

Proposal submitted under

STAR COLLEGE SCHEME

FOR

STRENGTHENING OF SCIENCE EDUCATION AND

TRAINING AT

UNDERGRADUATE LEVEL



GOVERNMENT COLLEGE KOTTAYAM

NATTAKOM P O, KOTTAYAM DISTRICT

KERALA-686013

(Affiliated to Mahatma Gandhi University, Kottayam
Re-accredited by NAAC with "A" grade)

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Email: gckottayam@gmail.com, website: <http://gckottayam.ac.in>

To

DEPARTMENT OF BIOTECHNOLOGY

MINISTRY OF SCIENCE & TECHNOLOGY

GOVERNMENT OF INDIA

NEW DELHI – 110003

July- 2017

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राष्ट्रीय मूल्यांकन एवं प्रत्यायन परिषद

विश्वविद्यालय अनुदान आयोग का स्वायत्त संस्थान

NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL

An Autonomous Institution of the University Grants Commission

Certificate of Accreditation

*The Executive Committee of the
National Assessment and Accreditation Council
on the recommendation of the duly appointed*

Peer Team is pleased to declare the

Government College

Nattakom, Kottayam,

affiliated to Mahatma Gandhi University, Kerala as

Accredited

with CGPA of 3.05 on seven point scale

at A grade

valid up to September 15, 2021

Date : September 16, 2016



DP Singh
Director





MAHATMA GANDHI UNIVERSITY
Kottayam, Kerala - 686 560

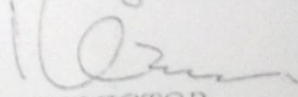
CERTIFICATE

Certified that Govt. College, Kottayam
Mahatma Gandhi University, Kerala is included under Section 2(f) and
2(B) of UGC Act 1956. The College is included in the list of colleges
under Section 2(f) of the UGC Act as on June 30, 1996 published by the
UGC on Page 187 as item No. (01) under the category
B. Colleges Teaching upto Bachelor's Degree.

P.D. Hills

Dated: 14.02.03




DIRECTOR
College Development Council

PROFORMA**Proforma for submission of Application under the Strengthening component for Star****College Scheme****PART- A:****Information about Existing Facilities and Programs:**

Sl.No	Parameter	Sub-Parameter
SECTION-A: GENERAL INFORMATION		
A-1	Name of the College	GOVERNMENT COLLEGE KOTTAYAM
A-2	Nature of the College (Government, Private, Autonomous)	Government
A-3	Whether registered under 12(b) and 2(f) of the UGC? Please enclose Documentary Evidence	YES
A-4	Application Status	Fresh
A-5	Complete Postal Address with Pin-Code	GOVERNMENT COLLEGE KOTTAYAM NATTAKOM P.O, KOTTAYAM DISTRICT KERALA, PIN 686013
A-6	Name of the Principal Telephone No. with STD Code Mobile number Fax No. E-mail Website (URL)	DR. MERCIAMMA FRANCIS 0481-2363116 94495690832 FAX: 0481-2363116 EMAIL: mfcpr.in@gmail.com http://gckottayam.ac.in
A-7	Location of College	g) Rural

A-8	Age of the College	b) 26-50 years	
A-9	Affiliated to which University	MAHATMA GANDHI UNIVERSITY , KOTTAYAM , KERALA	
A-10	Status about Affiliation	a) Permanent	
A-11	Name of Departments for which the support is being sought under the Star College Scheme (Subject wise) Name of Contact Person from each department	BOTANY, CHEMISTRY, GEOLOGY, MATHEMATICS, PHYSICS AND ZOOLOGY	
a.	BOTANY	Name of Degree course	B.Sc Botany, Model 1
		Date of start of Course	05-06-1972
	Name of the Contact Person SMT. PONNAMMA K K	Designation : Complete Address c) Phone : d) Email	Associate Professor and HOD, Department of Botany, Government College Kottayam -13 9447587886 gckbotany1972@gmail.com
b.	CHEMISTRY	Name of Degree course	B.Sc Chemistry- Model II (Vocational)
		Date of start of Course :	2004
	Name of the Contact Person DEVAN V R	Designation : Complete Address c) Phone : d) Email	Assistant Professor Department of Chemistry Government College Kottayam , Kottayam -13 9446425367 vrdevan@gmail.com

c.	GEOLOGY	Name of Degree course	B.Sc GEOLOGY
		Date of start of Course	1974
	Name of the Contact Person P G DILIPKUMAR	Designation : Complete Address c) Phone : d) Email	Assistant Professor and HOD Department of Geology Government College Kottayam Kottayam -13 9446054021 pgdilipkumar@yahoo.com
d.	MATHEMATICS	Name of Degree course	B.Sc Mathematics Model I
		Date of start of Course	1972
	Name of the Contact Person DR P N JAYAPRASAD	Designation : Complete Address c) Phone : d) Email	Assistant Professor Department of Mathematics Government College Kottayam , Kottayam -13 9447535103 jayaprasadpn@gmail.com
e.	PHYSICS	Name of Degree course	B.Sc PHYSICS, Model 1
		Date of start of Course	1981
	Name of the Contact Person DR. K S SREELATHA	Designation : Complete Address c) Phone : d) Email	Assistant Professor Department of Physics Government College Kottayam , Kottayam -13 9447415110 drsreelathaks@gmail.com

	ZOOLOGY	Name of Degree course	B.Sc ZOOLOGY- Model II AQUACULTURE
		Date of start of Course	1998
b.	Name of the Contact Person DR.SUJATHA S	Designation : Complete Address c) Phone : d) Email	Assistant Professor and HOD Department of Zoology Government College Kottayam -13 9495365974 sujasreedhar31@
A-12	Name of Programme Coordinator for Star College Scheme Dr. U. S. SAJEEV	a) Designation : ASSISTANT PROFESSOR b) Complete Address :DEPARTMENT OF PHYSICS c) Phone : 0481-2363116 d) Email :ussajeev@gmail.com e) Mobile No: 9447191048	

SECTION-B: INFRASTRUCTURE					
B.I DEPARTMENT OF BOTANY					
B-1	Laboratories (details of Proposed Departments)		DEPARTMENT: BOTANY Total expenditure during the past three years : 9,00,000/-		
List of equipment in the Department					
	Sl No	Name of Equipment	Year of Purchase	Number	Functional or Not
	1	Binocular research microscope	2015	1	Functional
	2	Photochem Microprocessor colorimeter	2015	1	Functional
	3	Digital pH meter	2016	1	Functional
	4	Monocular Microscope with LED illumination	2016	1	Functional
	5	Double distillation unit	2016	1	Functional
	6	Magnus Monocular Microscope	2016	1	Functional
	7	Orbital shaking incubator	2016	1	Functional
	8	Cooling Centrifuge	2016	1	Functional
	9	Digital pH meter	2016	1	Functional
	10	Rotary Evaporator	2016	1	Functional
	11	Pocket type pH meter	2016	1	Functional
	12	Student Monocular Microscope	2016	1	Functional
B-2	Library		a) Are there separate departmental libraries other than Central Library- b) Indicate total amount spent during last three years-		YES Rs: 30,000/-
B-3	Computer Internet facility		YES		
B-4	a) No. of lecture halls		3		
	a) No. of laboratories		2		

B.II DEPARTMENT OF CHEMISTRY :INFRASTRUCTURE				
B-1	Laboratories (details for proposed Departments)		Department Total expenditure During the past three years: 12 lakhs	
List of equipment attached				
Sl No	Name of the equipment	Number	Year of purchase	Functioning or not
1	Ultrasonicator	1	2016	Functional
2	Flame photometer	1	2016	Functional
3	Multiparameter Analyzer	1	2016	Functional
4	Tensile testing machine	1	2016	Functional
5	Laoratory incubator	1	2016	Functional
6	BOD incubator	1	2016	Functional
7	Rotatory evapourator	1	2016	Functional
8	Laminar air flow	1	2016	Functional

9	Air Oven	1	2015	Functional
10	Magnetic stirrer	2	2015	Functional
11	Digital potentiometer	4	2015, 2014	Functional
12	Digital conductivity meter	4	2015, 2014	Functional
13	Muffle furnace	1	2014	Functional
B-2	Library			
	a) Are there separate departmental libraries other than the Central Library	Yes 1800 books		
	b) Indicate total Amount spent during the last three years	Rs.60, 000/-		
B-3	Computer Internet Facility	Yes		
B-4	a) No. of Lecture Halls b) No. of Laboratories	3 2		

B.III DEPARTMENT OF GEOLOGY					
B-1	Laboratories (details for proposed Departments)		DEPARTMENT : GEOLOGY Total expenditure During the past three years: 37 lakhs		
List of equipment in the department					
	Sl No	Name of the equipment	Number	Year of purchase	Function or nor
	1	Leica Polarizing microscope	1	2017	working
	2	Fluid inclusion stage Linkam THMSG 600 – KSCSTE - SARD	1	2017	working
	3	Polarizing microscope (Trinocular) – DST FIST	9	2016	working
	4	GIS software - DST FIST	3 licence	2016	working
	5	GPS	3	2016	working
B-2	Library				
	a) Are there separate departmental libraries other than the Central Library	YES Total number of Books - 2800			
	b) Indicate total Amount spent during the last three years	1,20,000			
B-3	Computer Internet Facility	YES			
B-4	a) No. of Lecture Halls b) No. of Laboratories	3 (Under graduate) + 2 for Post graduate 2 UG+2 PG +1 museum			

B.IV MATHEMATICS				
B-1	Laboratories (details for proposed Departments)		Department Total expenditure During the past three years: 1. List of equipment 2. Name 3. No. 4. Year of purchase 5. Functional or not List of equipment attached	
	1. Name of the equipment	Number	Year of purchase	Function or nor
	Desktop Computers	16	16	Working
B-2	Library			
	a) Are there separate departmental libraries other than the Central Library		YES	
	b) Indicate total Amount spent during the last three years		60,000	
B-3	Computer Internet Facility		YES	
B-4	a) No. of Lecture Halls b) No. of Laboratories		Lecture Halls-3 (Under graduate) Computer Lab-1	

B.V DEPARTMENT OF PHYSICS					
B-1	Laboratories (details for proposed Departments)		DEPARTMENT: PHYSICS Total expenditure During the past three years : 90 lakhs including research facilities: For degree lab Rs: 8,00,000 lakhs only		
	1. List of equipment Department of Physics				
	Sl No	Name of the equipment	Number	Year of purchase	
		Functioning /not functioning			
	1	XRD-Rigaku miniflex 600	1	2016	working
	2	UV-Vis Spectrophotometer	1	2015	working
	3	Electrospinning Unit,	1	2015	working
	4	Hot air Oven,	1	2015	working
	5	High temperature Furnace,	1	2014	working
	6	Magnetic stirrer,	4	2014	working
	7	Ultra sound Sonicator,	1	2014	working
	8	Spin coating Unit,	1	2016	working
	9	Nano source measurement unit	1	2016	working
	10	Spray Pyrolysis	1	2016	working
	12	Ellipsometer	1	2015	working
	13	CRO	6	2014	working

	15	Spectrometer	3	2014	working
	16	Digital Balance,	2	2013,2016	Working
B-2	Library				
		a. Are there separate departmental libraries other than the Central Library			YES number of Books -5000
		b) Indicate total Amount spent during the last three years			1.0 lakhs
B-3	Computer Internet Facility		YES		
B-4	a) No. of Lecture Halls		3 (Under graduate) + 2 for Post graduate		
	b) No. of Laboratories		2 Under graduate +1 Computer Lab+ 1 PG+2 research		

B. VI ZOOLOGY					
B-1	Laboratories (details for proposed Departments)		DEPARTMENT : ZOOLOGY Total expenditure During the past three years: Rs. 9,41,240/-		
List of Equipment Department of Zoology					
	Sl No	Name of the equipment	Number	Year of purchase	Function or not
	1	PCR Machine	1	2016	Functioning
	2	Electrophoresis unit	1	2016	Functioning
	3	UV trans illuminator	1	2016	Functioning
	4	Microcentrifuge	1	2017	Functioning
	5	Hot air oven	1	2016	Functioning
	6	Shaking water bath	1	2017	Functioning
	7	Vortex mixer	1	2017	Functioning
	8	Microwave oven	1	2016	Functioning
	9	Micropipettes	1	2016	Functioning
	10	Autoclave	1	2015	Functioning
	11	pH meter	1	2015	Functioning
B-2	Library				
		a) Are there separate departmental libraries other than the Central Library			Yes
		b) Indicate total Amount spent during the last three years			Rs.49702/-
B-3	Computer Internet Facility		Yes		
B-4	a) No. of Lecture Halls		3		
	b) No. of Laboratories		2		

