

B.Sc
Biotechnology
(Honours)
NEP-2020

तालिका-2

3 year Honours/Single subject programme structure aligned with FYUGP of UGC
Table-2(To be in effect from 2025-26 session)

Cumulative Minimum Credits Required for Award of Certificate/ Diploma/ Degree			Subject I	Subject II	Subject III	Vocational Skill Enhancement Courses (SEC) with Summer Internship	Co-curricular Ability/ Enhancement Courses (AEC)	Research Project/ Dissertation/ Internship/ Field or Survey work	Minimum Credits for the Year
	Year	Sem.	Major (core)	Major (core)	Minor Multidisciplinary	Minor	Minor	Major	
			4/5/6 Credits	4/5/6 Credits	6 Credits	3 Credits	2 Credits	3/4 Credits	
			Own Faculty	Own Faculty	Other Faculty	Vocational Skill Enhancement Courses (SEC) with Summer Internship	Co-curricular Ability/ Enhancement Courses (AEC)	Inter/Intra Faculty related to main subjects	
(40) Certificate in Faculty	1	I	Th-3(4) or Th-2(4)+ Pract-1(4)		1 (6)	1 (3)	1 (2)		40
		II	Th-3(4) or Th-2(4)+ Pract-1(4)			1 (3)	1 (2)		
(40+40=80) Diploma in Faculty	2	III	Th-3(4) or Th-2(4)+ Pract-1(4)		1 (6)	1 (3)	1 (2)		40
		IV	Th-3(4) or Th-2(4)+ Pract-1(4)				1 (2)	1 (3) Point 7.1	
(80+40=120) 3-year Single Subject Plain UG Degree	3	V	Th-4(4) or Th-3(4)+ Pract-1(4)					1 (4)	40
		VI	Th-4(4) or Th-3(4)+ Pract-1(4)					1 (4)	
OR									
(80+50=120) 3-year Single Subject Honours UG Degree	3	V	Th-4(5) or Th-4(4)+ Pract-1(4)					1 (5)	50
		VI	Th-4(5) or Th-4(4)+ Pract-1(4)					1 (5)	

*Single subject 3 years UG programme examples: BBA, BCA, BHM, BSc(Chemistry).

*After both the above programmes (3 year plain or Honours degree), one has to pursue 4th / 5th years of UG/PG programmes as given in Table-1. in the same manner as the one who completes, 3 years UG degree of Table 1.

Monika

Atish

उदाहरण (Illustration):

एकल विषय स्नातक वाले विद्यार्थी प्रथम दो वर्षों में प्रत्येक सेमस्टर में (प्रथम से चतुर्थ तक) या तो 4-4 क्रेडिट के 03 थ्योरी पेपर (Theory Paper) का अध्ययन करेगा

अथवा

4-4 क्रेडिट के 02 थ्योरी पेपर (Theory Paper) + 4 क्रेडिट का एक प्रयोगात्मक पेपर (Practical Paper) का अध्ययन करेगा ।

इसका निर्णय सम्बंधित बोर्ड ऑफ स्टडीज एवं अन्य सक्षम समिति द्वारा लिया जायेगा ।

- ✓ तृतीय वर्ष में विद्यार्थी प्रत्येक सेमस्टर में (पंचम एवं षष्ठम सेमस्टर में)

या तो 4-4 क्रेडिट के 04 थ्योरी पेपर (Theory Paper) का अध्ययन करेगा

अथवा

4-4 क्रेडिट के 03 थ्योरी पेपर + 4 क्रेडिट का एक प्रयोगात्मक पेपर (Practical Paper) का अध्ययन करेगा ।

साथ ही विद्यार्थी पंचम एवं षष्ठम सेमस्टर में 4-4 क्रेडिट की एक-एक शोध परियाजना करेगा यथा तृतीय वर्ष कुल 40 क्रेडिट्स का होगा ।

इसका निर्णय सम्बंधित बोर्ड ऑफ स्टडीज एवं अन्य सक्षम समिति द्वारा लिया जायेगा ।

ऐसे विद्यार्थी को त्रिवर्षीय एकल विषय में स्नातक डिग्री प्रदान की जाएगी ।

अथवा

- ✓ तृतीय वर्ष में विद्यार्थी प्रत्येक सेमस्टर में (पंचम एवं षष्ठम सेमस्टर में) या

तो 5-5 क्रेडिट के 04 थ्योरी पेपर (Theory Paper) का अध्ययन करेगा

अथवा

4-4 क्रेडिट के 04 थ्योरी पेपर (Theory Paper) + 4 क्रेडिट का एक Practical Paper का अध्ययन करेगा ।

साथ ही विद्यार्थी पंचम एवं षष्ठम सेमस्टर में 5-5 क्रेडिट की एक-एक शोध परियाजना करेगा यथा तृतीय वर्ष कुल 50 क्रेडिट्स का होगा ।

इसका निर्णय सम्बंधित बोर्ड ऑफ स्टडीज एवं अन्य सक्षम समिति द्वारा लिया जायेगा ।

ऐसे विद्यार्थी को त्रिवर्षीय एकल विषय में स्नातक (मानद) डिग्री प्रदान की जाएगी ।

- ✓ इसके अतिरिक्त एकल विषय स्नातक वाले विद्यार्थी प्रथम दो वर्षों में एक-एक तीसरे गौण (Minor) विषय का चयन बहुविषयकता के लिए किसी भी अन्य संकाय से विश्वविद्यालय/ महाविद्यालय में सीट उपलब्धता के आधार पर करेगा । तीसरे गौण (माइनर) विषय का कोर्स किसी भी विषय का इलेक्टिव पेपर (6 क्रेडिट) होगा, न कि पूर्ण विषय। इस कोर्स के चुनाव में Pre-requisite का ध्यान रखा जाना आवश्यक नहीं है। विश्वविद्यालय अपने स्तर पर यह निर्धारित कर सकते हैं कि कौन सा कोर्स गौण (माइनर) विषय के रूप में दिया जा सकता है।

- ✓ विद्यार्थी प्रथम दो वर्षों में प्रथम सेमस्टर में तृतीय सेमस्टर तक एक-एक कौशल विकास कोर्स (Vocational/Skill development Courses) का चयन करेगा ।

Monika

[Signature]

[Signature]

[Signature]

- ✓ विद्यार्थी प्रथम दो वर्षों में प्रथम सेमस्टर में चतुर्थ सेमस्टर तक एक-एक सह-पाठ्यचर्या पाठ्यक्रम/कोर्स (Co-Curricular Courses) का अध्ययन करेगा ।
- ✓ विद्यार्थी को द्वितीय वर्ष के चतुर्थ सेमस्टर में चतुर्थ सेमस्टर तक एक शोध परिजयोजना करनी होगी ।

Monika







FYUP के अन्तर्गत प्रथम तीन वर्षों (बी०ए०, बी०एससी० एवं बी०कॉम०) एवं त्रिवर्षीय एकल विषय स्नातक हेतु ग्रेडिंग प्रणाली

सत्र 2025-26 से विश्वविद्यालय द्वारा FYUP को अंगीकृत कर लिया गया है। इसके अंतर्गत स्नातक पाठ्यक्रमों में प्रथम तीन वर्षों एवं त्रिवर्षीय एकल विषय स्नातक में निम्नलिखित 10 पॉइंट ग्रेडिंग प्रणाली लागू किये जाने की संस्तुति की गयी है, जो यूजीसी के दिशा-निर्देशों पर आधारित है।

लैटर ग्रेड	विवरण	अंको की सीमा	ग्रेड पॉइंट
O	Outstanding	91-100	10
A+	Excellent	81-90	9
A	Very Good	71-80	8
B+	Good	61-70	7
B	Above Average	51-60	6
C	Average	41-50	5
P	Pass	33-40	4
F	Fail	0-32	0
AB	Absent		0

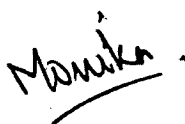
2. उत्तीर्ण प्रतिशत

2.1 उपरोक्त तालिका में मुख्य एवं माइनर विषयों का प्रत्येक कोर्स/पेपर (थ्योरी एवं प्रैक्टिकल सभी) पूर्णांक 100 के Credit course है तथा इन सभी का उत्तीर्ण प्रतिशत 33 प्रतिशत होगा।

2.2 चार सह-पाठ्यक्रम कोर्स (co-curricular courses) तथा द्वितीय वर्ष में लघु शोध (Minor Project) पूर्णांक 100 के Credit course है तथा इनका उत्तीर्णांक भी 33 प्रतिशत ही होंगे।

2.3 तीन कौशल विकास कोर्स (Skill development/Vocational course) भी Credit Course हैं तथा इनके उत्तीर्णांक 40% होंगे। शासनादेश संख्या: 2058/सत्र-3-2021-08 (33)-2020 टी.सी. दिनांक 26 अगस्त 2021 में प्रदान की गई व्यवस्था के अनुक्रम में कौशल विकास/रोजगार परक कोर्स/पेपर का मूल्यांकन कुल पूर्णांक 100 में से होगा, जिनमें से प्रशिक्षण / ट्रेनिंग / प्रैक्टिकल आधारित कार्य का मूल्यांकन 60 अंकों में से होगा तथा सैद्धांतिक (Theory) आधारित कार्य का मूल्यांकन 40 अंकों में से होगा। कौशल विकास कोर्स/पेपर में कुल पूर्णांक 100 में से न्यूनतम उत्तीर्णांक 40 होंगे। प्रशिक्षण / ट्रेनिंग एवं सैद्धांतिक (Theory) में अलग-अलग कोई न्यूनतम उत्तीर्णांक नहीं होंगे।

