pass %
			Theory	Practical	Theory		Practical			
					Hrs.	Marks	Hrs	Marks		
BT 201	Genetic Engineering	4	4	-	3	100	-	-	100	50
BT 202	Immunology	4	4	-	3	100	-	-	100	50
BT 203	Bioprocessing and Biochemical Engineering	4	4	-	3	100	-	-	100	50
BT 204	Computer Applications, Biostatistics and Bioinformatics	4	4	-	3	100	-	-	100	50
BT 205	Laboratory 1	6	-	6	-	-	6	100	100	50
BT 206	Laboratory 2	6	-	6	-	-	6	100	100	50
	Total	28							600	50

III SEMESTER

Paper Code	Paper Title	Credits	Teaching Scheme		Exam. Scheme				Total Marks	Pass %
			Theory	Practical	Theory		Practical			
					Hrs.	Marks	Hrs.	Marks		
BT 301	Microbial Technology	4	4	-	3	100	-	-	100	50
BT 302	Plant Biotechnology	4	4	-	3	100	-	-	100	50
BT 303	Animal Cell Science and Technology	4	4	-	3	100	-	-	100	50
BT 304	Environmental Biotechnology	4	4	-	3	100	-	-	100	50
BT 305	Pharmaceutical Biotechnology	4	4	-	3	100	-	-	100	50
BT 306	Laboratory 1	6	-	6	-	-	6	100	100	50
BT 307	Laboratory 2	6	-	6	-	-	6	100	100	50
	Total	32							700	50

IV SEMESTER

BT- 401: Biotechnology Business Management (100 marks)

BT- 402: Assignments (**100** marks)

BT- 403: 3 Elective Papers (403 A / 403 B / 403 C) of **100 marks each** (Total **300** marks): Agricultural Biotechnology / Food Biotechnology / Industrial Biotechnology / Medical & Clinical Biotechnology / Environmental Biotechnology & Engineering / Bioinformatics **OR** 403 D Dissertation (300 marks)

Paper Code	Paper Title	Credits	Teaching Scheme		Exam. Scheme				Total Marks	Pass %
			Theory	Practical	Theory		Viva			
					Hrs.	Marks	Hrs.	Marks		
BT 401	Biotechnology Business Management	4	4	-	3	100	-	-	100	50
BT 402	Assignments	2	-	-	-	-	-	-	100	50
BT 403A	Elective Paper A	18	4	-	3	100	-	-	300	50
BT 403B	Elective Paper B		4		3	100				
BT 403C	Elective Paper C		4		3	100				
OR										
BT 403D	Dissertation	18	-	-			0.5	300	300	50
	Total	24							500	50

The detailed syllabus of BT-401, 403A, 403B and 403C shall be notified later.

KADI SARVA VISHWA VIDYALAYA GANDHINAGAR



M.Sc. BIOTECHNOLOGY (2010-2012) SYLLABUS

BIOTECHNOLOGY

Course Description: This course is designed to enable students to acquire understanding of fundamentals of Biotechnology and applications of various Biotechnological resources and techniques. It also provides opportunities for utilizing Biotechnology products for the benefit of mankind. The course also provides practical training on Biotechnological resources, techniques and processes for creation of trained manpower for adsorption in upcoming Biotechnology Industry.

I SEMESTER

- BT - 101 MOLECULAR BIOLOGY
- BT - 102 BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES
- BT - 103 CELL BIOLOGY AND MICROBIAL PHYSIOLOGY
- BT - 104 BIOCHEMISTRY AND ENZYMOLOGY
- BT - 105 LABORATORY
- BT - 106 LABORATORY

II SEMESTER

- BT - 201 GENETIC ENGINEERING
- BT - 202 IMMUNOLOGY
- BT - 203 BIOPROCESSING AND BIOCHEMICAL ENGINEERING
- BT - 204 COMPUTER APPLICATIONS, BIOSTATISTICS AND BIOINFORMATICS
- BT - 205 LABORATORY
- BT - 206 LABORATORY