Section-C: Faculty					
C. I BOTANY					
C-1	Details about Teachers in each participating Department (Details attached)		a) Number, Name b) Permanent: 4 c) Temporary: Nil d) Part Time: Nil e) Adhoc/Re-employed: Nil f) Qualification(MSc/MPhil, PhD) g) Area of specialization h) list of publications in last five years (only in soft copy, if too long)		
	Sl No , Name	Qualification	Experience	Area of specialisation	List of publications
	1. Ponnamma K K	M.Sc , B.Ed	28 years	Angiosperm taxonomy	
	2. Jazir Haneef	M.Sc, NET, JRF, ICAR-NET	6 years	Biotechnology	2
	3. Prasanna Rajan	M.Sc, NET	7 Years	Ethnobotany	
	4. Dr. Kavitha R	M.Sc, M.Phil, Ph.D	6 Years	Tissue Culture, Medicinal plant onservation	
	i) R&D projects received from different funding agencies indicating title, cost, duration, date of sanction, name of funding agencies				
	Title & Name of Principal Investigator	Cost in lakhs	Duration & Date of sanction,	Name of funding agencies	Status
	Ex-situ conservation and cultivation of medicinal plants Dr. Kavitha R	2.00	2 years 18-12-2015	State Medicinal Plants Board, Kerala	Ongoing
C-2	Details about in service training for teachers of participating departments: Address a) – c) and give Additional inputs, if any Number attended during last five years under the following (duration and period)			a) Orientation Course (ASC/Identified Dept /College) b) Refresher Course c)Conferences/Symposia/Seminar/Workshop	
	Name of faculty	Programme	Date /Duration	Institute	
	Jazeer Haneef	Refresher	5-7-2012 to 19-10-2012)	ASC- University of Kerala	
	Prasanna Rajan	Orientation	(26-11-2014 to 23-12-2014)	Academic Staff College, calicut	
	Dr. Kavitha R	Refresher FDP	16-07- 2015 to 12-08- 2015 July 2015	ASC- University of Kerala MG University	

C.II CHEMISTRY						
Section-C: Faculty Department of Chemistry						
C-1	Details about Teachers in each participating Department		a) Number, Name b) Permanent: 6 c) Temporary: Nil d) Part Time: Nil e) Adhoc/Re-employed: Nil f) Qualification(MSc/MPhil, PhD) g) Area of specialization h) list of publications in last five years (only in soft copy, if too long)			
DETAILS OF FACULTY: DEPARTMENT OF CHEMISTRY						
SI No	Name	Qualification	Experience (years)	Area of specialisation	Publications	Teachers Training
1,	Dr. Mercyamma Francis	MSc, PhD, NET	27	Organic Chemistry	4	Orientation Programme and Refresher Course
2.	Dr. Seno Jose	MSc, PhD, NET	11	Physical Chemistry, Polymer Chemistry	36	Orientation Programme and Refresher Course
3.	Ms. Smitha V K	MSc, M Phil, NET	10	Physical Chemistry, Polymer Chemistry		Orientation Programme and Refresher Course
4.	Mr. Devan V R	MSc, NET	8	Theoretical Chemistry, Physical Chemistry		Refresher Course
5.	Ms. Laigi Joseph	MSc, M Phil, NET	4	Inorganic Chemistry, Environmental Chemistry		Orientation Programme and Refresher Course
6.	Ms. Anila B N	MSc, M Phil, NET	5	Inorganic Chemistry	4	Orientation Programme and Refresher Course
	i) R&D projects received from different funding agencies indicating title, cost, duration, date of sanction, name of funding agencies		Major projects: Nil Minor Projects: 2 Assistance under FIST scheme-0 level grant Details given separately			

R& D PROJECTS DEPARTMENT OF CHEMISTRY						
	Title & Name of Principal Investigator	Cost in lakhs	duration	date of sanction,	name of funding agencies	status
	Dr. Seno Jose	1.5	Two		UGC	Completed
	Ms. Anila B N	1.85	two		UGC	Completed
C-2	Details about in service training for teachers of participating departments: Address a) – c) and give Additional inputs, if any Number attended during last five years under the following (duration and period)		a) Orientation Course (ASC/Identified Dept /College) b) Refresher Course c) Conferences/Symposia/Seminar/Workshop (All faculty members attended for Orientation and refresher courses at UGC-Academic Staff college in the Past Five years)			

LIST OF PUBLICATIONS : DEPARTMENT OF CHEMISTRY

2017

1. JyotishkumarParameswaranpillai, Sisanth Krishnan Sidhardhan, P. Harikrishnan, Jürgen Pionteck, SuchartSiengchin, AparnBeenaUnni, Anthony Magueresse, Yves Grohens, NisharHameed, Seno Jose, Morphology, thermo-mechanical properties and surface hydrophobicity of nanostructured epoxy thermosets modified with PEO-PPO-PEO triblock copolymer, *Polymer Testing* 59 (2017) 168-176. Publishers: Elsevier, Impact factor: 2.24

2016

2. SenoJose, Sabu Thomas, Jyotishkumar P., AbiSanthoshAprem, J. Karger-Kocsis. Dynamic Mechanical Properties of Immiscible Polymer Systems with and without Compatibilizer, *Polymer Testing*, 44 (2015), 168-176. Publishers: Elsevier, Impact factor: 2.24
3. JyotishkumarParameswaranpillai a, Vivek Kumar Dubey, K.S. Sisanth , Seno Jose, Ajesh K. Zachariah, SuchartSiengchin, Nisa V. Salim, NisharHameed, Tailoring of interface of polypropylene/polystyrene/carbon nanofibrecomposites by polystyrene-block-poly(ethylene-ran-butylene)-blockpolystyrene, *Polymer Testing* 51 (2016) 131-141 Publishers: Elsevier, Impact factor: 2.24
4. JyotishkumarParameswaranpillai, Sisanth Krishnan Sidhardhan, Seno Jose, Nisa V. Salim, SuchartSiengchin, Jürgen Pionteck, Anthony Magueresse, Yves Grohens, NisharHameed, Micro phase separated epoxy/poly(ϵ -caprolactone)-blockpoly(dimethylsiloxane)-block-poly(ϵ -caprolactone)/4,4'-diaminodiphenylsulfone systems: Morphology, viscoelasticity, thermo-mechanical properties and surface hydrophobicity, *Polymer Testing* 55 (2016) 115-122. Publishers: Elsevier, Impact factor: 2.24
5. JyotishkumarParameswaranpillai, Sisanth Krishnan Sidhardhan, Seno Jose, NisharHameed, Nisa V. Salim, SuchartSiengchin, Jürgen Pionteck, Anthony Magueresse, Yves Grohens, Miscibility, phase morphology, thermo-mechanical, viscoelastic and surface properties of PCL modified epoxy systems: Effect of curing agents, *Ind. Eng. Chem. Res.*, 55 (2016), 10055-10064. Publishers: American Chemical

Society, Impact factor: 2.567

7. Seno Jose, Jyotishkumar Parameswaranpillai, Bejoy Francis, Abi Santhosh Aprem, and Sabu Thomas, Thermal degradation and crystallization characteristics of multiphase polymer systems with and without compatibilizer, *AIMS Materials Science*, 3 (2016) 1177-1198.
8. Jyotishkumar P., George Joseph, Seno Jose and Nishar Hameed. Miscibility, UV resistance, thermal degradation and mechanical properties of PMMA/SAN blends and their composites with MWCNTs, *J. Appl. Polym. Sci.*, 133, (2016), 43628. Publishers: Wiley, Impact factor: 1.786.
2015
9. Jyotishkumar P., George Joseph, K. P. Shinu, Seno Jose, Nisa V. Salim and Nishar Hameed. Development of hybrid composites for automotive applications: effect of addition of SEBS on the morphology, mechanical, viscoelastic, crystallization and thermal degradation properties of PP/PS-xGnP composites, *RSC Advances*, 5, (2015) 25634-25641. Publishers: Royal Society of Chemistry, Impact factor, 3.84.
10. Jyotishkumar P., George Joseph, Seno Jose and Nishar Hameed. Phase morphology, thermomechanical, and crystallization behavior of uncompatibilized and PP-g-MAH compatibilized polypropylene/polystyrene blends, *Journal of Applied Polymer Sciences*, 132, (2015) 42100. Publishers: Wiley, Impact factor: 1.786.
11. Seno Jose, Sabu Thomas, Indose Aravind, J. Karger-Kocsis. Rheology of multiphase polymer blends with and without reactive compatibiliser: evaluation of interfacial tension using theoretical predictions, *International Journal of Plastic Technology*, Springer, 18, (2015), 223-240. Publishers: Springer
12. Jyotishkumar P., George Joseph, K.P. Shinu, P.R. Sreejesh, Seno Jose, Nisa V. Salim, Nishar Hameed, The role of SEBS in tailoring the interface between the polymer matrix and exfoliated graphene nanoplatelets in hybrid composites, *Materials Chemistry and Physics* 163 (2015) 182-189. Publishers: Elsevier, Impact factor: 2.259
13. Jyotishkumar P., George Joseph, K.P. Shinu, P.R. Sreejesh, Seno Jose, Nisa V. Salim, Nishar Hameed, High performance PP/SEBS/CNF composites: Evaluation of mechanical, dynamic mechanical, thermal degradation and crystallization properties, *Polymer Composites* (2015) DOI 10.1002/pc.23830. Publishers: Elsevier, Impact factor: 1.632.

Section-C: Faculty						
C.III GEOLOGY						
C-1	Details about Teachers in each participating Department		a) Number, Name b) Permanent: 6 c) Temporary: 1 (FIP Substitute) d) Part Time: Nil e) Adhoc/Re-employed: Nil f) Qualification(MSc/MPhil, PhD) g) Area of specialization h) list of publications in last five years (only in soft copy, if too long)			
	Sl. No	Name	Qualification	Experience	Area of specialisation	List of Publications
	1.	Dilip Kumar P. G.	M.Sc. ,	17 years (7 years State Ground Water Dept)	Hydrogeology	
	2.	Dr. Anto Francis K.	M.Sc, M.phil., Ph.D.	14 years (4 years State Ground Water Dept)	Petrology, geochemistry, Tectonics, Fluid inclusion	1
	3.	Ajay K. K.	M.Sc, Ph.D	9 Years (1 year GeoTechnical Field UAE)	Geotectonics, Seismic stratigraphy, Structural geology	1 1
	4.	Suraj P. R.	M.Sc, M.Tech.	4 Years (4 years Exploration geologist)	Exploration Geology	
	5.	Priya P. N.	M.Sc, B.Ed.	2 years	Sedimentology	
	6.	Dr. Manulal P. Ram	M.Sc, M.Phil, Ph.D	1 year (10 years Mining and Geology Dept)	Micropalaentology	
	7.	Praveen Kurian Thomas	M.Sc	1 year	Fluid inclusion, Petrology	1
	i) R&D projects received from different funding agencies indicating title, cost, duration, date of sanction, name of funding agencies		Major projects: 2 Minor Projects: 0 Assistance under FIST scheme-0 level grant Details given separately			
SPONSORED PROJECTS , DEPARTMENT OF GEOLOGY						
	Title	Name of Principal Investigator	Cost in lakhs	Duration & Date of sanction	Name of funding agencie	Status

					s	
	Metamorphic history of Kerala segment of Madurai granulite block.	Dr. Anto Francis K. (PI) & Dr. Ajay K. K. (Co-I)	24.23	3 years 15/12/2016	KSCST E	On going
	Research on Petrology, Hyrogeology, Remote Sensing and Neotectonics	Dr. Anto Francis K. (Co-ordinator)	27.75	3 years 4/06/2015	KSCST E - SARD	On going
	FIST -0 level Grant (college level)		90.00	3 years	DST	On going
C-2	Details about in service training for teachers of participating departments: Address a) – c) and give Additional inputs, if any Number attended during last five years under the following (duration and period)	a) Orientation Course (ASC/Identified Dept /College) b) Refresher Course c) Conferences/Symposia/Seminar/Workshop (Detailed List attached)				

1. Sri. DILIP KUMAR P. G., ASSISTANT PROFESSOR

Sl. No.	Title of the Seminar/Workshop/Training Programme	Dates	Duration	Venue	Sponsors/Organizers	Remarks
1	Petroleum Resources and Exploration Techniques	20 th -21 st Dec., 2016	2days	Govt College Kottayam	Govt of Kerala	Participant
2	Refresher course in Environmental Studies	Jan., 2016	21days	ASC- kerala university	UGC	Participant
3	Refresher course in Environmental Studies	8 th - 28 th Jan., 2015	21days	Academic Staff College, Calicut	UGC	Participant
4	Seminar on 'Natural disasters: Mitigation and management'	11&12 ^h Dec., 2013	2days	Dept of Geology, Govt College Kottayam	Collegiate Education, Govt of Kerala	Participant
5	National seminar on 'Soil quarrying and its impact on groundwater resources'	27&28 ^h Sept, 2013	2days	BK College, Amalagiri, Kottayam	UGC	Paper presented
6	Seminar on 'Groundwater resources of Kerala: prospect and retrospect'	6&7 th March, 2013	2days	Dept of Geology, Govt College Kottayam	Collegiate Education, Govt of Kerala	Resource person
7	Kerala Science Congress	29-31 st January, 2012	3days	, Rubber Board, Kottayam	KSCSTE	Participant