2.4 सभी विषयों के मुख्य/माइनर पेपर (केवल थ्योरी) में अधिकतम अंक 100 में से प्राप्तांकों की गणना 25 अंकों के सतत आन्तरिक मूल्यांकन व 75 अंकों की विश्वविद्यालय (बाह्य) परीक्षा में प्राप्त अंकों को जोड़ कर की जायेगी। मुख्य एवं माइनर विषयों के प्रत्येक कोर्स/पेपर (केवल थ्योरी) में उत्तीर्ण होने हेतु (अ) विश्वविद्यालय की परीक्षा में अधिकतम 75 अंकों में से न्यूनतम 25 अंक (75 का 33 प्रतिशत) लाने आवश्यक होंगे तथा (ब) आन्तरिक एवं बाह्य परीक्षाओं में कुल मिलाकर न्यूनतम 33 अंक प्राप्त करने होंगे।






2.5 सभी विषयों के मुख्य/माइनर (प्रेक्टिकल)/सह-पाठ्यक्रम/लघु शोध के प्रत्येक कोर्स/पेपर के अधिकतम 100 अंको की बाह्य परीक्षा विश्वविद्यालय द्वारा करवाई जायेगी। इनमें कोई सतत आन्तरिक मूल्यांकन नहीं करवाया जायेगा। अतः मुख्य एवं माइनर विषयों के प्रत्येक कोर्स/पेपर (प्रेक्टिकल)/सह-पाठ्यक्रम/लघु शोध में उत्तीर्ण होने हेतु विश्वविद्यालय की बाह्य परीक्षा में न्यूनतम 33 अंक प्राप्त करने होंगे।

2.6 किसी भी कोर्स/पेपर के आन्तरिक मूल्यांकन में कोई भी न्यूनतम उत्तीर्ण प्रतिशत नहीं है। यदि किसी विद्यार्थी को आन्तरिक मूल्यांकन में शून्य अंक व बाह्य परीक्षा में न्यूनतम उत्तीर्णांक 33 (मुख्य एवं माइनर विषयों में) प्रतिशत अंक मिलते हैं, तब भी वह उत्तीर्ण होगा। आन्तरिक मूल्यांकन में पूर्ण अनुपस्थिति पर भी शून्य अंक ही मिलेंगे।

2.7 किसी भी प्रकार के कृपांक (Grace marks) नहीं दिये जायेंगे।

3. कक्षान्नोति (Promotion)

3.1 विद्यार्थी को वर्तमान सेमेस्टर से अगले सेमेस्टर में सदैव प्रोन्नत किया जायेगा, चाहे वर्तमान सेमेस्टर का परिणाम कुछ भी हो। वर्तमान सेमेस्टर में जिस पेपर में विद्यार्थी अनुत्तीर्ण होगा, उसे उस पेपर को बैंक पेपर (Re-Exam) के रूप में देना होगा।

4. बैंक पेपर अथवा सुधार (Improvement) परीक्षा

4.1 आन्तरिक परीक्षा में बैंक पेपर अथवा सुधार (Improvement) हेतु परीक्षा नहीं होगी।

4.2 विद्यार्थी को बैंक पेपर अथवा सुधार (Improvement) की सुविधा सम (विषम) सेमेस्टर्स के पेपर्स के लिए सम (विषम) सेमेस्टर्स में ही उपलब्ध होगी। विद्यार्थी सुधार (Improvement) की परीक्षा केवल किन्हीं भी दो पेपर में दे सकता है।

4.3 विद्यार्थी को बैंक पेपर अथवा सुधार (Improvement) हेतु परीक्षा के लिए कोर्स/पेपर तथा उसका पाठ्यक्रम (Syllabus) वही होगा जो उस वर्तमान सेमेस्टर जिसमें वह परीक्षा दे रहा है, में उपलब्ध होगा।

4.4 विद्यार्थी बैंक पेपर अथवा सुधार (Improvement) हेतु किसी भी कोर्स / पेपर की विश्वविद्यालय (बाह्य) परीक्षा काल बाधित ना होने तक, चाहे कितनी भी बार दे सकता है।

5. काल अवधि

किसी भी एक वर्ष को पूरा करने की अधिकतम अवधि तीन वर्ष होगी।

व्याख्या:- (Explanation) यदि विद्यार्थी सततता में तीनों वर्ष की पढ़ाई करता है, तो उसे अधिकतम नौ वर्ष मिलेंगे। किन्तु यदि विद्यार्थी किसी एक वर्ष का सर्टिफिकेट/डिप्लोमा लेकर चला जाता है, तो वह बाकी के वर्षों की पढ़ाई दोबारा शुरू करने के लिए कभी भी वापस आ सकता है तथा उसे आगे के वर्षों की पढ़ाई पूरा करने के लिए तीन वर्ष (प्रति एक वर्ष की पढ़ाई) के मिलेंगे।

6 CGPA की गणना

6.1 SGPA एवं CGPA की गणना निम्नवत सूत्रों से की जाएगी:

j^{th} सेमेस्टर के लिए $SGPA(S_j) = \Sigma(C_i \times G_i) / \Sigma C_i$	यहाँ पर: C_i = number of credits of the i^{th} course in j^{th} semester. G_i = grade point scored by the student in the i^{th} course in j^{th} semester
$CGPA = \Sigma(C_j \times S_j) / \Sigma C_j$	यहाँ पर: S_j = SGPA of the j^{th} semester. C_j = total number of credits in the j^{th} semester.

Mamika

[Signature]

[Signature]

[Signature]

6.2 CGPA को प्रतिशत अंको में निम्नलिखित सूत्र के अनुसार परिवर्तित किया जायेगा:

$$\text{समतुल्य प्रतिशत} = \text{CGPA} \times 9.5$$

6.3 विद्यार्थियों को निम्नवत सारणी के अनुसार श्रेणी (Division) प्रदान की जाएगी:

प्रथम श्रेणी	6.50 अथवा उससे अधिक तथा 10.00 से कम CGPA
द्वितीय श्रेणी	5.00 अथवा उससे अधिक तथा 6.50 से कम CGPA
तृतीय श्रेणी	4.00 अथवा उससे अधिक तथा 5.00 से कम CGPA

7. किसी भी विद्यार्थी को सर्टिफिकेट/डिप्लोमा/डिग्री तब ही प्रदान किया जायेगा, जबकि उसने अपने पूर्ण आवश्यक क्रेडिट प्राप्त कर लिये हो।

पेपर का प्रकार	अधिकतम अंक	सतत आंतरिक मूल्यांकन	बाह्य परीक्षा (विश्वविद्यालय द्वारा)	उत्तीर्णांक
मुख्य एवं माइनर विषयों का थ्योरी पेपर	100	25	75	33 % अधिकतम अंक 100 में से प्राप्तांकों की गणना 25 अंकों के सतत आन्तरिक मूल्यांकन व 75 अंकों की (बाह्य) परीक्षा में प्राप्त अंकों को जोड़ कर की जायेगी। उत्तीर्ण होने हेतु (अ) विश्वविद्यालय की परीक्षा में अधिकतम 75 अंकों में से न्यूनतम 25 अंक (75 का 33 प्रतिशत) लाने आवश्यक होंगे तथा (ब) आन्तरिक एवं बाह्य परीक्षाओं में कुल मिलाकर न्यूनतम 33 अंक प्राप्त करने होंगे।
मुख्य एवं माइनर विषयों का प्रैक्टिकल पेपर	100	नहीं होगा	100	33 %
सह-पाठ्यक्रम कोर्स	100	नहीं होगा	100	33 %
लघु शोध	100	नहीं होगा	100	33 %
कौशल विकास कोर्स	100	(अ) प्रशिक्षण / ट्रेनिंग / प्रैक्टिकल आधारित कार्य का मूल्यांकन 60 अंकों में से होगा (ब) सैद्धांतिक (Theory) आधारित कार्य का मूल्यांकन 40 अंकों में से होगा।		कौशल विकास कोर्स/पेपर में कुल पूर्णांक 100 में से न्यूनतम उत्तीर्णांक 40 होंगे। प्रशिक्षण / ट्रेनिंग एवं सैद्धांतिक (Theory) में अलग-अलग कोई न्यूनतम उत्तीर्णांक नहीं होंगे।

Manika   

स्नातक चतुर्थ वर्ष एवं परास्नातक (एम०ए०, एम०एम०सी०, एम०कॉम०) हेतु श्रेष्ठ प्रणाली। सत्र 2025-26 से विश्वविद्यालय द्वारा FYUP को अंगीकृत कर लिया गया है। इसके अंतर्गत स्नातक चतुर्थ वर्ष एवं परास्नातक पाठ्यक्रमों में निम्नलिखित 10 पॉइंट श्रेष्ठ प्रणाली लागू किये जाने की संस्तुति की गयी है, जो यूजीसी के दिशा-निर्देशों पर आधारित है।

लैटर ग्रेड	विवरण	अंको की सीमा	श्रेष्ठ पॉइंट
O	Outstanding	91-100	10
A+	Excellent	81-90	9
A	Very Good	71-80	8
B+	Good	61-70	7
B	Above Average	51-60	6
C	Average	41-50	5
P	Pass	36-40	4
F	Fail	0-35	0
AB	Absent		0

2. उत्तीर्ण प्रतिशत

2.1 मुख्य विषयों का प्रत्येक कोर्स/पेपर (थ्योरी एवं प्रैक्टिकल सभी) पूर्णांक 100 के Credit course है तथा इन सभी का उत्तीर्ण प्रतिशत 36 प्रतिशत होगा। वृहद शोध परियोजना के कोर्स/पेपर भी पूर्णांक 100 के Credit course है तथा इनमें भी उत्तीर्णांक 36 प्रतिशत ही होगा।

2.2 सभी विषयों के मुख्य पेपर (केवल थ्योरी) में अधिकतम अंक 100 में से प्राप्तांकों की गणना 25 अंकों के सतत आन्तरिक मूल्यांकन व 75 अंकों की विश्वविद्यालय (बाह्य) परीक्षा में प्राप्त अंकों को जोड़ कर की जायेगी। मुख्य विषयों के प्रत्येक कोर्स/पेपर (केवल थ्योरी) में उत्तीर्ण होने हेतु (अ) विश्वविद्यालय की परीक्षा में अधिकतम 75 अंकों में से न्यूनतम 27 अंक (75 का 36 प्रतिशत) लाने आवश्यक होंगे तथा (व) आन्तरिक एवं बाह्य परीक्षाओं में कुल मिलाकर न्यूनतम 36 अंक प्राप्त करने होंगे।