III SEMESTER

- BT - 301 MICROBIAL TECHNOLOGY
- BT - 302 PLANT BIOTECHNOLOGY
- BT - 303 ANIMAL CELL SCIENCE AND TECHNOLOGY
- BT - 304 ENVIRONMENTAL BIOTECHNOLOGY
- BT - 305 LABORATORY
- BT - 306 LABORATORY

IV SEMESTER

- BT - 401 PHARMACEUTICAL BIOTECHNOLOGY
- BT - 402 LABORATORY
- BT - 403 DISSERTATION WORK

BT: 101- MOLECULAR BIOLOGY

Course Description: This course is designed to enable students to acquire basic knowledge of molecular biology thus paving way for the applied courses.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	4	Mendel's laws – Law of segregation, Law of Independent Assortment, Exceptions to Mendel's Laws – Law of Incomplete dominance, Law of Co - dominance, Linkage, Sex linked Inheritance in human beings – Color blindness, hemophilia.	8
2	11	The genetic material –Properties, Experiments that prove DNA / RNA as genetic material, Chromatin structure and types, Organization of nucleosome and chromosomes, Prokaryotic and eukaryotic DNA replication, Telomerase	22
3.	11	Promoters, Enhancers, RNA Polymerases in prokaryotes, eukaryotes, Prokaryotic and eukaryotic Transcription and its regulation. Types of RNA	20
SECTION B			
4.	11	Genetic code - Properties, Wobblers Hypothesis, Ribosomes, Polysomes, Protein synthesis in prokaryotes and eukaryotes	20
5.	7	Regulation of gene expression in Prokaryotes – lac operon, trp operon, DNA damage – Thymine dimers , DNA repair mechanisms– Photoreactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair	22
6.	4	Overview of Recombination, Transposable genetic elements – Insertion Sequences, Composite Transposons and Non composite transposons, transposition – replicative and non replicative mechanisms	8

BT: 102- BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

Course Description: This course is designed to enable students to acquire basic knowledge of instruments and techniques related to analytical and separation procedures.

Theory:

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	10	Use of analytical microscopy in elucidating the structure-function relationship in microbes: Electron microscopy, phase contrast and fluorescence microscopy and scanning tunneling microscopy. Introduction to Osmosis, diffusion and Donnan Equilibrium.	25
2	16	Principles, types and applications of centrifuges and centrifugation techniques, Separation and characterization of bio-molecules using Centrifugation techniques. Principles, types and applications of chromatographic techniques. Principles, types and applications of Electrophoresis, Separation and characterization of bio-molecules using electrophoretic techniques.	25
SECTION B			
3	18	Basic concepts of Electromagnetic radiation – wave length, frequency, wave number, velocity, Properties of U.V and IR rays, fluorescence, Phosphorescence. Absorption and emission spectroscopy – principles and applications of Visible, UV, IR, AAS, NMR, ESR and MS spectroscopy.	25
4	4	Radio isotope techniques: Detection and measurement of radioactivity, Geiger Muller counters, Scintillation counting, Autoradiography and RIA; Applications of isotopes in biological studies. CD, ORD & fluorescence spectroscopy, Raman spectroscopy, Characterization of macromolecules using X-ray diffraction analysis.	25

BT: 103 - CELL AND MICROBIAL PHYSIOLOGY

Course Description: This course is designed to enable students to acquire knowledge on the structure, behaviour and functioning of cell constituents of Microbes and other living organisms.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	16	Cell origin and evolution, overview of structure and functions of cellular organelles in Prokaryotes and Eukaryotes, organization of Cytoskeleton and nuclei, Cell division and overview of cell cycle. Bio-membranes: Structures and Transport process	25
2	12	Microbial growth: Definition, mathematical expression of growth, growth curve, Growth as affected by environmental factors like temperature, acidity, alkalinity, water availability and oxygen: Sterilization: Applications in biotechnology, various sterilization methods, Microbial contamination control and sterility testing	25
SECTION B			
	14	Microbial metabolic diversity: Photosynthesis, Methanogenesis, Acetogenesis, Nitrogen fixation and Hydrocarbon transformations in microorganisms. Mitochondrial respiratory chain, order and organization of carrier's proton gradient, iron sulphur proteins, cytochromes and characterization. Regulation of respiration.	25
4	6	Microbial diversity : Nutritional & environmental types: Extremophiles, Biochemical characterization, Culture collection: Maintenance of cultures Antimicrobial agents: Antibacterial, Antiviral, Antifungal agents, Mode of action and resistance to antibiotics	25

BT: 104 - BIOCHEMISTRY & ENZYMOLOGY

Course Description: This course is designed to enable students to acquire knowledge on the structure, behaviour and functioning of cell constituents of Microbes and other living organisms.