2. Dr. ANTO FRANCIS K., ASSISTANT PROFESSOR

Sl. No.	Title of the Seminar/Workshop /Training Programme	Dates	Dur atio n	Venue	Sponsors/Organ izers	Remarks
1	Petroleum Resources and Exploration Techniques	20 th -21 st Dec., 2016	2day s	Dept of Geology, Govt College Kottayam	Govt of Kerala	Participant
2	Workshop cum Seminar on Asian Current Research on Fluid Inclusions	22 nd -27 th Nov., 2016	6day s	IIT Mumbai	IIT Mumbai	Participant
3	Training course on 'Aquifer management and local groundwater issues in Kerala'	3 rd -7 th Feb., 2014	5day s	Scholl of Environmental Science, Mahatma Gandhi University, Kottayam	Central Groundwater Board, Ministry of Water Resources, Govt of India	Participant
4	Seminar on 'Natural disasters: Mitigation and management'	11&12 ^t h Dec., 2013	2day s	Dept of Geology, Govt College Kottayam	Dept of Collegiate Education, Govt of Kerala	Coordinat or
5	National seminar on 'Soil quarrying and its impact on groundwater resources'	27&28 ^t h Sept, 2013	2day s	BK College, Amalagiri, Kottayam	UGC	Paper presented
6	National workshop on 'Recent scientific advances in southern granulite terrain'	18-19 th April, 2013	2day s	Geological Survey of India, Chennai	Geological Survey of India, Chennai	Participant
7	Seminar on 'Condensed matter physics'	20-23 rd March, 2013	3day s	Dept of Physics, Govt College Kottayam	Dept of Collegiate Education, Govt of Kerala	Resource person
8	Seminar on 'Groundwater resources of Kerala: prospect and retrospect'	6&7 th March, 2013	2day s	Dept of Geology, Govt College Kottayam	Dept of Collegiate Education, Govt of Kerala	Resource person
9	Workshop on 'Precambrian plate tectonics: Recent advances from southern India and East Antarctica'	3 rd Jan., 2013	1day	Dept of Geology University of Kerala	Dept of Geology University of Kerala	Participant
10	Training on 'Open	16 &	2day	Dept of PG	Kerala State	Participant

	source Geoinformatic tools' (TOGT-2011)	17 th Dec., 2013	s	studies & Research in geology, MES college, Ponnani	Council for Science Technology and Environment, Tvm	
11	Kerala Science Congress	29-31 st January , 2012	3days	Rubber Board, Kottayam	KSCSTE	Participant

3. Dr. Ajay K. K.

Internships

FLAIR National Internship at International Institute of Information Technology Bangalore (IIIT-B) on 'Course Design' based on ADDIE Model and Learning Management System, for one month from 02.02.2015 to 03.03.2015.

Trainings

- Application of isotope techniques in water resource management, March 2016, at Centre for water resources development and management, Kozhikode, Kerala, india
- Faculty Development Programme, July-August 2015, at Mahatma Gandhi University, Kottayam, Kerala, India.
- FLAIR (Fostering Linkages in Academic Innovations and Research) refresher training programme, July 2015, at Thiruvananthapuram, Kerala, India.
- Training programme of FLAIR, November 2014, on communication skill development at Sreekaryam, Thiruvananthapuram, Kerala, India.
- Five days induction training of FLAIR, November 2013, in modern teaching and learning methods, at Ulloor, Thiruvananthapuram, Kerala, India.
- Orientation programme, September-October 2013, organized by UGC-Academic Staff College, University of Calicut, Kerala, India.

Workshops

- Cluster workshop of Walk with Scholar Programme, January 2017, CMS College, Kottayam, Kerala, India.
- Workshop for question paper preparation of Scholar Support Programme, Department of Collegiate Education, Kerala, on October 2014, Ernakulam, Kerala, India.
- Workshop on "Precambrian plate tectonics: Recent advances from southern India and East Antarctica, January 2013, Department of geology, University of Kerala, Trivandrum, India.

Conferences

- National conference on "Recent trends in the tectonics of Peninsular India", 5 & 6 February 2016, Department of Geology, University of Kerala, Thiruvananthapuram, Kerala, India.
- Presented a paper on "Neo-tectonic activities and reactivation of structural lineaments along the southwest continental margin of India"

Seminars Participated

- Third UGC SAP DRS II Seminar on "Shear zones and crustal blocks of southern India", 15 & 16 February 2016, Department of Geology, University of Kerala, Thiruvananthapuram, Kerala, India.
- Presented a paper on "Continental crustal blocks and reactivated structural lineaments of Laccadive Ridge, southwest continental margin of india"

Conducted

- National seminar on "Earthquake: Prediction & Preparedness", January 2016, Government College, Kottayam, Kerala, India.

Attended

- National seminar on “Petroleum resources and exploration techniques”, December 2016, Government College, Kottayam, Kerala, India.
- National seminar on “Environmental Impacts of Mining on Western Ghats” March 2015, Government College, Kottayam, Kerala, India.
- National seminar on Human rights issues in early marriage, 17 October 2013, University of Calicut, Kerala, India.
- State wide seminar on “Ground water resources of Kerala: Retrospect and prospect”, March 2013, Government college, Kottayam, Kerala, India.
- National seminar on “Recent trends in petroleum exploration”, February 2010, Government College, Kasargod, Kerala, India.

4. Sri. SURAJ P R

- Participated in two day training in “**IT tools (MOODLE)**” organised by **ICT Academy of Kerala** at LBS Institute of Technology for Women, Poojappura, Thiruvananthapuram on 27th and 28th November 2015.
- Coordinated the seminar on “**Petroleum Resources and exploration techniques**” organized by Department of Geology, Government College, Kottayam on 20th and 21st December 2016
- Attended Seminar on “**Earthquake – Prediction and Preparedness**” organised by Department of Geology, Government College, Kottayam from 27th to 28th Jan 2016.
- Attended “**Orientation programme**” organised by UGC – Academic Staff College, Calicut from 9th Jan to 6th Feb 2015.
- Participated in FLAIR training programme on “**Communication skill development**” organised by New Initiative in Higher Education, Directorate of Collegiate Education, Govt. of Kerala from 14th to 15th Nov 2014.
- Participated “**Faculty development programme**” organised by Teaching Learning Centre (TLC), IIT, Madras from 4th to 6th August 2014.
- Attended One day workshop on World Soil day – 2013 at D C books auditorium, Kottayam, organised by Dept. of Soil survey and soil conservation, Government of Kerala on 5th Dec 2013
- Attended “**FLAIR Induction training programme**” on Good Learning at Centre for water Education, Thiruvananthapuram organised by New Initiative in Higher Education, Directorate of Collegiate Education, Govt. of Kerala from 28 Oct to 1st Nov 2013.
- Attended the seminar on “**Ground water resources of Kerala, Prospects and Retrospect**” organised by Department of Geology, Government College, Kottayam from 6 to 7th March 2013.
- **Ms. PRIYA P N** National seminar on “Environmental impact of mining on Western Ghats” held in 2015
- National seminar on “Earthquake : Prediction and Preparedness” held in 2016
 - National seminar on” Petroleum Resources and Exploration Techniques” held in December

C.IV MATHEMATICS						
C-1	Details about Teachers in each participating Department		a) Number, Name b) Permanent: 4 c) Temporary: Nil d) Part Time: Nil e) Adhoc/Re-employed: Nil f) Qualification(MSc/MPhil, PhD) g) Area of specialization h) list of publications in last five years (only in soft copy, if too long)			
	No. &Name	Qualificati on	Experien ce	Area of specialisation	List of publications	
	1.V.V.Jayalal	M.Sc	24 years	Formal Languages and Automata		
	2.Dr. Varghese Jacob	M.Sc, M.Phil, Ph D.	20 years	Stochastic Modelling	4	
	3.Dr.Jayaprasad P N	M.Sc, Ph.D	17Years	General Topology,Fra mes and Locales	3	
4.Dr.MadhavanNam poothiri N M	M.Sc, Ph.D	12 Years	Topology	7		
i) R&D projects received from different funding agencies indicating title, cost, duration, date of sanction, name of funding agencies				Minor Projects: 1 Assistance under UGC scheme		
Title & Name of Principal Investigator		Cost in lakhs	duration,	date of sanction,	name of funding agencies	status
Dr. Varghese Jacob- Study of customer and server induced interruption in queuing system with application in wireless networks.		1.75 lakhs	2 years	01/09/2013	UGC	Ongoing
C-2	Details about in service training for teachers of participating departments: Address a) – c) and give Additional inputs, if any Number attended during last five years under the following (duration and period)		a) Orientation Course (ASC/Identified Dept /College) b) Refresher Course c) Conferences/Symposia/Seminar/Workshop			

Name of the Faculty	Programme	Duration
1.Dr. Varghese Jacob	1.National Seminar on Free and Open Source Mathematical Software at Government College, Chittur	07/12/2012 to 09/12/2012
	2. 8 th International Conference on Matrix Analytic methods in Stochastic Models at NIT, Calicut	06/01/2014 to 10/01/2014
	3.International Conference on Semigroups, Algebra and Operator Theory at CUSAT	26/02/2014 to 28/02/2014
2.Dr. Madhavan Namboothiri N M	1.National Workshop on Topology	23/01/2016 to 22/03/2016
	2.National Seminar on Mathematical Analysis and Applications at University College, Thiruvananthapuram	28/01/2015 to 29/01/2015
	3.National Workshop on Multi variable Calculus and Applications at Department of Mathematics, Government College, Kasargod	02/12/2014 to 05/12/2014
	4.National Seminar on Analysis and Geometry at Government Brennen College, Thalassery	31/10/2014
	5.National Seminar on Excursions in Complex analysis and Differential Equations at Government College, Chavara	23/10/2013 to 25/10/2013
	6.National seminar on Fuzzy Graphs and Combinatorics, BCM College, Kottayam	06/03/2014 to 07/03/2014
	7.National Seminar on Category Theory at Devamatha College, Kuravilangad	07/12/2013
	8.National Seminar on recent Trends in Graph Theory, PTM Government College, Perunthalmanna	23/01.2012 to 24/01/2012
	9.National Seminar on Analysis and Geometry, S N College,alathur	13/02/2012 to 14/02/2012
3.Dr. Jayaprasad P. N	1.Refresher Course in Mathematics at Academic Staff College, University of Kerala, Kariavattom	05/09/2012 to 26/09/2012
	2. National seminar on Operator Theory and Fourier Analysis at Government College, Kottayam	18/02/2016 to 19/02/2016
	3.National seminar on Topology and Analysis at St. Paul's College, Kalamasserry	09/10/2014 to 10/10/2014
	4.Workshop on Latex and Python programming at Government College, Kottayam	14/02/2013 to 16/02/2013
	5.National Conference on Algebra and Number Theory at CUSAT	16/07/2012 to 18/07/2012
	6.National Seminar on recent Trends in Mathematics-topology and its Applications at Government College, Kottayam	09/02/2012 to 10/02/2012

LIST OF PUBLICATIONS – DEPARTMENT OF MATHEMATICS

(I) Dr. VARGHESE JACOB (Ph.D from CUSAT, 2012)

(1). Varghese Jacob , Srinivas R. Chakravarthy and A. Krishnamoorthy (2012) :On a Customer Induced Interruption in a service system. Stochastic Analysis and Applications, 30 : 6, 949--962, DOI: 10.1080/07362994.2012.704845, Taylor & Francis, USA. ISSN 0736-2994

(2). Krishnamoorthy, A and Varghese Jacob. (2012) : Analysis of Customer Induced Interruption in a multi server system. Neural, Parallel and Scientific Computations , 20, 153-172. Dynamic publishers, Inc, Georgia, USA ISSN 1061-5369.

(3) Dudin, A.N., Varghese Jacob and Krishnamoorthy, A. (2013), A multi-server queueing system with service interruption, partial protection and repetition of service. Annals of Operations Research, DOI 10.1007/s10479-013-1318, 3, Springer, New York, USA. ISSN 0254-5330.

(4). Varghese Jacob and Krishnamoorthy, A. (2014) :Analysis of customer induced interruption and retrial of interrupted customers. American Journal of Mathematical and Management Sciences. DOI 10.1080/01966324.2015.1042562, Taylor & Francis, USA. ISSN 01966324.

(II) Dr. JAYAPRASAD P. N.

(1). Jayaprasad, P. N and Johnson, T.P. (2012), Reversible Frames, Journal of Advanced Studies in Topology, Vol.3, No.2, (2012) 7-13.

(2). Jayaprasad, P. N and Johnson, T.P. (2012), Automorphism Group of Finite frames, International Journal of Algebra and Statistics, Vol.1:2 (2012), 118-123.(3). Jayaprasad, P. N (2013)

(3). On Singly Generated Extension of a Frame. Bulletin of Allahabad Mathematical Society, Vol 28,Part 2 (2013), 183-193.

(III) Dr. BLOOMY JOSEPH (Ph. D.from CUSAT 2008)

Papers published: **Three**

(1). Bloomy Joseph (2012) Some properties of Product closure spaces. Bulletin of Kerala Mathematical Association, Vol. 9, No. 2, (2012), 337-341.

(2). Bloomy Joseph (2013), A Note on mappings between closure and monotone spaces.. Bulletin of Kerala Mathematical Association, Vol. 10, No. 2, (2013), 117-121.

(3). Bloomy Joseph (2014),A Note on Fuzzy closure and fuzzy convexity spaces. Bulletin of Kerala Mathematical Association, Vol. 11, No. 1, (2014), 117-121.