2.3 सभी विषयों के मुख्य पेपर(प्रैक्टिकल)/शोध के प्रत्येक कोर्स/पेपर के अधिकतम 100 अंको की बाह्य परीक्षा विश्वविद्यालय द्वारा करवाई जायेगी। इनमें कोई सतत आन्तरिक मूल्यांकन नहीं करवाया जायेगा। अतः मुख्य विषयों के प्रत्येक कोर्स/पेपर (प्रैक्टिकल)/शोध परियोजना में उत्तीर्ण होने हेतु विश्वविद्यालय की बाह्य परीक्षा में न्यूनतम 36 अंक प्राप्त करने होंगे।

2.4 किसी भी कोर्स/पेपर के आन्तरिक मूल्यांकन में कोई भी न्यूनतम उत्तीर्ण प्रतिशत नहीं है। यदि किसी विद्यार्थी को आन्तरिक मूल्यांकन में शून्य अंक व बाह्य परीक्षा में न्यूनतम उत्तीर्णांक 36 प्रतिशत अंक मिलते हैं, तब भी वह उत्तीर्ण होगा। आन्तरिक मूल्यांकन में पूर्ण अनुपस्थिति पर भी शून्य अंक ही मिलेंगे।

2.5 किसी भी प्रकार के कृपांक (Grace marks) नहीं दिये जायेंगे।

Mouka

3. कक्षान्नोति (Promotion)

3.1 विद्यार्थी को वर्तमान सेमेस्टर से अगले सेमेस्टर में सदैव प्रोन्नत किया जायेगा, चाहे वर्तमान सेमेस्टर का परिणाम कुछ भी हो। वर्तमान सेमेस्टर में जिस पेपर में विद्यार्थी अनुत्तीर्ण होगा, उसे उस पेपर को बैक पेपर (Re-Exam) के रूप में देना होगा।

3.2 स्नातकोत्तर कार्यक्रम का प्रथम वर्ष उच्च शिक्षा का चतुर्थ वर्ष होगा। इसको न्यूनतम 4.5 CGPA के साथ पूर्ण करके यदि कोई विद्यार्थी छोड़कर जाना चाहता है तो उसे स्नातक (मानद शोध सहित), स्नातक (मानद) अथवा स्नातक (एपिन्ट्ससिप एम्बेडिड) की उपाधि दी जायेगी।

4. बैक पेपर अथवा सुधार (Improvement)

4.1 आन्तरिक परीक्षा में बैक पेपर अथवा सुधार (Improvement) हेतु परीक्षा नहीं होगी।

4.2 विद्यार्थी को बैक पेपर अथवा सुधार (Improvement) की सुविधा सम (विषम) सेमेस्टर्स के पेपर्स के लिए सम (विषम) सेमेस्टर्स में ही उपलब्ध होगी। विद्यार्थी सुधार (Improvement) की परीक्षा केवल किन्हीं भी दो पेपर में दे सकता है।

4.3 विद्यार्थी को बैक पेपर अथवा सुधार (Improvement) हेतु परीक्षा के लिए कोर्स / पेपर तथा उसका पाठ्यक्रम (Syllabus) वही होगा जो उस वर्तमान सेमेस्टर जिसमें वह परीक्षा दे रहा है, में उपलब्ध होगा।

4.4 विद्यार्थी बैक पेपर अथवा सुधार (Improvement) हेतु किसी भी कोर्स/पेपर की विश्वविद्यालय (बाह्य) परीक्षा काल बाधित ना होने तक चाहे कितनी भी बार दे सकता है।

4.5 काल अवधि: किसी भी एक वर्ष को पूरा करने की अधिकतम अवधि तीन वर्ष होगी।

व्याख्या:- (Explanation) यदि विद्यार्थी सततता में दोनों वर्ष की पढ़ाई करता है, तो उसे अधिकतम छः वर्ष मिलेंगे। किन्तु यदि विद्यार्थी प्रथम वर्ष के पश्चात् स्नातक (मानद अथवा मानद शोध सहित) की उपाधि लेकर चला जाता है तो वह परास्नातक के एक वर्ष की पढ़ाई दोबारा शुरू करने के लिए कभी भी वापस आ सकता है तथा उसे आगे के एक वर्ष की पढ़ाई पूरा करने के लिए तीन वर्ष मिलेंगे।

5. CGPA की गणना

5.1 SGPA एवं CGPA की गणना निम्नवत सूत्रों से की जाएगी:

j^{th} सेमेस्टर के लिए $SGPA(S_j) = \Sigma(C_i \times G_i) / \Sigma C_i$	यहाँ पर: C_i = number of credits of the i^{th} course in j^{th} semester. G_i = grade point scored by the student in the i^{th} course in j^{th} semester
$CGPA = \Sigma(C_j \times S_j) / \Sigma C_j$	यहाँ पर: S_j = SGPA of the j^{th} semester. C_j = total number of credits in the j^{th} semester.

5.2 CGPA को प्रतिशत अंको में निम्नलिखित सूत्र के अनुसार परिवर्तित किया जायेगा:

$$\text{समतुल्य प्रतिशत} = CGPA \times 9.5$$

5.3 विद्यार्थियों को निम्नवत सारणी के अनुसार श्रेणी (Division) प्रदान की जाएगी:

प्रथम श्रेणी	6.50 अथवा उससे अधिक तथा 10.00 से कम CGPA
द्वितीय श्रेणी	5.00 अथवा उससे अधिक तथा 6.50 से कम CGPA
तृतीय श्रेणी	4.00 अथवा उससे अधिक तथा 5.00 से कम CGPA

Monika

5.4 किसी भी विद्यार्थी को डिग्री तब ही प्रदान की जायेगी, जबकि उसने अपने पूर्ण आवश्यक क्रेडिट्स प्राप्त कर लिये हो।

पेपर का प्रकार	अधिकतम अंक	सतत आंतरिक मूल्यांकन	बाह्य परीक्षा (विश्वविद्यालय द्वारा)	उत्तीर्णांक
मुख्य विषय के थ्योरी पेपर	100	25	75	36 % अधिकतम अंक 100 में से प्राप्त अंकों की गणना 25 अंकों के सतत आन्तरिक मूल्यांकन व 75 अंकों की (बाह्य) परीक्षा में प्राप्त अंकों को जोड़ कर की जायेगी। उत्तीर्ण होने हेतु (अ) विश्वविद्यालय की परीक्षा में अधिकतम 75 अंकों में से न्यूनतम 27 अंक (75 का 36 प्रतिशत) लाने आवश्यक होंगे तथा (ब) आन्तरिक एवं बाह्य परीक्षाओं में कुल मिलाकर न्यूनतम 36 अंक प्राप्त करने होंगे।
मुख्य विषय के प्रैक्टिकल पेपर	100	नहीं होगा	100	36 %
शोध परियोजना	100	नहीं होगा	100	36 %

Monika

[Signature]

[Signature]

Options Regarding Selection of MINOR paper in UG I and II year as per FYUP

S.No.	Level	Options	
1	UG First Year (either in I or II Semester)	If opted in Semester-I May select any paper of 06 credits among the paper taught in semester-I	OR Any one paper among listed by University from SWAYAM Portal or any other Online platform. University will provide a list of Online Papers at the beginning of each session.
		If opted in Semester-II May select any paper of 06 credits among the paper taught in semester-II	
2	UG Second Year (either in III or IV Semester)	If opted in Semester-III May select any paper of 06 credits among the paper taught in semester-I and III	
		If opted in Semester-IV May select any paper of 06 credits among the paper taught in semester-II and IV	

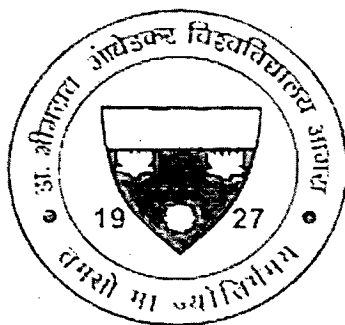
Note: The provision of multi-faculty is to be maintained as per NEP-2020.

Monika

[Signature]

[Signature]

**DR. BHIMRAO AMBEDKAR UNIVERSITY
AGRA**



B. Sc. Biotechnology (Honours)

Course Structure

As per UP Govt Order No. 2090/Sattar-3-2024- 09(01)/2023 (L4)
dated 02.09.2024

Session 2026-27 onwards

Monika

[Signature]
[Signature] *[Signature]*

DR. BHIMRAO AMBEDKAR UNIVERSITY AGRA



Three-Year Undergraduate Programme

Syllabus of

B.Sc. BIOTECHNOLOGY (HONOURS)

THREE-YEAR B.Sc. (HONOURS)

IN BIOTECHNOLOGY

SESSION 2026-2027

ONWARDS

Mamika

[Signature]

[Signature]

[Signature]



DR. BHIMRAO AMBEDKAR UNIVERSITY AGRA

**STRUCTURE OF SYLLABUS FOR THE
Program: B. Sc. Biotechnology (Honours)**

Syllabus Developed By			
Name of BoS convenor/ BoS member	Designation	Department	College/University
Prof. R. K. Agnihotri	Convenor/Dean. Faculty of Life Science	Department of Botany. School of Life Sciences	Dr. Bhimrao Ambedkar University Agra
Dr. Monika Asthana	Internal Expert	Department of Biotechnology. School of Life Sciences	Dr. Bhimrao Ambedkar University Agra
Prof. Amita Sarkar	Internal Expert	Department of Zoology	Agra College. Agra
Dr. Hirawati Deval	External Expert	Department of Molecular Biology	NJIL & OMD. Tajganj. Agra
Prof. Rajendra Shrama	External Expert	Retd.. Department of Botany. School of Life Sciences	Dr. Bhimrao Ambedkar University Agra