First year I Sem.
Hours (Theory 48)

Time: Theory-48

Theory:

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	12	Carbohydrates: Glycolysis, citric acid cycles its function in energy generation and biosynthesis of energy rich bonds, Alternate pathways of carbohydrate metabolism. Gluconeogenesis, inter conversion of sugars, Biosynthesis of Oligosaccharides. Amino acids: Biosynthesis and degradation of amino acid. Regulation of amino acid metabolism in microbial system.	25
2	12	Lipids: Fatty acid biosynthesis, Acetyl CoA carboxylase, Fatty acid synthase, desaturase and elongase. Fatty acid oxidation. Nucleic acid: Biosynthesis of purines and pyrimidines. Regulation of purines and pyrimidines biosynthesis. Structure and regulation of ribonucleotide reductase.	25
SECTION B			
3	12	Classification & nomenclature of Enzymes, Units of activity, Specific activity of enzyme and Methods of enzyme assay, isolation & purification. Enzyme specificity, Factors affecting the rate & efficiency of enzyme catalyzed reactions forms and derivation of MM equation; Significance of V_{max} and K_m . Enzyme inhibition – type of inhibitions, Protein ligand binding; Protein sequencing	25
4	12	Allosteric enzymes; Multi-enzyme system: Occurrence, isolation and their properties; Polygenic nature of multi-enzyme systems, Coenzymes and co-factors. Immobilized enzymes and their utility. General mechanism of enzyme regulation; Feedback inhibition and feed forward stimulation; Enzyme repression, induction and degradation; Enzyme engineering and its applications. Manufacturing & applications of enzymes.	25

BT: 201- GENETIC ENGINEERING

Course Description: This course is designed to enable students to acquire basic knowledge genetic engineering.

Unit	Time (Hrs)	Content	Likely Weightage
		SECTION A	
1	12	Concept and emergence of r-DNA technology, Tools of r-DNA technology – isolation of DNA, Restriction endonuclease, Modification methylases and other enzymes to modify the DNA, vectors – plasmids, bacteriophages, cosmids, phagemids, artificial chromosome vectors (YAC, BAC), Animal virus derived vectors - SV40 and retroviral vectors, Vectors in yeast and cloning in eukaryotes. Optimizing the expression of cloned Genes,	25
2	12	Molecular cloning, Genomic DNA libraries, Shot gun gene cloning, cDNA libraries, full length cDNA cloning, transformation of recombinant DNA, screening of recombinants, Southern, Northern and Western blotting, fluorescence in situ hybridization (FISH), Use of transposons in genetic analysis	25
		SECTION B	
3	12	Polymerase chain reaction and its applications, Sequencing of DNA – Maxam and Gilberts method, Sanger’s method and other advances in sequencing, overview of chemical synthesis of oligonucleotides; Mutation, Mutagens and Mutagenesis, techniques of in vitro mutagenesis, Site-directed mutagenesis	25
4	12	Applications of genetic engineering: Transgenic microbes/plants/animals, production of recombinant pharmaceuticals, gene therapy, diagnosis of diseases, Chromosome walking, DNA finger printing. DNA foot printing, Gel Retardation Assay, DNA microarrays, Biotechnology and Society – Social, ethical and legal aspects of biotechnology; Biotechnology in industries – international collaboration, national level policies on biotechnology; Regulatory mechanisms in releasing GMOs; IPR; Plant breeder’s rights; WTO; GATT & TRIPS; Biosafety regulations.	25