Section-C: Faculty					
C.V PHYSICS					
C-1	Details about Teachers in each participating Department	a) Number - 9 , Name b) Permanent: 9 c) Temporary: Nil d) Part Time: Nil e) Adhoc/Re-employed: Nil f) Qualification (MSc/MPhil, PhD) g) Area of specialization h) list of publications in last five years (only in soft copy, if too long)			
FACULTY DETAILS : DEPARTMENT OF PHYSICS					
a. Number & Name	f. Qualification	Experience years	g. Area of specialisation	h. Publications	
				Journal	Seminar
1. Dr. R Pragash	M.Sc, PhD	25	Material science, Crystal growth	3	4
2. Jacob George	M.Sc, M.Phil	30	Material science,	1	
3. A K Sadanandan	M.Sc, B.Ed, PGDCA	11	Material Science	1	1
4. Dr. K S Sreelatha	M.Sc, M.Phil, PhD	15	Non Linear Dynamics , Photovoltaic	25	35
5. Dr. Lyjo K Joseph	M.Sc, PhD	7	Photonics	7	15
6. Dr. Sajeev U S	M.Sc, M.Phil, Ph.D	13	Material Science	15	30
7. Savithri Devi E	M.Sc	6	Theoretical Physics	5	
8. Sanal Raj	M.Sc	4	Material Science		
9. Mary Linsa K S	M.Sc	4	Applied Electronics	1	
i) R&D projects received from different funding agencies indicating title, cost, duration, date of sanction, name of funding agencies			Assistance under FIST scheme-0 level grant Major projects: 2 Minor Projects: 2		
DETAILS OF SPONSORED PROJECTS, DEPARTMENT OF PHYSICS					
Title	Name of Principal Investigator	Cost in lakhs	Duration and date of sanction	Name of Funding agencies	Status
Natural Dyes-a promising sensitizer for DSSCs	Dr. K S Sreelatha (PI)& Dr. Lyjo K Joseph (Co-I)	29.43	3 years (2016-18)	KSCSTE	ongoing

Development of composite nanofibers by electrospinning for photonic applications	Dr.Sajeev .U S	12.93	3 years (2012-15)	UGC	Completed
Energy transfer studies of some rare-earth oxalate crystals	Dr. R Pragash	0.225	2 years (2007-09)	UGC	completed
Synthesis and characterization of some Nano ferrites	Jacob George	1.45	2 years 2013-15	UGC	completed
Pedagogy project MHRD,	Dr.K.S.Sreelatha, (Co-Developer)		2 years (2014-16)	With Amrita University	Completed
FIST -0 level Grant	Participant department	90.00	3 years	DST	On going
C-2	of participating departments: Address a) – c) and give Additional inputs, if any Number attended during last five years under the following (duration and period)	a) Orientation Course (ASC/IdentifiedDept /College) b) Refresher Course c) Conferences/Symposia/Seminar/Workshop			
Sl No	Name of faculty	Programme	Date /Duration	Institute	
1	Dr. R Pragash	Refresher	completed	Kerala University	
2	Jacob George	Refresher	2012	ASC- Kannur	
3	A K Sadanandan	Orientation Refresher	3-31Dec 2012, 3-24 Dec 2016	ASC, HRDC- Calicut University ASC- University of Kerala	
4	Dr. K S Sreelatha	Orientation	2013	ASC- University of Kerala	
5	Dr. Lyjo K Joseph	Orientation Refresher	2013 3-24Dec 2016	ASC- University of Kerala ASC- University of Kerala	
6	Dr.Sajeev U S	Refresher Orientation	25/11/15- 15/12/15 10/8/16 to 06/9/16	ASC- University of Kerala ASC- University of Kerala	
7	Savithri Devi E	Orientation	3-31 January 2013	ASC- Kannur University	
8	Sanal Raj				
9	Mary Linsa K S	Refresher Orientation	25/11/15- 15/12/15 21/6/13 to 18/7/13	ASC- University of Kerala ASC- University of Kerala	

Seminar presentations included in the list of publications in the online copy

C. VI DEPARTMENT OF ZOOLOGY							
C-1	Details about Teachers in each participating Department <i>Details give below</i>		a) Number, Name b) Permanent: 5 c) Temporary: Nil d) Part Time: Nil e) Adhoc/Re-employed: Nil f) Qualification (MSc/MPhil, PhD) g) Area of specialization h) list of publications in last five years (only in soft copy, if too long) – Only one				
	Name	Qualification	Experience	Area of specialisation	Orientation/refresher/seminar/workshop attended		
					<i>Orientation</i>	<i>Refresher</i>	<i>Seminar/workshop</i>
	1. Dr. Sebastian K S	M.Sc, NET, PhD	10 years	Cell and molecular biology	1	2	8
	2. Dr. Sujatha S	M.Sc, NET, PhD	9 years	Environmental science	1	1	7
	3. Dr. Shiny K J	M.Sc, NET, PhD	7	Environmental science	1	1	12
	4. Dhanya Balakrishnan	M.Sc, NET	7	Marine Biology	1	-	6
	5. Sojomon Mathew	M.Sc, NET	3	Ornamental fishes	-	-	5
	i) R&D projects received from different funding agencies indicating title, cost, duration, date of sanction, name of funding agencies			Major projects : Nil Minor Projects : Nil Assistance under FIST scheme-0 level grant (participant Department)			
C-2	Details about in service training for teachers of participating departments: Address a) – c) and give Additional inputs, if any Number attended during last five years under the following (duration and period)			a) Orientation Course (ASC/Identified Dept /College) b) Refresher Course c) Conferences /Symposia/Seminar/ Workshop			
	Name of faculty	Programme	From	To	Institute		
	1. Dr. Sebastian K S	Orientation	13/07/2011	09/08/2011	ASC-University of Kerala		
		Refresher	22/11/2013	12/12/2013	ASC-University of Calicut		
		Refresher	09/11/2016	29/11/2016	ASC-University of Calicut		
	2. Dr. Sujatha S	Orientation	09/01/2010	07/02/2010	ASC-University of Kerala		
		Refresher	02/07/2014	22/07/2014	ASC-University of Kerala		
	3. Dr. Shiny K J	Orientation	26/04/2011	23/05/2011	ASC-University of Kerala		
		Refresher	16/01/2014	5/02/2014	ASC-University of Kerala		
	4. Dhanya Balakrishnan	Orientation	13/07/2011	09/08/2011	ASC-University of Kerala		

Section-D: Students**D. 1 BOTANY**

D-1	Student Details	<p>a) Student Statistics for last 5 years (i) Sl. No.,(ii) Year,(iii) No. of seats (iv) Mode of selection, (v) No. of students admitted,(vi) No. of students passed out,(vii) Category G, SC, ST, OBC,(viii) Sex M/F</p> <p>b) Do all students under-take a summer training/ research project? If yes, what is the duration. No. of students in each project</p> <p>c) Provide the list of projects undertaken by students in last 2 years</p>	<p><i>List attached</i></p> <p><i>Yes: Project/dissertation as part of curriculum</i> <i>All students</i></p>
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STUDENT STATISTICS FOR THE LAST 5 YEARS: DEPARTMENT OF BOTANY
MODE OF SELECTION: Common Admission Program of MG University

SL NO	YEAR	NO OF SEATS	NO. STUDENTS ADMITTED	GEN	SC	ST	OBC	MALE	FEMALE	NO. STUDENTS PASSED OUT
1	2016-17	24	24	6	3	1	14	2	22	20
2	2015-16	24	21	4	5	0	12	4	17	20
3	2014-15	24	23	5	4	1	13	6	17	22
4	2013-14	24	23	4	4	1	14	4	19	17
5	2012-13	24	24	6	5	0	13	3	21	24

DII DEPARTMENT OF CHEMISTRY**D2 : CHEMISTRY**

D-1	Student Details	<p>a) Student Statistics for last 5 years (i) Sl. No.,(ii) Year,(iii) No. of seats,(iv) Mode of selection, (v) No. of students admitted, (vi) No. of students passed out, (vii) Category G, SC, ST, OBC, (viii) Sex M/F</p> <p>b) Do all students under-take a summer training/research project? If yes, what is the duration? No. of students in each project</p> <p>c) Provide the list of projects undertaken by students in last 2 years</p>	<p>Attached</p> <p>Yes: as part of their curriculum, All Students</p> <p>On-Job Training Various Industries</p>
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STUDENT STATISTICS FOR THE LAST 5 YEARS: DEPARTMENT OF CHEMISTRY

Mode of admission: Common admission programme of Mahatma Gandhi University

SL NO	YEAR	NO OF SEATS	NO. STUDENTS ADMITTED	GEN	SC	ST	OBC	MALE	FEMALE	NO. STUDENTS PASSED OUT
1	2016-17	24	20	8	4	0	5	9	11	12
2	2015-16	24	22	8	4	0	5	10	10	13
3	2014-15	24	20	8	4	0	6	11	9	12
4	2013-14	24	20	7	3	0	5	16	4	11
5	2012-13	24	23	8	4	1	6	11	12	23

D III GEOLOGY			
D-1	Student Details	<p>a) Student Statistics for last 5 years (i) Sl. No., (ii) Year, (iii) No. of seats (iv) Mode of selection, (v) No. of students admitted, (vi) No. of students passed out, (vii) Category G, SC, ST, OBC, (viii) Sex M/F</p> <p>b) Do all students under-take a summer training/research project? If yes, what is the duration. No. of students in each project</p> <p>c) Provide the list of projects under-taken by students in last 2 years</p>	<p>Attached</p> <p>Yes : Field trip and collection of samples Analysis</p> <p>Attached</p>

D-1 A. STUDENT STATISTICS FOR THE LAST 5 YEARS: DEPARTMENT OF GEOLOGY

SL NO	YEAR	NO OF SEATS	MODE OF SELECTION	NO. STUDENTS ADMITTED	GEN	SC	ST	OBC	MALE	FEMALE	NO. STUDENTS PASSED OUT
1	2016-17	15	Central Allotment	14	7	2	-	5	10	4	12
2	2015-16	15	Central Allotment	16 (1 Marginal Increase)	7	3	1	5	7	9	14
3	2014-15	15	Central Allotment	15	5	1	1	8	8	7	14
4	2013-14	15	Central Allotment	15	5	3	1	6	6	9	15
5	2012-13	15	Central Allotment	18 (3 Marginal Increase)	7	3	1	7	9	9	17

D-1 c. List of projects undertaken by students in last 2 years

(COMMON REPORTS BASED ON FIELD VIST)

2016-17 – (a). Solid waste management of Poovanthuruthu Small Scale Industries, Kottayam
(b). Impacts of solid wastes in Meenachil River Basin around Kottayam

Municipality

(c). Impacts of house boats in Vembanad Lake and surrounding environment.

2015-16 – Study of heavy mineral variation in beach sand from Cherthala to Thottappally, Alappuzha Dist.

D IV MATHEMATICS										
D-1	Student Details	a) Student Statistics for last 5 years (i) Sl. No.,(ii) Year,(iii) No. of seats,(iv) Mode of selection,(v) No. of students admitted,(vi) No. of students passed out,(vii) Category G, SC, ST, OBC (viii) Sex M/F b) Do all students under-take a summer training/research project? If yes, what is the duration. No. of students in each project c) Provide the list of projects under-taken by students in last 2 years						Attached Yes As part of curriculum Attached		
SL NO	YEAR	NO OF SEATS	NO. STUDENTS ADMITTED	GEN	SC	ST	OBC	MALE	FEMALE	NO. STUDENTS PASSED OUT
1	2016-17	24	20	14	2	0	4	12	8	13
2	2015-16	24	19	10	2	0	7	7	12	18
3	2014-15	24	24	9	2	0	13	10	14	18
4	2013-14	24	24	15	4	0	5	9	15	20
5	2012-13	24	22	19	0	1	2	14	8	21

MATHEMATICS: LIST OF PROJECTS COMPLETED BY STUDENTS DURING 2016-2017

Sl.No.	TITLE
1	IMPROPER INTEGRALS AND ITS APPLICATIONS
2	INTRODUCTION TO INTERPOLATION
3	INTRODUCTION TO TOPOLOGY
4	AUTOMATA
5	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS
6	BOOLEAN ALGEBRA
7	VECTORS AND CONVEX SETS
8	INTRODUCTION TO INTEGRAL TRANSFORM
9	SYLOWS'S THEOREM

10	SOME APPLICATIONS OF EIGENVALUES AND EIGEN VECTORS
11	INTRODUCTION TO MEASURE THEORY
12	STUDY OF MAPPINGS ON COMPLEX PLANE
13	INTRODUCTION TO TOPOLOGY
14	STUDY ON OPERATIONS RESEARCH
15	FORMAL LANGUAGES AND AUTOMATA
16	INTRODUCTION TO LAPLACE TRANSFORMS
17	STUDY OF LAGRANGE'S THEOREM AND ITS INVERSE

D. V PHYSICS			
D-1	Student Details	a) Student Statistics for last 5 years b) Do all students under-take a summer training/research project? If yes, what is the duration. No. of students in each project c) Provide the list of projects under-taken by students in last 2 years:	Given below Yes : Dissertation work as part of Curriculum <i>One project for a group of 2 or 3 students</i> list attached