Monika

FIRST YEAR

Semester-I			
Code	Paper	Courses	Credits
BTH101T	Core Course-I	Cell Biology	4
BTH 102T	Core Course-II	Biochemistry & Metabolism	4
BTH103P	Practical-I	Practical-I	4
VOC xxx	Skill Enhancement course (SEC)/Vocational Course	As per University Guidelines	3
	Co-curricular Course	First Aid and Basic Health	2
Total credits			17

Semester-II			
Code	Paper	Courses	Credit
BTH201T	Core Course-I	Mammalian Physiology	4
BTH202T	Core Course-II	Plant Physiology	4
BTH203P	Practical-II	Practical-II	4
BTH204M	Minor Course	I.P.R. Entrepreneurship Bioethics & Biosafety	6
VOC xxx	Skill Enhancement Course(SEC)/ Vocational Course	As per University Guidelines	3
	Co-curricular Course	Human Values and Environment Studies	2
Total Credits			23

Note:

1. Total Credits 40 till semester II
2. Student is entitled for certificate in Faculty after successful completion of first two semesters

Manika

[Signature] *[Signature]*

SECOND YEAR

Semester-III			
Code	Paper	Courses	Credits
BTH301T	Core Course-I	Genetics	4
BTH302T	Core Course-II	General Microbiology	4
BTH 303P	Practical-III	Practical-III	4
VOC xxx	Skill Enhancement course (SEC)/ Vocational Course	As per University Guidelines	3
	Co-curricular Course	Physical Education and Yoga	2
Total credits			17

Semester-IV			
Code	Paper	Courses	Credit
BTH401T	Core Course-I	Molecular Biology	4
BTH402T	Core Course-II	Immunology	4
BTH403P	Practical-IV	Practical-IV	4
	Minor Course	From other faculty	6
BTH404R	Project	Research Project/ Internship/ Field Work	3
	Co-curricular Course	Social Responsibility and Community Engagement/ Indian Language	2
Total Credits			23

Note:

1. Total Credits 80 till semester IV
2. Student is entitled for Diploma in Faculty after successful completion of four semesters

Manika

Ali
[Signature]

THIRD YEAR

Semester-V			
Code	Paper	Courses	Credits
BTH501T	Core Course-I	BioAnalytical Tools	4
BTH502T	Core Course-II	Recombinant DNA Technology	4
BTH503T	Core Course-III	Biostatistics	4
BTH504T	Core Course-IV	Bioinformatics	4
BTH505P	Practical- V	Practical-V	4
BTH506R	Research Project	Research Project on topics which are Inter/ Intra faculty	5
Total credits			25

Semester-VI			
Code	Paper	Courses	Credit
BTH601T	Core Course-I	Bioprocess Technology	4
BTH602T	Core Course-II	Genomics and Proteomics	4
BTH603T	Core Course-III	Animal Biotechnology	4
BTH604T	Core Course-IV	Plant Biotechnology	4
BTH605P	Practical-VI	Practical-VI	4
BTH606R	Research Project	Research Project on topics which are Inter/ Intra faculty	5
Total Credits			25

1. Total Credits 130 till semester VI
2. Student is entitled for Three Year B.Sc. (Honours) Biotechnology UG Degree after successfully completion of six semesters.

Monika

[Signature]

[Signature]

Subject Prerequisite

The candidate should have passed (10+2) examination in science stream with PCB (Physics, Chemistry, Biology and/or Biotechnology) or PCM (Physics, Chemistry and Maths) or any other science subject.

Programme Outcomes (POs)

After completion of the B.Sc. Biotechnology programme, the candidate should be able to:

PO1	Demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology research, Biotechnology Industry, Pharma industry, Medical or hospital related organizations, and Academia.
PO2	Demonstrate skills to use modern analytical tools/ software/ equipment and analyse and solve problems in various courses of biotechnology.
PO3	Execute their professional roles in society as biotechnology professionals, employers and employees in various industries, researchers and educators.
PO4	Design, perform experiments, analyze and interpret data for investigating complex problems in biotechnology and related fields.
PO5	Demonstrate learning skills to work as a team in a multidisciplinary environment.
PO6	Design and develop sustainable solutions to major biological problems by applying appropriate biotechnology tools.
PO7	Develop skills, attitude and values required for self-directed, lifelong learning and professional development.
PO8	Acquire knowledge and understanding of norms and ethics in the field of biotechnology.

Mam

Ali

Ali

PROGRAMME SPECIFIC OUTCOMES (PSOS)	
CERTIFICATE IN TOOLS AND TECHNIQUES OF BIOTECHNOLOGY	
First Year	This course introduces the knowledge of cell biology, genetics, molecular biology and genetic engineering. After completion of this certificate course, students will be able to – PSO1: Demonstrate and apply their knowledge of cell biology and Biochemistry to solve the problems related to the field of biotechnology. PSO2: Learn about the cell theory, cell cycle mechanisms, various cellular organelles and their fractionation PSO3: Learn the chemistry, structure and functions of major bio-molecules and metabolism of carbohydrate, protein etc. PSO4: Understand the significance of Biochemistry and basics of enzymes. PSO5: Develop an understanding of the inter relationships within and between anatomical and physiological systems of the human body. PSO6: Understand anatomy of different Plant organ and tissues and the role of physiological processes for plant growth and development.
DIPLOMA IN TOOLS AND TECHNIQUES IN BIOTECHNOLOGY	
Second Year	After completion of diploma course, students will be able to- PSO1: Familiarize with basic laboratory instruments and understand the principle of measurements using those instruments with experiments in biochemistry. PSO2: Gain knowledge about the application of various types of microscope, karyotyping, banding techniques, chromosome painting and FACS. PSO3: Understand the basic concepts of genetics and molecular biology such as inheritance pattern, DNA replication, transcription and translation. PSO4: Understand microbial taxonomy, morphology of microbes, microbes in extreme environments and microbial interactions. PSO5: Understand basics of Control of Microorganisms and different methods of sterilization. PSO6: Apply at technical positions in different research laboratories, diagnostic centers and industries. PSO7: Understand and also able to perform different immunological techniques like agglutination reaction, ABO typing and ELISA
DEGREE IN BACHELOR OF SCIENCE HONOURS	
Third Year	After completing the three years degree with honours course in Biotechnology, the students will be able to – PSO1: Understand and perform various recent molecular and recombinant DNA technology techniques in early diagnosis and prognosis of human diseases. Perform experiments of DNA isolation, agarose gel electrophoresis, gene cloning, transformations, protein expression and purification. This experience would enable them to begin a career in industry that engages in genetic engineering as well as in research laboratories conducting fundamental research. PSO2: Demonstrate the concepts in computational Biology. Understand the inter relationship between Biology and Computer acquire knowledge in different domains of biotechnology enabling their application in industry, research and academia. PSO3: Perform and analyse the results of experiments using basic laboratory techniques of cell biology, molecular biology, genetic engineering, biochemistry, immunology, microbiology, bioinformatics, biostatistics, animal and plant biotechnology and Food biotechnology. PSO4: Recognize the foundations of modern biotechnology and explain the principles that form the basis for recombinant technology. PSO5: Develop an ability to properly understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by humankind. PSO6: Exhibit ability to do research independently as well as in collaboration. PSO7: Recognize the importance of Bioethics, IPR, and entrepreneurship.

Monika

Ali

Programme /Class	Certificate	Year	B.Sc.1 st year	Semester	I
Subject		B.Sc. BIOTECHNOLOGY (HONOURS)			
Course Code	BTH101T		Course Title	Cell Biology	
• Course Outcome: Students will learn about cell theory, cell cycle mechanisms, various cellular organelles and their fractionation • Students will acquire insight in to the processes of transport across cell membranes • Students will gain knowledge about the concepts of various cellular signal transduction pathways					
Credits-4		Max.Marks:100 (25+ 75)		Min. Passing Marks:33	
Total No. of Lectures-Tutorials-Practical (in hours per week):4-0-0					
Unit	Topic				No of Lectures
Unit-I	Cell: Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation. Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport. The Indian Knowledge System: Contribution of Indian scientists.				10
Unit-II	Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments. Endoplasmic reticulum: Structure, function, including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion.				15
Unit-III	Lysosomes: Vacuoles and microbodies: Structure and functions Ribosomes: Structure and function including role in protein synthesis. Mitochondria: Structure and function, genomes, biogenesis. Chloroplasts: Structure and function, genomes, biogenesis, Light Reactions Nucleus: Structure and function, chromosomes and their structure.				20
Unit-IV	Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra-cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction: Second messengers- cAMP, cGMP, IP3, diacylglycerol, Ca ²⁺ , NO. Brief account of their importance and role in signalling and signal transduction. Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer.				15
Suggested Readings:					
1. Karp, G.2010. Cell and Molecular Biology: Concepts and Experiments. 6thEdition. John Wiley & Sons. Inc.					
2. De Robertis, E.D.P.and De Robertis, E.M.F.2006. Cell and Molecular Biology.8th edition. Lippincott Williams and Wilkins. Philadelphia.					
3. Cooper, G.M. and Hausman,R.E.2009. The Cell: A Molecular Approach. 5thedition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.					
4. Becker, W.M., Kleinsmith, L.J.,Hardin,J. and Bertoni,G.P.2009.The World of the Cell. 7 th edition. Pearson Benjamin Cummings Publishing, San Francisco.					