BT: 202- IMMUNOLOGY

Course Description: This course is designed to enable students to acquire understanding of fundamentals of Immunology and its applications in various Biotechnological techniques, products and processes.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	16	<p>Overview of the immune system : Innate and Adaptive immunity, Cells and organs of immune system Antigens and super antigens, epitopes.</p> <p>Antigen-antibody interactions : Agglutination, precipitation, Complement fixation, Immunofluorescence, ELISA</p> <p>Immunoglobulin: Structure and functions, Complement system.</p>	25
2	10	Cell mediated responses, Activation of T and B lymphocytes, Cytokines and their role, Hypersensitivity	25
SECTION B			
3	14	<p>B cell and T cell receptors , generation of antibody diversity, MHC, antigen processing and presentation</p> <p>Autoimmunity its mechanism and treatment with special reference to</p> <p>a. Organ specific diseases (Addison's disease, Autoimmune hemolytic anaemia, Good pastures syndrome , Graves disease , Hashimoto's thyroiditis, Insulin dependent diabetes mellitus, Myasthenia gravis, Glomerular nephritis and Pernicious anaemia)</p> <p>b. Systemic diseases (Multiple sclerosis, Rheumatoid arthritis, SLE)</p>	25
4	8	<p>Transplantation Immunology, Tumor immunology</p> <p>Immunity against infectious agents with special reference to: Virus: Influenza, Bacteria: Tuberculosis, Protozoans: Sleeping Sickness</p> <p>AIDS and other immuno deficiency diseases like</p> <p>a. SCID, b. WAS c.Di George Syndrome, d.Ataxia telangiectasia, e.Chediak Higashi Syndrome, f. Chronic granulomatous diseases</p> <p>Hybridoma technology: Introduction to Monoclonal antibodies and use of monoclonal antibodies in diagnostic kits.</p> <p>Vaccines: Different types of vaccines</p> <p>Immunomodulators.</p>	25

BT: 203-BIOPROCESS TECHNOLOGY & BIOCHEMICAL ENGINEERING

Course Description: The course imparts knowledge of production processes, infra structure & techniques for manufacture of Biotechnology products from microorganisms and waste management from manufacturing plants.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1.	16	Introduction to Fermentation & Bioprocess Technology, Growth phases, secondary metabolite pathways. Influence of environmental factors on growth and product formation. Growth kinetics: Microbial growth cycle, measurement of growth. Screening, preservation and improvement of industrially important microorganisms. Fermentation substrates and media formulation for inoculum development, and for fermentation processes	30
2.	10	Elements of biochemical engineering, Bioreactor design; Solid state / Submerged cultivation; Batch, fed batch and continuous cultivation. Sterilization of media reactor and air; Agitation and aeration and mass transfer of oxygen in different types of Bioreactors; additions and sampling;	20
SECTION B			
3.	12	Control of process parameters: measurement of process parameters like pH, temperature, DO, foam etc.; Instruments in process control, two position and proportionate control, biosensors and enzyme probes, microprocessor based control systems. Downstream processing: Cell separation, Cell disintegration, product purification	30
4.	10	Enzyme technology: Immobilization of enzymes, Enzyme reactors & bioconversion. Effluent and Waste treatment, . Scale up of bioprocesses, Bioprocess economics, Investment decision and Entrepreneurship development	20

BT 204: COMPUTER APPLICATIONS AND BIOSTATISTICS

Course Description: This course is designed to enable students to acquire the knowledge of plant tissue culture and other applications.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	12	Definitions and scope of Biostatistics: Variable in biology, Sampling Techniques and data collection, classification and tabulation of data. Graphical and diagrammatic representation, histogram, frequency polygon, frequency curve. Descriptive statistics: Measures of central tendency – Mean (arithmetic, harmonic and geometric), Median and Mode. Measures of dispersion – Standard deviation and standard errors.	25
2	12	Elements of probability theory. Probability distributions – binominal and Poisson distribution, Measures of Asymmetry, Correlation coefficient, Simple linear regression, Basic idea of significance test. Statistical hypotheses, types of errors, level of significance, Student's t, chi-square, goodness of fit and F tests.	25
SECTION B			
3	12	History, development and types of computers: General awareness of computer systems – hardware and software (CPU and other peripheral devices, computer arithmetic, computer logic, programming languages – machine language, assembly language, higher level languages). General awareness and use of popular software package for word processing, DBMS, spread sheets, graphics, statistical packages – MINITAB, MATLAB etc.	25
4	12	Bioinformatics: Introduction to bioinformatics. Use of nucleic acid and protein data banks – NCBI, EMBL, DDBJ, SWISSPORT. Pairwise sequence alignment, Multiple sequence alignment. Gene prediction. Genome analysis and phylogenetic prediction.	25