STUDENT STATISTICS FOR THE LAST 5 YEARS : DEPARTMENT OF PHYSICS

Mode of selection of students: **Common admission programme of Mahatma Gandhi University** based on merit

SL NO	YEAR	NO OF SEATS	NO. STUDENTS ADMITTED	GEN	SC	ST	OBC	MALE	FEMALE	NO. STUDENTS PASSED OUT
1	2016-17	24	23	8	5	0	5	10	13	17
2	2015-16	24	24	8	5	0	5	8	16	17
3	2014-15	24	16	7	4	0	5	9	7	16
4	2013-14	24	18	9	4	0	5	11	7	16
5	2012-13	24	22	11	5	0	6	11	11	20

LIST OF PROJECT/DISSERTATION, B.SC. PHYSICS 2016 AND 2017

1. Characterisation of dye intercalated montmorillonite clay mineral
2. Studies on the interaction of cellulose fibers with dyes and pigments
3. Development of lasing medium for random lasers- an investigation
4. Studies on graphene doped poly ethane oxide and polypyrrole thinfilms prepared by electrospinning
5. Dark sensor using LDR
6. Band gap energy of semiconductor diode
7. Structural characterization of TiO₂ nano particles
8. Study of absorption spectrum of water and cellulose fibre treated with NaOH

9. IR sensor module
10. A study on optical properties of Poly ethelene oxide membrane doped with silver nanoparticle
11. Study on the nano structure of the wings of morpho peleids Butterfly
12. Effect of graphene doping in the optical and structural properties of poly poly pyrrole
13. Studies on the magnetic properties of current
14. Electric oscillator circuit and its application using IC555
15. Determination of electron change using band gap method
16. Influence of spraying speed on particle speed on particle size of ZnO nanoparticles synthesised by spray pyrolysis method
17. Preparation of dye sensitized solar cell (DSSC) using alizarin dye :
18. Lawsons Dye complex : an efficient sensitizer for a dye sensitized solar cell

D. VI ZOOLOGY			
D-1	Student Details	a) Student Statistics for last 5 years – (i) Sl. No.,(ii) Year,(iii) No. of seats (iv) Mode of selection,(v) No. of students admitted,(vi) No. of students passed out,(vii) Category G, SC, ST, OBC,(viii) Sex M/F b) Do all students under-take a summer training/research project? If yes, what is the duration. No. of students in each project – c) Provide the list of projects under taken by students in last 2 years	Attached <i>Yes, each student – list given below</i> <i>List attached</i>

D-1 a. STUDENT STATISTICS LAST 5 YEARS : DEPARTMENT OF ZOOLOGY

SL NO	YEAR	NO OF SEATS	NO. STUDENTS ADMITTED	GEN	SC	ST	OBC	MALE	FEMALE	NO. STUDENTS PASSED OUT
1	2016-17	24	22	5	3	-	14	2	20	16
2	2015-16	24	22	2	3	1	16	6	16	14
3	2014-15	24	19	7	2	-	10	8	11	17
4	2013-14	24	18	4	-	-	14	3	15	14
5	2012-13	24	22	6	3	-	13	9	13	16

D-1 c. List of projects undertaken during the last two years: Department of Zoology

Sl. No	Project title	Student	Supervisor	Year
1	Biology and host preference of <i>Odiophorus longicollis</i>	Santhikrishna	Hayarnnisa M	2017
2	A study on essential oil repellents for land leeches	Jilu M G	Shiny K J	2017
3	Cognitive behavior of guppy	Gopika G	Shiny K J	2017

4	Studies on camouflage strategies among animals	Anju Santhosh	Sujatha S	2017
5	A study on the fish diversity of Nedumudi region of Vembanadu lake	Sherin Maria Thankachan	Sebastian K S	2017
6	Study on the antibacterial activity of <i>Allium cepa</i> and <i>Allium sativum</i> against <i>Escherichia coli</i> and <i>Staphylococcus aureus</i>	Indulekha S	Hayarnnisa M	2017
7	A study on the butterfly diversity in Govt. College, Kottayam campus	Ameena N	Dhanya Balakrishnan	2017
8	Studies on dengue fever and its vector in rural surroundings	Anakha Raj	Hayarnnisa M	2017
9	A study on the association between physical activity and incidences of diabetes in ward No.14 of Aymanam Panchayathu	Arya Mohan	Sebastian K S	2017
10	Effect of carbonated soft drinks on human teeth	Arya Muraleedharan	Sujatha S	2017
11	Amphibian diversity of Govt. College, Kottayam campus	Liji Krishna	Sujatha S	2017
12	A study on the preference and avoidance of <i>Drosophila</i> using spices	Saranya B	Dhanya Balakrishnan	2017
13	A study on the dragonfly diversity of Govt. College Kottayam campus and its surrounding	Abdul Khadher M	Sebastian K S	2017
14	A study on the pesticidal activity of plant extracts against larva and adult of <i>Tribolium castaneum</i>	Sruthy P K	Dhanya Balakrishnan	2017
15	Proximate composition of two commercially important fishes, <i>Sardinella longiceps</i> and <i>Euthynus affinis</i>	Lekshmi O	Sujatha S	2017
16	A study on the effect of wave length of light on movement of <i>Drosophila melanogaster</i>	Athira Shaji	Dhanya Balakrishnan	2017
17	A study on the quality and freshness of Sardine and Mackerel collected from Malappuram – Kottakal fish market	Ummu Habeeba Manappurath	Shiny K J	2017
18	Larvicidal effects of leaf extracts of <i>Adathoda vasica</i> and <i>Leucas aspera</i> on <i>Aedes aegypti</i>	Adithya M Balachandran	Hayarnnisa M	
19	A study on the paddy pests and their management methods in the paddy fields of Mankuttiyaadam, Vengola village, Ernakulam	Sneha Santhosh	Sebastian K S	2017
20	A study on the pest control of chick pea using medicinal plant extracts	Dhanya C Raj	Dhanya Balkrishnan	2017
21	Antibacterial activity of some essential oils	Karuna Krishna	Shiny K J	2017
22	A study on the diversity of gastropods in Neendakara fishing harbour	Akhil B Nair	Hayarnnisa M	2017

23	A study on biorepellents for land leeches	Athira Purushothaman	Shiny K J	2016
24	Larvicidal effect of plant extract against mosquito larvae	Anandu Suresh	Sujatha S	2016
25	A study on the aquatic insects in a part of Meenachil river ranging from Kanjiram to Thazhathangady	Habeeba K B	Sebastian K S	2016
26	Studies on the response of birds to different food colors	Aswathy K Unni	Sujatha S	2016
27	Studies on the habitat selection of antlion larvae – <i>Myremeleon crudelis</i>	Archana K Suresh	Hayarnnisa M	2016
28	A retrospective study on the incidences of communicable diseases reported at general hospital Kottayam during the period 2010 to 2015	Sruthy Suresh	Sebastian K S	2016
29	Toxicity in <i>Puntius filamentosus</i> exposed to pesticide REEVAS	Aswini Shaji	Shiny K J	2016
30	A study on the impact of stress on heart using Holmes and Rahe stress scale	Aswathy M	Dhanya Balakrishnan	2016
31	A study on relation between blood groups and diabetes	Arundhathy M	Sujatha S	2016
32	A study on the diversity of trash fishes from Azheekal harbor	Abhirami Sabu	Dhanya Balakrishnan	2016
33	A preliminary study on the biodiversity of Ayiramthengu mangrove – Kollam district	Harsha Chandran C	Sujatha S	2016

SECTION-E : CURRICULUM

E.I BOTANY		
E-1	a) Enclose copy of curriculum b) List of the practical experiments in the curriculum actually done by the students and practical demonstrated. c) When was the last exercise for curriculum revision undertaken? d) Specialization of the course	a) Separate sheet attached b) Separate sheet attached c) 2017 d) Horticulture , Medicinal plants

DEPARTMENT OF CHEMISTRY

SECTION-E : CURRICULUM

E-1	a) Enclose copy of curriculum b) List of the practical experiments in the curriculum actually done by the students and practical demonstrated. c) When was the last exercise for curriculum revision undertaken? d) Specialization of the course	a) Separate sheet attached b) Separate sheet attached c) 2017 d) Industrial Chemistry
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SEMESTER I AND II - CORE CHEMISTRY PRACTICALS CH2CRP01 - VOLUMETRIC ANALYSIS

Credits: 2 (72 Hrs)

A. Acidimetry and Alkalimetry

1. Strong acid-Strong base
2. Strong acid – Weak base
3. Strong base – Weak acid
4. Estimation of Na_2CO_3 and NaHCO_3 in a mixture
5. Estimation of NaOH and Na_2CO_3 in a mixture
6. Estimation of ammonia in ammonium salts by direct and indirect methods

B. Complexometric Titrations Using EDTA

1. Estimation of Zn
2. Estimation of Mg
3. Estimation of Mg and Ca in a mixture
4. Estimation of Ni
5. Determination of hardness of water

C. Oxidation – Reduction Titrations

(i) Permanganometry

1. Estimation of ferrous iron
2. Estimation of oxalic acid
3. Estimation of sodium oxalate
4. Estimation of calcium

(ii) Dichrometry

1. Estimation of ferrous iron using internal indicator

2. Estimation of ferrous iron using external indicator
3. Estimation of ferric iron using internal indicator
4. Estimation of ferric iron using external indicator

(iii) Iodimetry and Iodometry

1. Estimation of copper
2. Estimation of arsenious oxide

References:

1. A. I. Vogel 'A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis': (Third Ed.) (ELBS)
2. D.A.Skoog, D.M.West and S.R.crouch, Fundamentals of Analytical Chemistry, 8thEdn., Brooks/Cole Nelson.
3. Vogels Textbook of Quantitative Chemical Analysis, 6thEdn., Pearson Education Ltd.

**SEMESTER III AND IV ORGANIC CHEMISTRY
PRACTICALS- I
CH4CRP02 - QUALITATIVE ORGANIC ANALYSIS
Credit-2 (72 Hrs)**

1. Determination of physical constants of solids and liquids – melting and boiling points.
2. Tests for elements: Nitrogen, Halogens and Sulphur
3. Tests for unsaturation.
4. Tests for aromatic character.
5. Study of the reactions of the following functional groups: carboxylic acid, 1,2-dicarboxylic acid, phenol, aldehyde, ketone, ester, reducing and nonreducing sugars, polynuclear hydrocarbon, primary, secondary and tertiary amines, amides, diamide, nitro and halogen compounds.
6. Systematic analysis and preparation of solid derivative of the following organic compounds: carboxylic acid, 1,2-dicarboxylic acid, unsaturated acids, phenol, hydroxy acids, aldehyde, ketone, ester, reducing and nonreducing sugars, polynuclear hydrocarbon, primary, secondary and tertiary amines, amide, diamide, nitro and halogen compounds.

(Minimum twelve compounds to be analysed)

References

1. Furniss, B.S.; Hannaford, A.J.; Rogers, V. Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, 5th ed., Pearson Education, 2005.
2. Mann, F.G.; Saunders, B.C. *Practical Organic Chemistry*, 4th ed., Pearson Education, 2009.
3. Ahluwalia, V.K.; Dhingra, S. *Comprehensive Practical Organic Chemistry – Qualitative Analysis*, Universities Press, 2000.
4. Vishnoi, N.K. *Advanced Practical Organic Chemistry*, 3rd ed., Vikas Publishing House, New Delhi, 2010.

**PRACTICALS
SEMESTER V & VI
CH6CRP03 - QUALITATIVE INORGANIC ANALYSIS
Credit – 3 (108 Hrs)**

1. Study of the reactions of the following radicals with a view to their identification and confirmation. Ag^+ , Hg_2^{2+} , Pb^{2+} , Cu^{2+} , Bi^{2+} , Cd^{2+} , As^{3+} , Sn^{2+} , Sb^{3+} , Fe^{2+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Co^{2+} , Ni^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+} , Mg^{2+} , Li^+ , Na^+ , K^+ , NH_4^+ . CO_3^{2-} , S^{2-}

, SO₄²⁻, NO₃⁻, F⁻, Cl⁻, Br⁻, BO₂⁻, C₂O₄²⁻, C₄H₄O₆²⁻, CH₃COO⁻, PO₄³⁻, AsO₃³⁻, AsO₄³⁻ and CrO₄²⁻

2. Systematic qualitative analysis of mixtures containing two acid and two basic radicals from the above list without interfering radical and with one interfering radical by Semimicro method only. (Minimum of 10 mixtures to be analysed)

References

1. Vogel 'A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis': (Third Ed.) (ELBS)
2. G. Svehla, Text Book of Vogel's Macro and Semi-micro Inorganic Analysis, revised, Orient Longman.
3. V. V. Ramanujam, 'Inorganic Semi micro Qualitative Analysis', The National Publishing Co., Chennai,
4. W. G. Palmer 'Experimental Inorganic Chemistry', Cambridge.

CH6CRP04 - ORGANIC PREPARATIONS AND LABORATORY TECHNIQUES Credits-2 (72 Hrs)

A. Basic Laboratory Techniques

1. Crystallisation – Any four compounds using ethyl acetate, ethanol, and water - Record the yield of recovery.
2. Distillation - Purification of water and ethyl acetate-Record the yield of recovery.
3. Solvent extraction – aniline from water - methyl benzoate from water - using ether-
4. Record the yield of recovery. (*Any two experiments shall be done*).