Monika

[Signature]

Programme /Class	Certificate	Year	B.Sc.1 st year	Semester	I
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BTH102T		Course Title	Biochemistry and Metabolism	
• Course Outcome-After successful completion of the course, student will be able to: • Understand the significance of Biochemistry. • Learn the chemistry of carbohydrates, lipids, proteins and amino acids. • Understand the basics of enzymes. • Know the chemical structure of nucleotides including their components • Understand the metabolism of carbohydrate and proteins					
Credits-4		Max. Marks:100(25+ 75)		Min. Passing Marks:33	
Total No. of Lectures-Tutorials-Practical(in hours per week):4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Introduction to Biochemistry: A historical prospective. Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape, Different Levels of structural organization of proteins. Protein Purification, Denaturation and renaturation of proteins. Fibrous and globular proteins. Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides, and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Glycoprotein's and their biological functions. IKS: Contribution of Indian scientists.				15
UNIT-II	Lipids: Structure and functions- Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol. Nucleic acids: Structure and functions: Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines, Biologically important nucleotides. Double helical model of DNA structure and forces responsible for A, B & Z - DNA, denaturation and renaturation of DNA				15
UNIT-III	Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metallo enzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites, enzyme specificity: types & theories, Biocatalysts from extreme thermophilic and hyperthermophilic archaea and bacteria. Role of NAD ⁺ , NADP ⁺ , FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxal phosphate, lipoic-acid, Biotin vitamin B12, Tetrahydro folate and metal-ions				15
UNIT-IV	Carbohydrates Metabolism: Reactions, energetic and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation, β -oxidation of fatty acids. Protein degradation to amino acids, urea cycle, feeder pathways into TCA cycle				15
Suggested Readings: 1. Berg, J.M., Tymoczko, J.L. and Stryer, L.(2006). Biochemistry. VI Edition. W.H Freeman and Co. 2. Nelson, D.L., Cox, M.M.(2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA. 3. Hopkins, W.G. and Huner, P.A.(2008) Introduction to Plant Physiology. John Wiley and Sons. 4. Salisbury, F.B. and Ross, C.W.(1991) Plant Physiology. Wadsworth Publishing Co. Ltd.					

Monika

[Signature]

Programme /Class	Certificate	Year	B.Sc. 1 st year	Semester	I
Subject		B.Sc. BIOTECHNOLOGY (HONOURS)			
Course Code	BT11103P	Course Title	Practical-I		
• Course Outcome- After successful completion of the course, student will be able to perform: • Qualitative tests of different Biomolecules • Preparation of buffer • Microscopy of Prokaryotic and Eukaryotic cells for structure and shape analysis • Preparation of Nuclear, Mitochondrial, and cytoplasmic Fractions					
Credits-4		Max. Marks:100 (25+ 75)		Min. Passing Marks:33	
Total No. of Lectures-Tutorials-Practical (in hours per week):0-0-4					
Unit	Topic				No of Lectures/ Demonstrations
	• Qualitative tests for Carbohydrates, lipids and proteins • Preparation of buffers. • Principles of Colorimetry: (i)Verification of Beer's law, estimation of protein. (ii) To study the relation between absorbance and % transmission. • To study the activity of any enzyme under optimum conditions. • Estimation of blood glucose by the glucose oxidase method. • Study of the structure of any Prokaryotic and Eukaryotic cell. • Cell fractionation and determination of enzyme activity in organelles using sprouted seed or any other suitable source. • Cell division in onion root tip/insect gonads. • Preparation of Nuclear, Mitochondrial, & cytoplasmic Fractions				30+30
Suggested Readings: • An Introduction to Practical Biochemistry, David T. Plummer (2006) Tata McGraw Hill Education, 3rd edition • Karp,G.2010. Cell and Molecular Biology: Concepts and Experiments, 6th Edition. John Wiley & Sons, Inc. • De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia.					

VOCxxx: {Skill Enhancement course(SEC)}: Vocational Skill Enhancement course: As per Univ. Syllabus

Co-curricular Course: First Aid and Basic Health: As per Univ. Syllabus

Monika *[Signature]* *[Signature]*
[Signature]

Programme /Class	Certificate	Year	B.Sc. 1 st year	Semester	II
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code		BTH201T	Course Title		Mammalian Physiology
- Course Outcome- - After the successful course completion, learners will develop following attributes - Develop an understanding of the inter relationships within and between anatomical and physiological systems of the human body. - Develop the understanding of basic concepts of physiology and biochemistry of Digestion, Respiration, Circulation, Excretion, and Neurotransmission.					
Credits-4		Max. Marks: 100(25+ 75)		Min. Passing Marks:33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Digestion and Respiration Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice Respiration: Exchange of gases, Transport of O ₂ and CO ₂ , Oxygen dissociation curve, Chloride shift, IKS: Contribution of Indian scientists.				15
UNIT-II	Circulation: Composition of blood, Plasma proteins & their role, blood cells, Hemopoiesis, Mechanism of coagulation of blood, Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat.				15
UNIT-III.	Muscle physiology and osmo-regulation Structure of cardiac, smooth & skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Physical, chemical & electrical events of mechanism of muscle contraction, Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.				15
UNIT-IV	Nervous and endocrine coordination Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, saltatory conduction, Neurotransmitters Mechanism of action of hormones (insulin and steroids)\Different endocrine glands- Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions.				15
Suggested Readings: 1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Her court Asia PTE Ltd. /W.B. Saunders Company. 2. Tortora, G.J.&Grabowski, S.(2006).PrinciplesofAnatomy&Physiology.XI Edition.Johnwiley&sons,Inc.					

Mamika

Atini

[Signature]

Programme /Class	Certificate	Year	B.Sc. 1 st year	Semester	II
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code		BT11202T	Course Title		Plant Anatomy And Physiology
Course Outcome- After the completion of the course the students will be able to: - Understand anatomy of different Plant organ and tissues and the role of Physiological processes for plant growth and development. - Learn mechanism of imbibition, guttation, transpiration, stomata & their mechanism of opening & closing. - Understand criteria for identification of essentiality of nutrients, roles and deficiency systems of nutrients, mechanism of uptake of nutrients, mechanism of food transport - Assimilate Knowledge about Photosynthesis pigments, photophosphorylation, calvin cycle, CAM plants, photorespiration, and Nitrogen metabolism					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0					
Unit	Topic				No. of Lectures
UNIT-I	Anatomy The shoot and root apical meristem and its histological organization, simple & complex permanent tissues, primary structure of shoot & root, secondary growth, growth rings, leaf anatomy (dorsi-ventral and isobilateral leaf). IKS: Contribution of Indian scientists.				10
UNIT-II	Plant water relations and micro & macronutrients Plant water relations: Importance of water to plant life, diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration, stomata & their mechanism of opening & closing. Micro & macro nutrients: criteria for identification of essentiality of nutrients, roles and deficiency systems of nutrients, mechanism of uptake of nutrients, mechanism of food transport				12
UNIT-III	Carbon and nitrogen metabolism Photosynthesis- Photosynthesis pigments, concept of two photo systems, photophosphorylation, calvin cycle, CAM plants, photorespiration, compensation point Nitrogen metabolism- inorganic & molecular nitrogen fixation, nitrate reduction and ammonium assimilation in plants.				20
UNIT-IV	Growth and development Definitions, phases of growth, growth curve, growth hormones (auxins, gibberellins, cytokinin, abscisic acid, ethylene) Physiological role and mode of action, seed dormancy and seed germination, concept of photoperiodism and vernalization				18
Suggested Readings: - Dickinson, W.C. 2000 Integrative Plant Anatomy. Harcourt Academic Press, USA. - Esau, K. 1977 Anatomy of Seed Plants. Wiley Publishers - Fahn, A. 1974 Plant Anatomy. Pergmon Press, USA and UK. - Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons. - Mauseth, J.D. 1988 Plant Anatomy. The Benjamin Cummings Publisher, USA. - Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4th edition, W.H. Freeman and Company, New York, USA. - Salisbury, F.B. and Ross, C.W. 1991 Plant Physiology, Wads worth Publishing Co. Ltd. - Taiz, L. and Zeiger, E. 2006 Plant Physiology, 4th edition, Sinauer Associates Inc. MA, USA					

Mamika

Am

Programme /Class	Certificate	Year	B.Sc. 1 st year	Semester	II
B.Sc. BIOTECHNOLOGY (HONOURS)					
Subject	Practical-II				
Course Code	BT11203P	Course Title			
• Course Outcome-After successful completion of the course, student will be able to perform experiments related to plant and animal physiology and can analyze blood samples.					
Credits-4	Max. Marks: 100 (25+ 75).		Min. Passing Marks: 33		
Total No. of Lectures- Tutorials- Practical (in hours per week): 0-0-4					
Unit	Topic				No of Lectures/ Demonstrations
					30+30
	• Determination of blood groups, Determination of Hemoglobin. • Finding the coagulation time of blood • Counting of mammalian RBCs • Determination of TLC and DLC • Demonstration of serum alkaline Phosphatase enzyme activity • Preparation of stained mounts of anatomy of monocots and dicots' roots, stems & leaves. • Demonstration of plasmolysis by Tradescantia leaf peel. • Demonstration of opening & closing of stomata • Separation of photosynthetic pigments by paper chromatography. • Demonstration of aerobic respiration.				
Suggested Readings: Textbook of Medical Laboratory Technology by Praful B. Godkar and Darshan P. Godkar Medical Laboratory Technology by Ramniksood, 5 Edition, 1999, Jaypee publishers. Practical Clinical Biochemistry, Harold Varley, 4 th edition, CBS Publication and Distributors, New Delhi.					

Monika

Dr.

Attri

Programme /Class	Certificate	Year	B.Sc. 1 st year	Semester	II
Subject		B.Sc. BIOTECHNOLOGY (HONOURS)			
Course Code	BTH204M	Course Title	I.P.R. Entrepreneurship Bioethics & Biosafety		
Course Outcome- Students-					
- Will able to understand Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations. - Learn about Entrepreneurship, Bioethics, Biosafety					
Credits—4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations.				15
UNIT-II	Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc. The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.				20
UNIT-III.	Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National& International. Ethical issues against the molecular technologies.				10
UNIT-IV	Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).				15
Suggested Readings:					
- Entrepreneurship: New Venture Creation: David H. Holt Patterns of Entrepreneurship: Jack M. Kaplan - Entrepreneurship and Small Business Management: C.B. Gupta, S.S. Khanka, Sultan Chand & Sons. - Sateesh MK (2010) Bioethics and Biosafety, I.K. International Pvt Ltd. - Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international Publisher.					