BT: 301-MICROBIAL BIOTECHNOLOGY

Course Description: The course imparts knowledge of production processes, techniques and utility of Biotechnology products from microorganisms in various areas including food, beverages, health & medicine, fuels, energy and environment.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1.	6	General concepts of Microbial Biotechnology, Principles of exploitation of microbial biodiversity: Extremophiles, primary and secondary metabolism.	10
2	16	Microbial production of: Antibiotics: Penicillin, Streptomycin; Enzymes: Proteases, Amylases; Organic acids : Citric acid, acetic acid; Vitamins : Vit. B ₁₂ , Vit.B ₂ ; Amino acids: Glutamic acid, Lysine, Alcohol: beer, wine, sake; Polysaccharides, Alkaloids; Microbial Transformations of Steroids.	30
3.	4	Microbial production of Food and Dairy products: Single cell proteins; Cheese, bread and yoghurt, Mushroom cultivation.	10
SECTION B			
4.	10	Algae: as a source of food, feed, industrial uses of algae. Mass cultivation of commercially valuable marine macroalgae for agar, alginates and other products of commerce and their uses; Mass cultivation of microalgae as a source of proteins, feed & oils. Biofertilizers and Biopesticides: Nitrogen fixation and biofertilizers - Blue-green algae, Azolla - mass production for practical applications, Mycorrhizae - importance in agriculture and forestry.	25
5.	10	Biopolymers and bioplastics, Bio-fuels, Microbial Enhanced Mineral & Oil Recovery	25

BT: 302- PLANT BIOTECHNOLOGY

Course Description: This course is designed to enable students to acquire the knowledge of plant tissue culture and its applications.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	9	Conventional plant breeding. Introduction to cell and tissue culture; Tissue culture as technique to produce novel plants and hybrids. Tissue Culture Media (Composition & Preparation); Sterilization in tissue culture. Initiation and maintenance of callus and suspension cultures; Single cell clones; Organo-genesis; Somatic embryogenesis; Shoot tip culture; Rapid clonal propagation and production of virus-free plants; Embryo culture and embryo rescue ; Transfer and establishment of whole plants in soil.	20
2	9	Protoplast isolation, culture and fusion; Selection of hybrid cells and regeneration of hybrid plants; Symmetric and asymmetric hybrids, cybrids. Anther, pollen and ovary culture for production of haploid plants and homozygous lines. Somaclonal variation. Cryopreservation	20
3	6	Markers – Types their advantages and disadvantages Molecular markers – RFLP, RAPD, AFLP map based cloning, Molecular marker assisted selection.	10
SECTION B			
4	12	Plant transformation technology – Basis of tumor formation; Features of Ti and Ri plasmids; Mechanisms of DNA transfer; Role of virulence genes; Use of Ti and Ri as vectors; Binary vectors; Use of 35 S and other promoters; Genetic markers; Use of reporter genes; Methods of nuclear transformation; Viral vectors and their applications; Vectorless or direct DNA transfer; Particle bombardment, Electroporation, Microinjection; Chloroplast transformation – Advantages, Vectors, Success with tobacco and potato, Mitochondrial Transformations.	25
4	12	Application of Plant Biotechnology & Commercial Transgenic plants- Herbicide resistance, insect resistance, Bt genes, disease resistance, virus resistance, antifungal proteins, nematode resistance, abiotic stresses. successes: Metabolic engineering and industrial products – Plant secondary metabolites, Control mechanisms and manipulation of phenyl propanoid pathway, shikimate pathway	25