B. Organic Preparations

Organic preparations involving:

1. Oxidation (benzaldehyde to benzoic acid).
2. Hydrolysis (methyl salicylate or ethyl benzoate to the acid).
3. Nitration (*m*-dinitrobenzene and picric acid).
4. Halogenation (*p*-bromoacetanilide from acetanilide).
5. Acylation (Benzoylation of aniline, phenol, *o*-naphthol).
6. Esterification (benzoic acid ester).
7. Iodoform from acetone or ethyl methyl ketone.
8. Side chain oxidation (benzyl chloride to benzoic acid).
9. Claisen – Schmidt reaction: Dibenzal acetone from benzaldehyde.

C. Chromatography

1. TLC - Separation and identification- Determination of R_f value of *o*- and *p*-nitroanilines, *o*- and *p*-chloroanilines, *p*-chlorophenol and *p*-nitrophenol, *p*-chloroaniline and *p*-nitroaniline, benzil and *o*-nitroaniline or any two amino acids.
2. Column Chromatography – Purification of *o*-nitro aniline, *o*-nitrophenol, benzil, *m*-dinitrobenzene, benzene azo *o*-naphthol (*non-evaluative*).

References

1. Furniss, B.S.; Hannaford, A.J.; Rogers, V. Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, 5th ed., Pearson Education, 2005.
2. Mann, F.G.; Saunders, B.C. *Practical Organic Chemistry*, 4th ed., Pearson Education, 2009.
3. Ahluwalia, V.K.; Aggarwal, R. *Comprehensive Practical Organic Chemistry – Preparation and Quantitative Analysis*, Universities Press, 2000.
4. Vishnoi, N.K. *Advanced Practical Organic Chemistry*, 3rd ed., Vikas Publishing House, New Delhi, 2010.

CH6CRP05 - PHYSICAL CHEMISTRY PRACTICALS

Credits 3 (108 hrs)

1. Viscosity – percentage composition of a mixture.
2. Heat of solution – KNO_3 , NH_4Cl
3. Heat of neutralization
4. Determination of equivalent conductance of an electrolyte
5. Conductometric titration – strong acid vs. strong base, weak acid-strong base
6. Transition temperature of salt hydrates. (Sodium thiosulphate, sodium acetate)
7. Determination of the surface tension of a liquid (Drop number method or Drop weight method)
8. Critical solution temperature of phenol-water system.
9. Effect of electrolytes on the CST of phenol-water system.
10. Molecular weight determination by Rast's method. (using naphthalene, camphor or biphenyl as solvent and acetanilide, p-dichlorobenzene etc. absolute.)
11. Kinetics of simple reactions eg. Acid hydrolysis of methyl acetate.
12. Potentiometric titration – Fe^{2+} vs. $\text{Cr}_2\text{O}_7^{2-}$, I^- vs. MnO_4^-
13. Data analysis of kinetic experiments using spreadsheet program (determination of rate constant)
14. Determination of equivalence point of potentiometric and conductometric titrations using spreadsheet program.

References

1. W. G. Palmer: 'Experimental physical chemistry', Cambridge University Press.
2. J.B. Yadav: Advanced Practical Physical Chemistry Goel Publishing House.
3. R.C. Das and B. Behra; 'Experiments in Physical Chemistry', Tata McGraw Hill.
4. K.K. Sharma : 'An Introduction of Practical Chemistry': Vikas Publishing House, New Delhi
5. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).

CH6CRP06 GRAVIMETRIC ANALYSIS

2 Credits (36 Hrs) – Semester VI only

1. Estimation of Barium as barium sulphate
2. Estimation of iron as Fe_2O_3
3. Estimation of sulphate as barium sulphate
4. Estimation of copper as cuprous thiocyanate
5. Estimation of nickel as nickel dimethyl glyoxime.

References

1. J. Mendham. R.C. Denney, J.D. Barnes and M. Thomas, *Vogel's Textbook of Quantitative Chemical Analysis*, 6th Edition, Pearson Education, Noida, 2013.
2. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, *Fundamentals of Analytical Chemistry*, 8th Edition, Brooks/Cole, Thomson Learning, Inc., USA, 2004.
3. G. D. Christian, *Analytical Chemistry*, John Wiley and Sons.
4. R. D. Day, A. L. Underwood, *Quantitative analysis*

COMPLEMENTARY COURSES

PRACTICAL-I

(Semester I and II)

(Common to Physical sciences, Life sciences, Geology and Family & Community sciences)

CH2CMP01 - VOLUMETRIC ANALYSIS

Credit – 2 (72 Hrs)

Standard solution must be prepared by the student.

1. Acidimetry and Alkalimetry

1. Standardization of HCl with standard Na₂CO₃ solution
2. Standardization of NaOH with standard oxalic acid solution
3. Estimation of any acid using standard NaOH
4. Estimation of any alkali using standard HCl.

2. Permanganometry

1. Standardization of KMnO₄ using (i) oxalic acid (ii) Mohr's salt
2. Estimation of Fe²⁺ in Mohr's salt and crystalline Ferrous Sulphate using standard KMnO₄.

3. Dichrometry

1. Estimation of Ferrous ions (external indicator)
2. Estimation of Ferrous ions (internal indicator)
3. Estimation of FeSO₄ · 7 H₂O (external indicator)

4. Iodimetry and Iodometry

1. Standardization of Iodine solution
2. Standardization of Sodium thiosulphate
3. Estimation of KMnO₄
4. Estimation of Copper

References

1. D. A. Skoog, D. M. West, and S. R. Crouch, *Fundamentals of Analytical Chemistry* 8th edn, Brooks/Cole Nelson
2. *Vogel's Textbook of Quantitative Chemical Analysis* 6th edn., Pearson Education. Ltd.
3. G. D. Christian, *Analytical Chemistry*, JohnWiley and Sons
4. R.D Day, A.L. Underwood, *Quantitative Analysis*, 6th Edn., Prentice Hall of India Pvt. Ltd.

PRACTICAL – II

(Semesters III and IV)

CH4CMP02 - PHYSICAL CHEMISTRY PRACTICALS

(For students who have opted Physical Sciences and Geology as Main)

Credit – 2 (72 Hrs)

1. Viscosity-percentage composition of sucrose solution.
2. Determination of Partition coefficient of a non-volatile solute
3. Transition temperature of salt hydrates, eg. Sodium thiosulphate Sodium acetate etc.
4. Critical solution temperature of phenol water system

5. Phase diagram of two component systems
6. Heat of Solution KNO_3 , NH_4Cl
7. Heat of neutralization
8. Determination of equivalent conductance of an electrolyte
9. Conductometric titration of strong acid Vs. strong base
10. Potentiometric titrations : Fe^{2+} Vs. $\text{Cr}_2\text{O}_7^{2-}$ and Fe^{2+} Vs. KMnO_4
11. Determination of molecular weight by Rast's method. (Using naphthalene, or biphenyl as solvent and acetanilide, p-dichlorobenzene etc. as solute)
12. Kinetics of simple reactions, e.g. Acid hydrolysis of methyl acetate

References

1. W. G. Palmer: 'Experimental physical chemistry', Cambridge University Press.
2. J. B. Yadav: Advanced Practical Physical Chemistry Goel Publishing House.
3. R. C. Das and B. Behra; 'Experiments in Physical Chemistry', Tata McGraw Hill.
4. K. K. Sharma : 'An Introduction of Practical Chemistry': Vikas Publishing House, New Delhi

CH4CMP03 - ORGANIC CHEMISTRY PRACTICALS

(For students who have opted Life Sciences and Family & Community Science as Core)

Credit – 2 (72 Hrs)

1. Tests for elements: Nitrogen, Halogen and Sulphur
2. Determination of physical constants
3. Study of reactions of common functional groups.
4. Qualitative analysis with a view to characterization of functional groups and identification of the following compounds: Naphthalene, anthracene, chlorobenzene, benzyl chloride, p-dichlorobenzene, benzyl alcohol, phenol, o-, m- and p- cresols, α -naphthol, β -naphthol, resorcinol, benzaldehyde, acetophenone, benzophenone: benzoic acid, phthalic acid, cinnamic acid, salicylic acid, ethyl benzoate, methyl salicylate, benzamide, urea, aniline, o-, m- and p- toluidines, dimethyl aniline, nitrobenzene, o-nitrotoluene, m-dinitrobenzene and glucose. (minimum of ten compounds to be analysed).
5. Organic preparation involving halogenation, nitration, oxidation, reduction, acetylation, benzylation, hydrolysis, diazotization.
6. Isolation of an organic compound from a natural source.

References:

1. A. I Vogel, *A Text Book of Practical Organic Chemistry*, Longman.
2. F. G. Mann and B.C. Saunders, *Practical Organic Chemistry*, 4th Edn., Pearson

Education.

3. V. K. Ahluwalia and S. Dhingra, *Comprehensive Practical Organic Chemistry*, Universities Press.

**VOCATIONAL PROGRAMME – INDUSTRIAL CHEMISTRY
SEMESTER I & II PRACTICAL
CH2VOP01 - INDUSTRIAL INORGANIC CHEMISTRY PRACTICAL
Credits-2 (72 Hrs)**

1. Simple Laboratory techniques: Crystallisation and distillation.
2. Estimation of copper in brass
3. Water Analysis
 - i) Estimation of dissolved oxygen by Winklers method
 - ii) Estimation of chloride in water
 - iii) Determination of total, temporary and permanent hardness using EDTA.
 - iv) Determine hydroxide alkalinity, carbonate alkalinity and bicarbonate alkalinity of the given water sample volumetrically.
 - v) Determination of Chemical Oxygen Demand (COD) of the given water sample.
4. Ore Analysis
 - i) To analyse the amount of calcium present in a given sample of limestone.
 - ii) Quantitative analysis of calcium and magnesium in dolomite by complexometric titration.
 - iii) Estimation of MnO₂ in pyrolusite.
 - iv) Estimation of Iron in iron ore.
5. Alloy Analysis
 - i) Estimation of copper in brass
 - ii) Estimation of zinc in brass
6. To determine the percentage of NaHCO₃ in a mixture of NaHCO₃ and NaCl.
7. Determination of weight percent of acetic acid in vinegar.
8. Determination of percentage of iron in Mohr's salt.
9. Determination of percentage of silica, calcium, magnesium and iron in the given cement sample.
10. Identification of cations in the mixture by paper chromatography.

References

1. D. A. Skoog, D. M. West, and S. R. Crouch, *Fundamentals of Analytical Chemistry*

8th edn, Brooks/Cole Nelson

2. Vogel's Textbook of Quantitative Chemical Analysis 6th edn, Pearsons Education Ltd.

3. R. D Day, A.L. Uderwood, Quantitative analysis, 6th Edn., Prentice Hall of India Pvt. Ltd.

4. Vogel's Qualitative Inorganic Analysis, 7th edn., Pearson Education Ltd. 7. A text book on experiments and calculation Engg. S.S. Dara., S. Chand & Company Ltd., Delhi.

5. Laboratory Manual on Engineering Chemistry, Dr. Subdharani, Dhanpat Rai Publishing.

6. Gurdeep Raj, Advanced Practical Inorganic Chemistry, Goel Publishing House.

SEMESTER (III&IV) PRACTICALS
CH4VOP02 - INDUSTRIAL ORGANIC CHEMISTRY PRACTICAL
Credits-2 (72 Hrs)

1. Unit Process:

One or two examples for each of the following unit process:

i) Nitration: Preparation of p-nitroacetanilide from acetanilide

ii) Sulphonation: Synthesis of 2,5-dimethylbenzene sulphonic acid from p-xylene

iii) Hydrolysis : Hydrolysis of methyl salicylate, ethyl benzoate and triglycerides

iv) Oxidation: Oxidation of cane sugar to oxalic acid, Preparation of p-nitro benzoic acid from p-nitro aniline.

v) Halogenation : 2,4,6-tribromoaniline

vi) Reduction: Preparation of m-nitroaniline from m-dinitrobenzene

vii) Polymerisation: Preparation phenol-formaldehyde resin and ureaformaldehyde resin

2. Determination of acid value, saponification value, and iodine value of oil.

3. Study of number of components in the organic mixture by TLC.

4. Synthesis of soap

5. Extraction of a known mixture: Separation of a mixture of aspirin, β -naphthol and naphthalene (or any other similar mixture) from one another and recrystallization of each component after separation.

6. Fractional distillation of a mixture of hexane and toluene.

7. Estimation of aspirin in the given tablet.

8. To determine the percentage purity of given sample of formaldehyde.
9. Separation of component from their mixture by fractional crystallization (acetanilideurea, Benzoic acid-oxalic acid).
10. Testing of turmeric powder, milk and mustard oil for adulterants.
11. Purification of an organic compound by column chromatography.

References

1. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
2. B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut.
3. Vogel's Text Book of Practical Organic Chemistry, Longman.
4. Steven F. Pedersen, and Arlyn M. Myers, Understanding the Principles of Organic Chemistry a Laboratory Course, Brooks/Cole.
5. V K Ahluwalia, SunitaDhingra, Adarsh Gulati, Practical Chemistry, Universities Press.
6. John Leonard, Barry Lygo and Garry Procter, Advanced Practical Organic Chemistry, CRC Press.
7. Zeba N. Siddiqui, Practical Industrial Chemistry, Anmol Publisher.