VOCxxx: {Skill Enhancement course (SEC)} As per Univ. Syllabus

Co-curricular Course: Human Values and Environment Studies: As per Univ. Syllabus

Monika

Ali

Qu

Programme /Class	Diploma	Year	B.Sc. 2 nd year	Semester	III
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BTH301T		Course Title	General Microbiology	
• Course Outcome-After the completion of the course the students will be able to: • Learn about Fundamentals, History and Evolution of Microbiology. • Understand Microbial taxonomy and Morphology and cell structure of major groups of microorganisms e.g. Bacteria, Algae, Fungi, Protozoa and Unique features of viruses. Course outcomes: • Understand basics of Control of Microorganisms • Study microbes in extreme environments and microbial interactions • Know the basics of recombination in Prokaryotes Basics of virology • Understand basics of Microbial growth and Microbial Metabolism					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Fundamentals, History and Evolution of Microbiology. Classification of microorganisms: Microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria. Bacterial Cell Wall Structure. Microbial Diversity: Morphology and cell structure of major groups of Microorganisms e.g. Bacteria, Algae, Fungi, Protozoa and Unique features of viruses. IKS: Contribution of Indian scientists.				10
UNIT-II	Cultivation and Maintenance of microorganisms: Nutritional categories of Microorganisms, methods of isolation, Purification and preservation.				10
UNIT-III	Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth, and factors affecting the growth of bacteria. Microbial Metabolism: Metabolic pathways, amphi-catabolic and biosynthetic pathways, Fermentation Bacterial Reproduction: Transformation, Transduction and Conjugation, Endospores and sporulation in bacteria.				20
UNIT-IV	Control of Microorganisms: By physical, chemical and chemotherapeutic Agent Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal Food Microbiology: Important microorganism in food Microbiology: Moulds, Yeasts, bacteria. Preservation of various types of foods. Fermented Foods. Major food and waterborne infections and intoxications.				20
Suggested Readings: • Madigan MT, Martinko J Mand Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/Benjamin Cummings. • Pelczar MJ, Chan EC Sand Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company. • Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.					

Monika

f. Alvi

Qu

Programme /Class	Diploma	Year	B.Sc. 2 nd Year	Semester	III
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code		BT11302T	Course Title		Genetics
• Course Outcome- • Understand the structure and chemical composition of chromatin and concept of cell division. • Interpret the Mendel's principles; acquire knowledge on cytoplasmic inheritance and sex-linked inheritance, mutations. • Understand the concept Non allelic interactions. Genetic organization of prokaryotic and viral genome • Understand Linkage and Recombination of genes in a chromosome. Cytological basis of Crossing over, and Extrachromosomal inheritance.					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Introduction: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance. Cell Cycle: Mitosis and Meiosis: Control points in cell-cycle progression in yeast. Role of meiosis in life cycles of organisms. Mendelian genetics: Mendel's experimental design, monohybrid, di-hybrid and tri hybrid crosses. Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses. Chromosomal theory of inheritance. Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, semi-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity. IKS: Contribution of Indian scientists.				12
UNIT-II	Non allelic interactions: Interaction producing new phenotype complementary genes, epistasis (dominant & recessive), duplicate genes and inhibitory genes. Chromosome and genomic organization: Eukaryotic nuclear genome nucleotide sequence composition –unique & repetitive DNA, satellite DNA, Centromere and telomere DNA sequences, middle repetitive sequences- VNTRs & dinucleotide repeats, repetitive transposed sequences- SINES & LINES, middle repetitive multiple copy genes, noncoding DNA. Genetic organization of prokaryotic and viral genome. Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin. Packaging of DNA molecule into chromosomes, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, concept of cistron, exons, introns, genetic code, gene function.				18
UNIT-III	Chromosome and gene mutations: Definition and types of mutations, causes of mutations, Ames' test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants, variations in chromosomes structure - deletion, duplication, inversion and translocation (reciprocal and Robertsonian), position effects of gene expression, chromosomal aberrations inhuman beings, abonormalities– Aneuploidy and Euploidy. Sex determination and sex linkage: Mechanisms of sex determination, Environmental factors and sex determination, sex differentiation, Barr bodies, dosage compensation, genetic balance theory, Fragile-X-syndrome and chromosome, sex influenced dominance, sex limited gene expression, sex linked inheritance.				15
UNIT-IV	Genetic linkage, crossing over and chromosome mapping: Linkage and Recombination of genes in a chromosome crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Crossing over at four strand stage, Multiple crossing overs Genetic mapping. Extra chromosomal inheritance: Rules of extra nuclear inheritance, maternal effects, maternal inheritance, cytoplasmic inheritance, organelle heredity, genomic				15

Mamke

[Signature]

imprinting.

Evolution and population genetics: In breeding and out breeding, Hardy Weinberg law (prediction, derivation), allelic and genotype frequencies, changes in allele frequencies, systems of mating, evolutionary genetics, natural selection.

Suggested Readings:

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics, VIII Edition John Wiley & Sons.
- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics, V Edition, John Wiley and Sons Inc
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics, IX Edition Benjamin Cummings.
- Russell, P.J. (2009). Genetics- A Molecular Approach, III Edition, Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition, Introduction to Genetic Analysis, W. H. Freeman & Co.

Monika

Qu

Stini

Programme /Class	Diploma	Year	B.Sc. 2 nd year	Semester	III
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BT11303P	Course Title		Practical-III	
• Course Outcome- After successful completion of the course. • The students will be able to perform different tests related to genetics and microbiology. • Students will learn basic molecular and microbial techniques required for analysis of different pathological samples.					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 0-0-4					
Unit	Topic				No of Lectures/ Demonstrations
	• Permanent and temporary mount of mitosis and meiosis. • Mendelian deviations in dihybrid crosses • Karyotyping with the help of photographs • Pedigree charts of some common characteristics like blood group, color blindness and PTC tasting. • Study of polyploidy in onion root tip by colchicine treatment. • Preparation of media & sterilization methods. • Methods of isolation of bacteria from different sources & their biochemical characterization. • Staining methods: simple staining, Gram staining, Endospore staining, negative staining. • Enumeration of microorganism- total & viable count.				30+30
Suggested Readings: • Hartl, D.L., & Jones, E.W. (1998). Genetics: Principles and Analysis. Sudbury, MA: Jones and Bartlett. • Roskam's J.Rodgers L. (2002). Lab Ref: A Handbook of Recipes, Reagents, and other reference tools for use at the Bench. Cold Spring Harbor Laboratory Press. USA. • Barker K (2004). At the Bench: A laboratory Navigator. Cold Spring Harbor Laboratory Press. USA					

VOCxxx: {Skill Enhancement course (SEC)}: Vocational Skill Enhancement course: As per Univ. Syllabus

Co-curricular Course: Physical Education and Yoga: As per Univ. Syllabus

Monika *[Signature]* *[Signature]* *Atini*

Programme /Class	Diploma	Year	B.Sc. 2 nd year	Semester	IV
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code		BTH401T	Course Title		Molecular Biology
Course Outcome-Students- - Will able to understand details of central dogma of life and DNA structure and replication - Get proper knowledge about DNA damage, repair and homologous recombination. - Gain knowledge about Transcription and RNA processing, Prokaryotic and eukaryotic translation					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	DNA structure and replication DNA as genetic material, Structure of DNA, Types of DNA, Replication of DNA in prokaryotes and eukaryotes: Semi conservative nature of DNA replication, Bi-directional replication, DNA polymerases, The replication complex: Pre- priming proteins, primosome, replisome, Rolling circle replication, Unique aspects of eukaryotic chromosome replication, Fidelity of replication. IKS: Contribution of Indian scientists.				15
UNIT-II	DNA damage, repair and homologous recombination DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair: Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, translesion synthesis, recombinational repair, non homologous end joining. Homologous recombination: models and mechanism.				15
UNIT-III	Transcription and RNA processing RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5'capformation, polyadenylation, splicing, rRNA and tRNA splicing.				15
UNIT-IV	Regulation of gene expression and translation Regulation of gene expression in prokaryotes: Operon concept (inducible and repressible system), Genetic code and its characteristics. Prokaryotic and eukaryotic translation: ribosome structure and assembly, Charging of tRNA, amino acyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Fidelity of translation, Inhibitors of translation. Post translational modifications of proteins.				15
SUGGESTED READING 1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc. 2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia. 3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G.P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco. 4. Watson, J.D., Baker T.A., Bell, S.P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.					