BT: 303 - ANIMAL CELL SCIENCE AND TECHNOLOGY

Course Description: This course is designed to enable students to acquire knowledge of Animal cell culture and the biotechnology products based on it.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	12	Structure and organization of animal cell. Equipments and materials for animal cell culture technology. Introduction to the balanced salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium; Role of carbon dioxide; Role of serum and supplements. Serum and protein free defined media and their applications	25
2	12	Primary and established cell line cultures. Measurement of viability and cytotoxicity. Measurement of cell death. Apoptosis. Biology and characterization of the cultured cells, measuring parameters of growth.	25
SECTION B			
3	12	Basic techniques of mammalian cell culture <i>in vitro</i> ; disaggregation of tissue and primary culture; maintenance of cell culture; Cell cloning and cell separation; Cell synchronization; Cell transformation. Scaling up of animal cell culture; Stem cell cultures, embryonic stem cells and their applications.	25
4	12	Somatic cell genetics; Organ and histotypic cultures; Three dimensional culture and tissue engineering. Embryo technology, Transgenic animals. Cell culture based vaccines.	25

BT: 304 - ENVIRONMENTAL BIOTECHNOLOGY

Course Description: This course is designed to enable students to acquire understanding of environment related issues caused by the biotechnology products and its management. The study also includes the role of microbes, flora & fauna in maintaining the ecological / environmental balance.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1	6	Environment: basic concepts and issues. Environmental pollution : Types of pollution and its measurement, Methodology of environmental management, Problem solving approach and its limitations. Air pollution and its control through Biotechnology.	20
2	20	Water pollution and its control through Biotechnology. Water as a scarce natural Resource, need for water management, Measurement of water pollution, COD, BOD, sources of water pollution. Microbiology of water and Public health. Waste water collections, Waste Water Treatment -Physical, chemical and biological treatment processes. Microbiology of waste water treatments Aerobic & Anaerobic processes, Sewage slurry as biological fertilizer, Bio-Gas Treatment schemes for various industrial waste waters: Dairy, Distillery, Tannery, Sugar, Antibiotic industry.	30
SECTION B			
3	6	Microbiology of degradation of Xenobiotics in environment (Ecological consideration, Decay behavior and degradative plasmids): Degradation of Hydrocarbons, Substituted hydrocarbon, Oil pollution, Surfactants, Pesticides	25
4	16	Global environmental problems, their impact and biotechnological approaches for management Ozone depletion, UV_B, Green house effect, Acid rains Bioremediation of contaminated soils and waste lands: In-situ and Ex-situ methods , Phytoremediation Biopesticides in Integrated Pest management Solid wastes : Sources and management, Composting, Vermiculture, Methane production	25

BT: 305-PHARMACEUTICAL BIOTECHNOLOGY

Course Description: The course provides knowledge on the utility of Biotechnology products & techniques useful as medicines / diagnostics including the recombinant DNA products.

Unit	Time (Hrs)	Content	Likely Weightage
SECTION A			
1.	12	The Drug Development Process for Biopharmaceuticals, Microbial, Recombinant, Biochemical and Molecular level screening systems and their construction/ design strategies, High throughput drug screening technology. Receptor versus enzyme mediated drug action. Dosage forms, Formulations and delivery routes for Biopharmaceuticals	20
2.	12	<ul style="list-style-type: none"> • Microbial products as drugs: • Therapeutic Proteins- Cytokines, Enzymes, Growth Hormones, Blood Factors, Monoclonal Antibodies, vaccines, immuno-modulators as drugs/diagnostic agents • Other microbial products in therapeutics • Novel drugs through enzymatic conversion of chemical drugs • Microbes as models of Mammalian drug metabolism 	30
SECTION B			
3	8	Manufacturing of Biopharmaceuticals including dosage forms, Q.A. measures & SOPs	20
4.	8	Phytochemicals / Animal based Biopharmaceuticals Stem Cells, Gene and Cell Therapy, Molecular Pharming	15
5.	8	Pharmaco-genetics and its impact on drug therapy Regulatory aspects of Biopharmaceuticals	15