CH4VOP03 - INDUSTRIAL PHYSICAL CHEMISTRY PRACTICAL Credits - 2 (72 Hrs)

1. Colorimetry:
 - i) Estimation of Iron in water colorimetrically.
 - ii) Determination of molar absorptivity of Fe^{3+} .
 - iii) Verification of Beer Lambert's law and determination of strength of unknown solution.
2. Flame photometric estimation of Na^+ in the given solution.
3. Determination of dissociation constant of weak acid using pH-meter.
4. To determine the concentrations of strong acid and weak acid in a mixture by conductometric titration using a strong base.
5. Determination of flash point and fire point of oil by Pensky Martin apparatus.
6. Polarimetry:
 - i) Determine the specific and molecular rotation of an optically active substance like cane sugar at a number of concentrations.
 - ii) Determine the concentration of a given solution of an optically active substance by polarimetric measurement.

7. Viscosity Measurements:

- i) To determine the coefficient of viscosity of a given liquid with the help of Ostwald's viscometer.
- ii) To determine the molecular weight of a polymer by viscosity measurements.

8. Surface Tension:

- i) To determine the surface tension of the given liquid by drop-number method.
- ii) To determine the surface tension of the given liquid by drop-weight method.

9. Refractive index measurements:

- i) Determine the refractive index of given liquid by Abbe's refractometer and find the specific and molar refraction.
- ii) Determination of concentration of given KCl solution by refractive index measurements.

10. Determination of dissociation constant of a weak acid potentiometrically.

11. Determination of molecular weight of a non-volatile solute by elevation of boiling point using water as a solvent (solute: urea, glucose, sucrose).

12. Study of adsorption of oxalic acid from solution on activated charcoal.

E.III., DEPARTMENT OF GEOLOGY

SECTION-E : CURRICULUM		
E-1	a) Enclose copy of curriculum b) List of the practical experiments in the curriculum actually done by the students and practical demonstrated. c) When was the last exercise for curriculum revision undertaken? d) Specialization of the course	a) Separate sheets attached b) Separate sheet attached c) 2017 d) Nil

GEOLOGY: LIST OF PRACTICALS B.SC GEOLOGY

SEMESTER 1&2 (First Year)

PRACTICAL 1: MAP READING AND INTERPRETATION

- Topographic sheets interpretation- scale , legend, direction
- Classification of toposheets
- Interpretation of contours
- Identification of land form features from toposheets
- Identification of natural landscape elements from toposheets

Identification of drainage patterns from toposheets
 Slope calculation.
 Determination of latitude and longitude from toposheets.
 section of earth and earth spheres
 sketching Plate boundaries,
 sketching global distribution of earthquake,
 sketching volcanoes,
 sketching mountain belts
 Delineation of drainage basins from toposheets
 Identification & illustration of stream orders from toposheets
 Identification and representation of different landforms in toposheets
 Schematic representation of evolution of fluvial landform -youth, mature and old stages
 Diagrammatic representation of evolution of meandering stream
 Diagrammatic representation of hydrologic cycle
 Diagrammatic representation of drainage network,
 Diagrammatic representation of sand dunes
 Preparation of thematic maps
 Morphometric analysis of drainage basins
 Preparation of profile from contour maps and toposheets

SEMESTER 3&4 (Second Year)

PRACTICAL: CRYSTALLOGRAPHY AND MINERALOGY

Identification of crystal models and write the symmetry elements
 Identification of crystal models and write the forms present
 Write the face symbols and Miller indices of crystal models
 Identification of type of twinning in crystal models
 Identification of form/ habit present
 Identification of crystal system of minerals
 Identification of type of cleavage and / or fracture
 Identification of luster
 Identification of color and streak
 Identification of most important distinguishing physical properties

MINERALOGY

Megascopic study and identification of following minerals:

Quartz, smoky quartz, milky quartz, amethyst, chalcedony, agate, jasper, chert, opal,
 orthoclase, microcline, plagioclase, perthite, nephelene, leucite, enstatite, bronzite,
 hypersthene, diopside, augite, wollastonite, anthophyllite, tremolite, actinolite, hornblende,
 olivine, serpentine, muscovite, biotite, vermiculite, phlogopite, chlorite, epidote, garnet,
 natrolite, stilbite, apophyllite, talc, gypsum, apatite, steatite, andalusite, kyanite, sillimanite,
 staurolite, cordierite, apatite, beryl, topaz, calcite, dolomite, tourmaline, zircon, fluorite.
 magnetite, hematite, chromite, sphalerite, psilomelane, pyrolusite, graphite, corundum. (14
 hrs) Microscopic study of following minerals ,Quartz, microcline, orthoclase, albite,
 oligoclase, labradorite, nephelene, leucite, enstatite, hypersthene, augite, diopside,
 hornblende, tremolite, actinolite, anthophyllite, biotite, muscovite, olivine, epidote, diopside,
 garnet, chlorite, cordierite, andalusite, sillimanite, kyanite, staurolite, calcite, apatite, zircon,
 tourmaline.(22 hrs)

SEMESTER 5&6 (Third Year)

Petrology ,Palaeontology,Structural Geology and Economic Geology

1.Megascopic identification of the following rocks:

Mica Granite, Hornblende Granite, Graphic granite, Granite Porphyry, Pegmatite, Aplite,
 Syenite, Nepheline Syenite, Syenite porphyry, Diorite, Gabbro, Anorthosite, Dunite,

Pyroxenite, Dolerite, Basalt, Rhyolite, Felsites, Obsidian, Pumice, Scoria.
Slate, Phyllite, Schist (different types), Gneiss (different types), Quartzite, Marble,
Amphibolite, Eclogite, Leptynite, Charnockite, Khondalite, Mafic Granulite, Schorl rock,
Banded Magnetite Quartzite. Conglomerate, breccia, sandstone (coarse, medium, fine),
limestone (micritic, dolomitic, marl, oolitic, fossiliferous), mudstone, shale, fossiliferous
shale, black shale.

2. Microscopic identification and description of the following rocks:-

Mica Granite, Hornblende Granite, Graphic Granite, Granite – porphyry, Syenite,
Nepheline Syenite, Diorite, Gabbro, Dunite, Pyroxenite, Dolerite, Anorthosite, Basalt, Slate,
Chlorite schist, Mica schist, Kyanite schist, Garnetiferous schist, Charnockite, Eclogite,
Amphibolite, Leptynite, Khondalite, Cordierite gneiss, Garnet–sillimanite gneiss,
Garnetiferous Biotite Gneiss

Sandstone (different types), limestone (different types), shale

3. Identification and description of general morphological features of the following
fossils: Phylum Mollusca: Pelecepods, Gasteropods, Cephalopods.

Phylum Brachiopoda.

Phylum Echinodermata: Echinoidea.

Phylum Arthropoda: Trilobites.

Plant fossils: Glossopteris, Ptilophyllum

4. Diagrammatic illustration of –

1. Structural features –

Attitude of beds, true and apparent dip, strike and dip symbols, rules of ‘V’, types of Folds,
Faults, Joints and Unconformities.

5. Maps with suitable sections and geological descriptions

Simple horizontal beds.

Illustrating Rule of V’s

Simple dipping beds.

Simple dipping beds with intrusions

Problems involving bore hole data, thickness, dip and apparent dip.

Dipping beds with unconformity.

Folded beds.

Maps with different types of faults.

Combination maps (Unconformity, intrusion, folds and faults) – at least 5-6 maps

6. Problems involving true and apparent dip, true vertical thickness and width of outcrops.

Three point problems. Stereographic projection of planar and linear features. 7. Megascopic
identification and description of Indian occurrences & uses of the following ore and industrial
Minerals: -

Sulphides: Realgar, Orpiment, Stibnite, Molybdenite, Galena, Sphalerite, Chalcophyrite,

Pyrite Sulphates: Barite, Celestite, Gypsum, Oxides: Corundum, Hematite, Ilmenite,

Magnetite, Chromite, Cassiterite, Pyrolusite, Psilomelane, Goethite, Limonite, Bauxite,

Carbonates: Calcite, Dolomite, Magnesite, Siderite, Aragonite, Cerussite, Azurite, Malachite.

Industrial Minerals: Halite, Fluorite, Phosphatic Nodule, Monazite, Graphite, Coal and its
varieties, Asbestos.

PART- B

(Enclosed separately) with the online version of the application

E.III., DEPARTMENT OF MATHEMATICS

SECTION-E : CURRICULUM		
E-1	a) Enclose copy of curriculum b) List of the practical experiments in the curriculum actually done by the students and practical demonstrated. c) When was the last exercise for curriculum revision undertaken? d) Specialization of the course	e) Separate sheets attached f) Separate sheet attached g) 2017 h) Nil

E. IV PHYSICS		
E-1	a) Enclose copy of curriculum b) List of the practical experiments in the curriculum actually done by the students and practical demonstrated. c) When was the last exercise for curriculum revision undertaken? d) Specialization of the course	a) Separate sheets attached b) Separate sheet attached c) 2017 d) Material Science

B. SC. PHYSICS PRACTICALS

Minimum 14 experiments to be done in each paper. Minimum number of experiments for appearing practical examination is 8. Division of internal marks for record (maximum 10 marks).

No. of Experiments	Marks
14 and above	10
12 & 13	8
10 & 11	6
9 & 10	4
8	2

Familiarization Experiments (Not for examination)

1. Determination of density of a solid cylinder using vernier calipers and Common Balance
2. Determination of density of a glass plate using Screw gauge and common Balance.
3. Measurements using travelling microscope.
4. Spectrometer-standardization.
5. Determination of thickness of a glass plate and radii of curvature of concave and convex surfaces using Spherometer.
6. Identification of electronic components and testing using multimeter.

7. Voltage and frequency measurements using CRO.
8. 8085 microprocessor- Data Transfer

SEMESTER	PAPER	PAPER CODE	TITLE
1 & 2	01	PH2CRP01	Mechanics and Properties of Matter
3 & 4	02	PH4CRP02	Optics, Laser and Electronics
5 & 6	03	PH6CRP03	Electricity and Magnetism
5 & 6	04	PH6CRP04	Digital and Opto Electronics and Microprocessor
5 & 6	05	PH6CRP05	Thermal Physics, Spectroscopy and Properties of matter
5 & 6	06	PH6CRP06	Linear IC's and Solid State Physics

SEMESTER 1&2 (First Year)

Core Practical 1: PH2CRP01 - Mechanics and Properties of Matter

1. Symmetric compound pendulum
2. Kater's pendulum
3. Torsion Pendulum- Rigidity modulus
4. Young's Modulus- non uniform bending- pin and microscope
5. Young's modulus- uniform bending- Pin and Microscope
6. Young's modulus- Cantilever- Scale and telescope
7. Static Torsion- Rigidity Modulus.
8. Flywheel – moment of inertia
9. Melde's string- frequency
10. Sonometer- Verification of laws, Determination of density
11. AC Sonometer- frequency
12. Lissajous figures-CRO
13. Ultrasonic- Determination of frequency
14. Ultrasonic- Determination of velocity in a liquid
15. Liquid lens- Optical Constants- Boy's method
16. Liquid Lens- Refractive index of a liquid- Boy's method
17. Newton's Rings- Wavelength
18. Spectrometer- Prism- Refractive index of glass
19. Spectrometer- Hollow Prism- Refractive index of liquid
20. Spectrometer- Small angled prism- refractive index- Normal incidence
21. Air wedge –radius of a thin wire
22. Optical constants of a concave lens.
23. Determination of principle refractive indices for O-ray and E-ray using calcite or quartz prism.
24. Resolving power of a prism.
25. Resolving power of grating.

SEMESTER 3&4 (Second Year)

Core Practical 02: PH4CRP02- Optics, Laser and Electronics

1. Asymmetric Compound pendulum
2. Torsion Pendulum- Rigidity modulus- Equal mass
3. Young's modulus- uniform bending-Optic lever- Scale and Telescope
4. Young's Modulus- Cantilever-Oscillation Method

5. Fly wheel- Moment of Inertia- oscillation method.
6. One dimensional elastic collision- law of conservation of energy and momentum- Hanging sphere method.
7. Viscosity of a liquid- Constant Pressure head
8. Forward characteristics of a pn junction diode
9. Zener characteristics - forward and reverse
10. Half wave rectifier- Ripple factor and efficiency
11. Full wave rectifier- (center tap) Ripple factor and efficiency
12. Full wave rectifier- (bridge) Ripple factor and efficiency
13. FET-characteristics, determination of parameters.
14. Full wave rectifier with L & Π section filters Bridge/Center tap
15. Voltage regulator using zener diode
16. Diode clippers- (positive, negative and biased)
17. Diode clampers-(positive, negative and biased)
18. Voltage multipliers- doubler & tripler
19. OPAMP characteristics- CMRR and open loop Gain
20. OPAMP- inverter, non inverter and buffer
21. OPAMP- adder and subtractor
22. CE characteristics of a transistor
23. RC coupled common emitter amplifier- frequency response and bandwidth.
24. Phase shift oscillator using transistor.
25. Hartley oscillator
26. Colpitt's oscillator.
27. Amplitude modulation.
28. Voltage regulator using zener diode and transistor.