Monika

AK

[Signature]

[Signature]

Programme /Class	Diploma	Year	B.Sc. 2 nd year	Semester	IV
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code			Course Title		
BTH402T			IMMUNOLOGY		

Course Outcome-

- Understand the principles of immunology
- Learn about structural features of components of immune system as well as their function and development of immune system and mechanisms by which our body elicits immune response.
- Predict about nature of immune response that develops against bacterial, viral or parasitic infection, and prove it by designing new experiments.
- Understand different tools and techniques of immunology
- Understand the biology of different vaccines against infectious agents

Credits-4

Max. Marks: 100 (25+ 75)

Min. Passing Marks: 33

Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0

Unit	Topic	No of Lectures
UNIT-I	Immune Response - An overview, components of the mammalian immune system, molecular structure of Immuno-globulins or Antibodies, Humoral & Cellular immune responses, T- lymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), T-cell receptors, genome rearrangements during B-lymphocyte differentiation, Antibody affinity maturation class switching, assembly of T-cell receptor genes by somatic recombination, KS: Contribution of Indian scientists.	20
UNIT-II	Regulation of immunoglobulin gene expression clonal selection theory, allotypes & idiotypes, allelic exclusion, immunologic memory, heavy chain gene transcription, genetic basis of antibody diversity, hypotheses (germ line & somatic mutation), antibody diversity.	15
UNIT-III	Major Histocompatibility complexes - class I & class II MHC antigens, antigen processing. Immunity to infection - immunity to different organisms, pathogen defense strategies, avoidance of recognition, Autoimmune diseases, Immunodeficiency-AIDS.	13
UNIT-IV	Vaccines & Vaccination - adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines toother infectious agents, Passive & active immunization. Introduction to immune diagnostics- RIA, ELISA.	12

Suggested Readings:

- Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
- Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
- Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
- Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

Monika *Sh* *Alin*

Programme /Class	Diploma	Year	B.Sc. 2 nd year	Semester	IV
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BTH403P		Course Title	Practical-IV	
• Course Outcome- After successful completion of the course. • The students will be able to perform different tests related to Molecular Biology and Immunology. • Students will earn basic molecular and Immunological techniques required for analysis of different pathological samples.					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 0-0-4					
Unit	Topic				No of Lectures/ Demonstrations
	• Preparation of solutions for Molecular Biology experiments. • Isolation of chromosomal DNA from bacterial cells. • Isolation of Plasmid DNA by alkaline lysis method • Agarose gel electrophoresis of genomic DNA & plasmid DNA • Qualitative and quantitative analysis of DNA using spectrophotometer • Hemagglutination assay • Hemagglutination inhibition assay • Separation of serum from blood • Double immune diffusion test using specific antibody and antigen. • Radial immune diffusion • ELISA.				30+30
• Suggested Readings: • Plummer D.T., An Introduction to Practical Biochemistry 3rd ed., Tata McGraw Hill Education Pvt. Ltd. 1998. • Wilson K. and Walker J., Principles and Techniques of Biochemistry and Molecular Biology, 7th ed., Cambridge University Press, 2010 • William, E.Paul (1989) Fundamental Immunology, 2nd Edition Raven Press, New York. • William, R. Clark (1991) the Experimental Foundations of Modern Immunology (4th Edition) John Wiley and Sons, New York. • Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company • Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins • Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).					

BTH405R: Project: Research Project/Internship/Fieldwork

Co-curricular Course: Social Responsibility and Community Engagement/Indian Language: As per Univ. Syllabus

Monika

[Signature]

[Signature]

Programme /Class	Honours	Year	B.Sc. 3 rd year	Semester	V
Subject		B.Sc. BIOTECHNOLOGY (HONOURS)			
Course Code	BTH501T	Course Title	Bio-Analytical Tools		
Course Outcome-					
- The objective of the course is to introduce various techniques to the students, which are used in biological research. - Students will acquire knowledge about the principles and applications of spectrophotometric and chromatography techniques used in a biochemistry lab. - Students will learn about the principle and application of electrophoresis, centrifugation techniques, microscopic and molecular biological techniques.					
Credits—4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Simple microscopy, phase contrast microscopy, florescence and electron microscopy (TEM and SEM), pH meter, absorption and emission spectroscopy, IKS: Contribution of Indian scientists.				10
UNIT-II	Principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infrared), centrifugation, cell fractionation techniques, isolation of sub-cellular organelles and particles.				15
UNIT-III	Introduction to the principle of chromatography, Paper chromatography, thin layer Chromatography, column chromatography: silica and gel filtration, affinity and ion Exchange chromatography, gas chromatography, HPLC.				15
UNIT-IV	Introduction to electrophoresis, Starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, Western blotting, Introduction to Biosensors and Nanotechnology and their applications.				20
Suggested Readings:					
1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6 th Edition. John Wiley & Sons, Inc.					
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8 th edition. Lippincott Williams and Wilkins, Philadelphia.					
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5 th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.					
4. Becker, W.M., Klein Smith, L.J., Hardin, J. and Bertoni, G.P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.					

Mamks *Qu* *Atin*

Programme /Class	Honours	Year	B.Sc. 3 rd year	Semester	V
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BTH502T	Course Title		Recombinant DNA Technology	
• Course Outcome- • Gain knowledge on the foundation of genetic engineering and their applications in biological research as well as in biotechnology industries. • Understand gene concept, plasmids, and wide range of techniques, especially modern molecular tools in diagnosis. • Acquainted with various techniques of genetic engineering and their applications in biological research, diagnostics as well as in biotechnology industries.					
Credits—4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Molecular tools and applications- restriction enzymes, ligases, polymerases, alkaline phosphatase, Gene Recombination and Gene transfer: Transformation, Episomes, Plasmids and other cloning vectors (Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication. Principle and applications of Polymerase chain reaction (PCR), primer-design, and RT- (Reverse transcription) PCR. IKS: Contribution of Indian scientists.				15
UNIT-II	Restriction and modification system, restriction mapping, Southern and Northern hybridization. Preparation and comparison of Genomic and c-DNA library, screening of recombinants, reverse transcription, Genome mapping, DNA fingerprinting. Applications of Genetic Engineering Genetic engineering in animals: Production and applications of transgenic mice, role of ES cells in gene targeting in mice. Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines (one example each).				20
UNIT-III	Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis, Gene shuffling, production of chimeric proteins, Protein engineering concepts and examples (any two).				10
UNIT-IV	Genetic engineering in plants: Use of <i>Agrobacterium tumefaciens</i> and <i>A. rhizogenes</i> , Ti plasmids, Strategies for gene transfer to plant cells, Direct DNA transfer to plants, Gene targeting in plants, Use of plant viruses as episomal expression vectors.				15
Suggested Readings: 1. Brown T.A. (2006). Gene Cloning and DNA Analysis, 5 th edition. Blackwell Publishing, Oxford, U.K. 2. Clark DP and Pazdernik NJ. (2009). Biotechnology - Applying the Genetic Revolution. Elsevier Academic Press, USA. 3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology - Principles and Applications of recombinant DNA. ASM Press, Washington 4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7 th edition. Blackwell Publishing, Oxford, U.K. 5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning- A Laboratory Manual, 3 rd edition. Cold Spring Harbor Laboratory Press.					

Monika



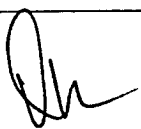




Programme /Class	Honours	Year	B.Sc. 3 rd year	Semester	V
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code		BT11503T		Course Title	BIOSTATISTICS
Course Outcome- • Learn the need of statistical approach, identify the different axiomatic approach. • Learn to study the variability of observation. • Know effective use of Office package- word, excel, ppt. and publisher etc • Understands imple calculation using excel					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Types of Data, Collection of data; Primary & Secondary data, Classification and Graphical representation of Statistical data. Measures of central tendency and Dispersion. Measures of Skewness and Kurtosis. IKS: Contribution of Indian scientists.				12
UNIT-II	Probability classical & axiomatic definition of probability, Theorems on total and compound probability), Elementary ideas of Binomial, Poisson and Normal distributions.				18
UNIT-III	Methods of sampling, confidence level, critical region, testing of hypothesis and standard error, large sample test and small sample test. Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)				18
UNIT-IV	Correlation and Regression. Emphasis on examples from Biological Sciences.				12
Suggested Readings: 1. LeCT (2003) Introductory biostatistics. 1st edition, John Wiley, USA 2. Glaser AN (2001) High Yield TM Biostatistics. Lippincott Williams and Wilkins, USA 3. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press. 4. Danial W (2004) Biostatistics: A foundation for Analysis in Health Sciences, John Wiley and Sons Inc..					

Monika . Qu d Almi

Programme /Class	Honours	Year	B.Sc. 3 rd year	Semester	V
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BTH504T		Course Title	BIOINFORMATICS	
Course Outcome- Understand the basic theories and practical's of common computational tools and databases which facilitate investigation of molecular biology and evolution- related concepts. critically analyse and interpret results of their studies with the help of bioinformatical tools.					
Credits—4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	History of Bioinformatics. The notion of Homology. Sequence Information Sources. EMBL, GENBANK, Entrez, UniGene, Understanding the structure of each source and using it on the web. IKS: Contribution of Indian scientists.				12
UNIT-II	Protein Information Sources. PDB, SWISSPROT, TREMBL. Understanding the structure of each source and using it on the web. Introduction of Data Generating Techniques and Bioinformatics problem posed by them- Restriction Digestion, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry.				18
UNIT-III	Sequence and Phylogeny analysis. Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.				18
UNIT-IV	Searching Databases: SRS, Entrez, Sequence Similarity Searches- BLAST, FASTA, Data Submission. Genome Annotation: Pattern and repeat finding, Gene identification tools.				12
Suggested Readings: - Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press. - Pevsner J. (2009) Bioinformatics and Functional Genomics. III Edition. Wiley- Blackwell. - Campbell A.M., Heyer L.J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.					

Monika .  

Programme / Class	Honours	Year	B.Sc. 3 rd year	Semester	V
Subject	B.Sc. BIOTECHNOLOGY (HONOURS)				
Course Code	BT11505P	Course Title	Practical-V		
• Course Outcome- After successful completion of the course, • Students will earn different Bioanalytical techniques and tools and techniques for genetic Engineering • Students learn about techniques of Biostatistics and Bioinformatics					
Credits-4	Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33		
Total No. of Lectures- Tutorials- Practical (In hours per week): 0-0-4					
Unit	Topic				No of Lectures/ Demonstrations 30+30
	• Preparation of the sub-cellular fractions of rat liver cells, • Preparation of protoplasts from leaves, • Separation of amino acids by paper chromatography; To identify lipids in a given sample by TLC. • To verify the validity of Beer's law and determine the molar extinction coefficient. • Restriction digestion of DNA • Competent Cells: Preparation and Transformation of Competent Cells, • Demonstration of PCR • Understanding and use of various web resources: EMBL, GenBank, Entrez, UniGene, • Understanding and using: PDB, Swiss Prot, TrEMBL • Using various BLAST and interpretation of results; Sequence alignment using BLAST; Multiple sequence alignment using Clustal W. • Practical Based on measures of Central Tendency & Dispersion, graphical Representation, Distributions, Binomial, Poisson, Normal, t, f, z, and Chi-square				
Suggested Readings:					
• Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology - Principles and Applications of recombinant DNA. ASM Press, Washington • Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K. • Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning- A Laboratory Manual, 3rd edition. Cold Spring Harbor Laboratory Press. • Glaser AN (2001) High Yield TM Biostatistics. Lippincott Williams and Wilkins, USA • Edmondson A and Druce D (1996) Advanced Biology Statistics. Oxford University Press. • Danial W (2004) Biostatistics: A foundation for Analysis in Health Sciences, John Wiley and Sons Inc. • Ghosh Z. and Bibek anand M. (2008) Bioinformatics: Principles and Applications, Oxford University Press. • Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell. • Campbell A.M., Heyer L.J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.					

BT11506R: (Research Project): Research Project on topics which are Inter/Intra faculty

Monika *Sh* *Shirish*

Programme /Class	Honours	Year	B.Sc. 3 rd year	Semester	VI
Course Code	Subject	B.Sc. BIOTECHNOLOGY (HONOURS)			
	BTTH601T	Course Title		BIOPROCESS TECHNOLOGY	
Course Outcome- - Understand the problems in isolation, strain improvement and growth of microorganisms in industrial processes. - Isolate and improve the industrially important microorganisms. - Understand design and types of fermenters and operation of fermenters.					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practial (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics- Batch, Fed batch and Continuous culture. IKS: Contribution of Indian scientists.				10
UNIT-II	Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inocula development and sterilization.				20
UNIT-III	Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting K_{La} . Bioprocess measurement and control system with special Reference to computer aided process control.				(15
UNIT-IV	Introduction to downstream processing. product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.				15
Suggested Readings: - Casida L.E. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited. - Crueger Wand Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi. - Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited. - Stanbury P.F., Whitaker A. and Hall S.J. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.					

Monika

[Signature]

[Signature]

Programme /Class	Honours	Year	B.Sc. 3 rd year	Semester	VI
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BTH602T		Course Title	GENOMICS & PROTEOMICS	
• Course Outcome-					
Credits—4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam & Gilbert and Sangers method. Pyrosequencing. Genome Sequencing: Shotgun & Hierarchical (clone counting) methods. Computer tools for sequencing projects: Genome sequence assembly software. IKS: Contribution of Indian scientists.				15
UNIT-II	Managing and Distributing Genome Data: Web based servers and software for genome analysis: ENSEMBL, VISTA, UCSC Genome Browser, NCBI genome. Selected Model Organisms' Genomes and Databases				10
UNIT-III	Introduction to protein structure, Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, van der waal interactions, hydrogen bonds, Hydrophobic interactions. Determination of sizes(Sedimentation analysis, gel filtration, SDS-PAGE); Native PAGE. Determination of covalent structures Edman degradation				20
UNIT-IV	Introduction to Proteomics, Analysis of proteomes. 2D-PAGE. Sample preparation, solubilization, reduction, resolution. Reproducibility of 2D-PAGE. Mass spectrometry based methods for protein identification. <i>Denovo</i> sequencing using mass spectrometric data.				15
Suggested Readings:					
1. Genes IX by Benjamin Lewin. Johns and Bartlett Publisher. 2006. 2. Modern Biotechnology, 2nd Edition, S.B.Primrose, Blackwell Publishing, 1987. 3. Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition. 4. B.R. Glick, J.J. Pasternakand C.L. Patten. 2010. 5. Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III, 1989. 6. Principles of Gene Manipulation 6th Edition, S.B. Primrose, R.M. Twymanand R.W.Old. Blackwell Science, 2001. 7. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc. 8. Klug, W.S.,Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings. 9. Russell, P.J. (2009). <i>i</i>Genetics- AMolecular Approach. III Edition. Benjamin Cummings. 10. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington. 11. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.					

Manika

Sh

A. J. Jiv

	Honours	Year	B.Sc. 3 rd year	Semester	VI
Subject			B.Sc. (HONOURS) BIOTECHNOLOGY		
Course Code	BH100603T		Course Title	ANIMAL BIOTECHNOLOGY	
Course Outcome-Students					
- Will learn about Gene transfer methods in Animals - Understand the concept of Transgenic Animals, Stem Cell Technology, gene therapy					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Gene transfer methods in Animals- Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Gene transfer. IKS: Contribution of Indian scientists.				10
UNIT-II	Introduction to transgenesis. Transgenic Animals- Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Animal diseases need help of Biotechnology - Foot-and mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.				20
UNIT-III	Animal propagation - Artificial insemination, Animal Clones. Conservation Biology - Embryo transfer techniques. Introduction to Stem Cell Technology and its applications.				10
UNIT-IV	Genetic modification in Medicine - gene therapy, types of gene therapy, vectors in gene therapy molecular engineering, human genetic engineering and ethics.				20
Suggested Readings:					
Brown, T.A. (1998). Molecular biology Lab fax II: Gene analysis. II Edition. Academic Press, California, USA.					
2. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bioscientific publishers.					
3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.					
4. Griffiths, A.J.F., J.H.Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.					
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA genes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.					

Moukher

[Signature]

[Signature]

Programme /Class	Honours	Year	B.Sc. 3 rd year	Semester	VI
Subject		B.Sc. BIOTECHNOLOGY (HONOURS)			
Course Code		BT11604T	Course Title		Plant Biotechnology
• Course Outcome- • Understand the principles, practices and applications of plant biotechnology, transgenic • Plant generation, plant tissue culture, plant genomics, and genetic transformation. • Understand applications of stem cells and tissues engineering. • Learn different gene delivery methods to deliver foreign gene in plants • Know about different products of transgenic animals, plants and microbes.					
Credits-4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 4-0-0					
Unit	Topic				No of Lectures
UNIT-I	Introduction, Cryo and organogenic differentiation. Types of culture: Seed, Embryo, Callus, Organs, Cell and Protoplast culture. Micropropagation Axillary bud proliferation, Meristem and shoot tip culture, cud culture, organogenesis, embryogenesis, advantages and disadvantages of micropropagation. IKS: Contribution of Indian scientists.				15
UNIT-II	<i>In vitro</i> haploid production Androgenic methods: Anther culture, Microspore culture androgenesis Significance and use of haploids, Ploidy level and chromosome doubling, diploidization, Gynogenic haploids, factors effecting gynogenesis, chromosome elimination techniques for production of haploids in cereals.				20
UNIT-III	Protoplast Isolation and fusion Methods of protoplast isolation, Protoplast development, Somatic hybridization, identification and selection of hybrid cells, Cybrids, Potential of somatic hybridization limitations. Somaclonal variation Nomenclature, methods, applications basis and disadvantages.				15
UNIT-IV	Plant Growth Promoting bacteria. Nitrogen fixation, Nitrogenase, Hydrogenase, Nodulation, Biocontrol of pathogens, Growth promotion by free- living bacteria.				10
Suggested Readings: 1. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice. 2. Brown, T.A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication. 3. Gardner, E.J. Simmonns, M.J. Snustad, D.P. 2008 8th edition Principles of Genetics. Wiley India. 4. Raven, P.H., Johnson, GB., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MCGraw Hill. 5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House. 6. Russell, P.J. 2009 Genetics- A Molecular Approach. 3rd edition, Benjamin Co. 7. Sambrook & Russel. Molecular Cloning: A laboratory manual. (3rd edition) 8. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.					

Monika

Dr

Atmi

Programme /Class	Honours	Year	B.Sc. Third year	Semester	VI
Subject			B.Sc. BIOTECHNOLOGY (HONOURS)		
Course Code	BTH605P		Course Title	Practical-VI	
Course Outcome-After successful completion of the course, student will be able to perform: experiments related to plant and animal physiology and can analyse blood samples.					
Credits—4		Max. Marks: 100 (25+ 75)		Min. Passing Marks: 33	
Total No. of Lectures- Tutorials- Practical (in hours per week): 0-0-4					
Unit	Topic				No of Lectures/ Demonstrations
	- Isolation of an industrially important microorganism from a natural resource. Bacterial growth curve. - Calculation of thermal death point (TDP) of a microbial sample. - Production and analysis of ethanol and lactic acid. - Production and analysis of amylase. - Use of SNP databases at NCBI and other sites; Use of OMIM database - Detection of Open Reading Frames using ORF Finder; Proteomics 2D PAGE database - Software for Protein localization; Hydropathy plots - Native PAGE and SDS-PAGE - Sterilization techniques: Glassware sterilization, Media sterilization. Laboratory sterilization; Sources of contamination and decontamination measures. - Preparation of Hank's Balanced salt solution; Preparation of Minimal Essential Growth medium - Isolation of lymphocytes for culturing - DNA isolation from animal tissue - Preparation of simple growth nutrient (Knop's medium), full strength, half strength, solid, and liquid. - Preparation of complex nutrient medium (Murashige & Skoog's medium); Significance of growth hormones in culture medium. - Selection, Pruning, sterilization, and preparation of an explants for plant tissue culture. - To demonstrate various steps of Micropropagation.				30+30
Suggested Readings: - Plummer D.T., An Introduction to Practical Biochemistry 3rd ed., Tata McGraw Hill Education Pvt. Ltd. 1998, - Wilson K. and Walker J., Principles and Techniques of Biochemistry and Molecular Biology, 7th ed., Cambridge University Press, 2010 - Bhojwani. S.S. and Razdan 2004 Plant Tissue Culture and Practice. - Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin. R.C. and Gelbart. W.M.(2009). An Introduction to genetic analysis. IX Edition. Freeman & Co., N.Y.. USA. - Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington. - Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.					

BTH606R: (Research Project): Research Project on topics which are Inter/Intra faculty

Mamika *Sh* *Atish*