SEMESTER 5&6 (Third Year)

Core Practical 03: PH6CRP03- Electricity and Magnetism

1. Potentiometer- Resistivity
2. Potentiometer- Calibration of low range voltmeter
3. Potentiometer- Calibration of high range voltmeter
4. Potentiometer- Calibration of low range Ammeter
5. Tangent Galvanometer- Calibration of Ammeter
6. Moving coil galvanometer- emf of a thermocouple
7. Moving coil galvanometer- figure of merit
8. Mirror Galvanometer- figure of merit
9. BG- Measurement of high resistance by leakage method
10. Field along the axis of a coil- B_H
11. Searle's vibration magnetometer- magnetic moment
12. Deflection and vibration magnetometer- m and B_H
13. CF Bridge- resistivity
14. Conversion of Galvanometer into voltmeter
15. Conversion of Galvanometer into ammeter
16. LCR series resonant circuit analysis
17. LCR parallel resonant circuit analysis
18. Verification of Thevenin's and Norton's theorems
19. Verification of Superposition and Maximum power transfer theorems.
20. Spectrometer- Stoke's formula
21. Spectrometer- i - d curve
22. Spectrometer -Verification of Fresnel's equation for reflection of EM waves.
23. Spectrometer - wavelength of Sodium D1 and D2 lines

24. Spectrometer - wavelength of Mercury light using plane diffraction Grating.
25. Dispersive power - Grating-Spectrometer
26. Dispersive power- Prism- Spectrometer
27. Absorption Co-efficient of KMnO_4 / Iodine
28. Spectrometer- Cauchy's constants

SEMESTER 5&6 (THIRD YEAR)

CORE PRACTICAL 04: PH6CRP04 - DIGITAL AND OPTO ELECTRONICS AND MICROPROCESSOR

1. Realization of Logic gates- AND, OR and NOT-using diodes, transistors etc.
2. Realization of Logic gates- AND, OR and NOT-from universal gates.
3. Verification of De Morgan's theorems.
4. BCD to 7 segment decoder
5. Realization of Half adder using gates.
6. Realization of Full adder using gates
7. Astable Multivibrator using Transistor
8. Astable Multivibrator using IC 555
9. Monostable Multivibrator using Transistor
10. Monostable Multivibrator using IC 555
11. Pulse Width Modulation using IC555
12. D/A converter using IC 741(R-2R ladder type)
13. A/D converter using IC 741
14. RS Flip Flop
15. JK Flip Flop
16. Realization of XOR and Ex NOR using transistor.
17. Regulated power supply using zener diode and IC 741
18. Regulated power supply using 78XX/79XX etc.
19. Dual regulated power supply using 78XX/79XX etc.
20. Schmitt trigger using IC 741.
21. Sweep wave generator-(Normally OFF only)
22. 8085 Microprocessor Addition of two eight bit numbers and result exceed 8 bit.
23. 8085 Microprocessor- Multiplication of two eight bit numbers (result 16 bit)
24. 8085 Microprocessor – BCD Addition
25. 8085 Microprocessor- Largest/smallest among a group of 20 numbers
26. 8085 Microprocessor- Sorting in Ascending/ descending order

SEMESTER 5&6 (Third Year)

Core Practical 05: PH6CRP05 - Thermal Physics, Spectroscopy and Properties of matter

1. Characteristics of Thermistor
2. Newton's law of cooling- Specific heat
3. Newton's law of cooling- Emissive Power
4. Thermal conductivity of bad conductor- Lee's disc
5. Thermal conductivity of powder-Lee's disc
6. Thermal conductivity of Rubber
7. Thermal conductivity of glass using glass tube.
8. CF Bridge- Temperature co-efficient of resistance.
9. CF bridge determination of unknown temperature.
10. Measurement of Stefan's constant.
11. Heating efficiency of electrical kettle with varying voltages.
12. Thermal behavior of a electric bulb (filament/torch light bulb)

13. To study the variation of thermo emf (Seebeck effect) across two junctions of a thermocouple with temperature.
14. To study the variation of junction temperature (Peltier effect) across two junctions of a thermocouple with current.
15. Specific heat capacity of a solid by method of mixtures
16. Electrochemical equivalent of Copper
17. Boltzmann constant using V-I characteristic of PN diode.
18. Planck's constant using LEDs of at least 4 different colours.
19. To determine e/k using transistor.
20. Diode as a temperature sensor.
21. Young's Modulus- Koenig's Method- uniform bending
22. Elastic constants- Searl's method.
23. Determination of Poisson's ratio of rubber.
24. Surface Tension of a liquid- Capillary rise method
25. Viscosity- Stoke's method.
26. Viscosity of a liquid- variable Pressure head

SECTION-E : CURRICULUM		
E.VI ZOOLOGY		
E-1	a) Enclose copy of curriculum b) List of the practical experiments in the curriculum actually done by the students and practical demonstrated. c) When was the last exercise for curriculum revision undertaken? d) Specialization of the course	a) Separate sheet attached b) List given below c) 2017 d) BSc Zoology Model II aquaculture

E-1 b. List of practical in the curriculum : Department of Zoology

Sl. No.	Name of experiments	Remarks
1	PCR, Southern blot, western blot, northern blot	Demonstration
2	DNA isolation	Demonstration
3	Study of instruments –Autoclave, hot air oven, bacteriological incubator	
4	Preparation of solid and liquid culture media	Demonstration
5	Streak plate and isolation of colonies	Demonstration
6	Gram staining	
7	Antibiotic sensitivity test	Demonstration
8	Instrumentation – Colorimeter, centrifuge , pH meter	
9	Determination of ABO Blood group and Rh factor	
10	Vital staining of chick embryo	
11	Estimation of fecundity of fish	
12	Calculation of gonado somatic index	
13	Chromatography	Demonstration
14	RBC counting using Haemocytometer	

15	WBC counting using Haemocytometer	
16	Estimation of Haemoglobin	
17	Effect of hyper, hypo and isotonic solution on diameter of RBC	
18	Study of barr body in Human bucal epithelium	
19	Study of human karyotype	
20	Mounting of polytene chromosomes	
21	Preparation of human blood smear and identification of leucocytes	
22	Squash preparation of onion root tip for mitotic stages	
23	Estimation of dissolved oxygen in water	
24	Estimation of carbon dioxide in water	
25	MS Excel, word and power point	
26	Drawing of pie diagram, bar diagram and histogram	
27	Downloading of any Genome sequence and study of its characteristic features	
28	Downloading of any protein sequence and study of amino acid composition	
29	Study of macromolecule visualization tool	
30	Micrometry	
31	Identification of fishes and insects using taxonomic key	

PART B

TECHNICAL DETAILS OF THE PROPOSED PROGRAM

I. DEPARTMENT OF BOTANY

1. Executive summary

Objective: To create skill, knowledge and interest in identification, collection and conservation of plant specimen.-To create an awareness in UG students about the importance and conservation of plants.

2. Specific objective

- Equip the students to identify plant specimens.
- Equip the students with skill of associated techniques for identification, collection and preservation like permanent slide preparation, herbarium preparation, bottled specimen preparation for museum and maintaining live plants in green house for further studies.

3. measures take to improve the bench skills of the students

design of new practical's, hands on training, site visits

4. Measures to be undertaken to upgrade skills of faculty

- Conduct hands on training to teachers and promote them to use this skill in their research activities and guiding projects
- In collaboration with Department of Physics and chemistry, research on potential of plant extracts in energy harvesting and photovoltaics

5. Modification proposed in the curriculum

Preparation of permanent slides, preparation of local flora

6. Techniques for hands on training for students

- Field trip and collection followed by proper identification of plant specimens
- Herbarium preparation
- Permanent slide preparation for future studies

Beneficiaries: 72 students

7. Activities for laboratory staff

-Equipping them for proper maintenance of associated equipments, herbarium and plants in green house.

8. Involvement of visiting faculty

Lecture on **Sustainable approaches for conservation**

Practical: Herbarium techniques, Permanent slide preparation, preparation of bottles specimens

9. Additional practical proposed

Permanent slide preparation, microtome sectioning

10. Time line of activities

Activity	First Year	Second Year	Third Year
Lecture and hands on training for teachers and students	✓		
Field trip, specimen collection and preservation	✓	✓	✓
Preparation of local flora			✓

11. Outreach activities of school teachers and college teachers

- consultancy on organic farming,
- medicinal garden maintenance ,
- training for school teachers and public in above fields

II. DEPARTMENT OF CHEMISTRY

1. Executive summary

Undergraduate department of Chemistry, established in 2004, offers BSc Chemistry Model – II (Vocational) with Industrial Chemistry as the vocational subject and Mathematics as the complementary subject. The annual intake capacity of the programme is 24. The programme provides a healthy interface between Industry and Academics. Industrial visits in various prestigious institutions like FACT, HLL, Travencore Cements Ltd, CMRL, Apollo Tyres, MRF, etc. and industry based practicals are the highlights of this programme. Moreover, students undergo On-the-Job Training Programme in reputed industries as a part of their curriculum. The department is conducting complementary course for the students of the Departments of Physics, Geology and Botany, and an open course in the fifth semester of the UG programme, for the students of all streams. After the successful completion of the

programme, eligible students can apply for Masters in Chemistry or Industrial Chemistry. Furthermore, they have the opportunity to develop career as technologists and supervisors in process improvement, production formulation, testing and analysis, quality control and production in chemical, polymer and petrochemical industries.

2. Specific objectives (not more than one page) Chemistry

- Introduce some important practicals and experiments relevant to academia and industry
- Develop basic skills in the various qualitative and quantitative experiments in organic, inorganic, physical and analytical chemistry
- Build up skills in the analysis and interpretation of experimental data in chemistry practical
- Strengthen the laboratory work by providing hands on experience of latest practical and experimental methods.
- Generate interest in the subject through experiments
- Reinforce subject knowledge through hands on experiments.
- Design of new experiments
- Understand the scope interdisciplinary relevance of the subject.
- Create research interest among students
- Improve the efficacy of lab management.
- Provide exposure to the students through industrial visits and interaction with researchers, industrialists and scientists
- Extension and outreach activities.

3. Measures to be adopted to enhance bench skills of students, project work, summer training & industrial training (department wise); No. of beneficiaries in each.

1. Industrial visits in every semester of the programme (all students).
2. On the Job Training in reputed industries (all students).
3. Lectures and invited talks of researchers, scientists and industrialists through National Seminars and Irving-Langmuir Lecture series (all students).
4. Field based projects and their presentation using ICT (all students).
5. Industry based practical and experiments (all students).

4. Measures to be undertaken to upgrade skills of faculty by participation in faculty improvement programme

- Training programmes at academic colleges, universities and national research institutes.
- Strengthening of scientific and research collaboration with reputed research institutions and Universities inside and outside the country.
- Participation in the seminars and workshops
- Organizing seminars and invited talks by famous academicians, researchers, industrialists and scientists.
- Submission of more research projects to funding agencies like , UGC, DST , DBT , State Government etc.
- Training on academic writing.

5. Appropriate modifications proposed in curriculum to cover laboratory exposure to students and IPR & biosafety issues (details thereof department wise)

- Classes and training on safety issues in connection with chemistry practical and experiments.
- Workshops on good laboratory practices.
- Introduction of experiments having interdisciplinary relevance.
- Training programmes in prestigious industries.

6. Techniques to be included for hands on training to students (department wise); No. of beneficiaries in each.

- Analysis of water quality parameters - 24 per year
- Characterization of polymer samples – 24 per year
- Basic skills in organic synthesis -24 per year
- Preparation and characterization of nanoparticles -24 per year

7. Proposed activities for laboratory staff.

- ✓ Training on the operation of various sophisticated instruments.
- ✓ Training on the maintenance and management of equipment.
- ✓ Training on first aid, handling of emergency situations and lab safety issues.

8. Involvement of visiting faculty (details of lecture & practical's to be covered in each department)

- ✓ Organic synthesis lab
- ✓ Water quality analysis
- ✓ Preparation and characterisation of nanoparticles

9. Additional practicals proposed to be undertaken by the college (within prescribed curriculum of the university), practical which could not be conducted earlier due to lack of equipment or costly consumables. New equipment proposed to be purchased to be correlated with new additional practical.

<u>Sl No</u>	<u>Name of the experiments</u>	<u>Apparatus proposed</u>
<u>1</u>	Preparation of p-nitroacetanilide from acetanilide Synthesis of 2,5-dimethylbenzene sulphonic acid from p-xylene Hydrolysis of methyl salicylate, ethyl benzoate and triglycerides Oxidation of cane sugar to oxalic acid Preparation of p-nitro benzoic acid from p-nitro aniline. Halogenation : 2,4,6-tribromoaniline Preparation of m-nitroaniline from m-dinitrobenzene Preparation phenol-formaldehyde resin and urea formaldehyde resin	Laboratory glasswares and apparatus for preparation and synthesis of organic compounds
<u>2</u>	Extraction of a known mixture Separation of a mixture of aspirin, β -naphthol and naphthalene (or any other similar mixture) from one another and recrystallization of each component after separation. Fractional distillation of a mixture of hexane and toluene. Separation of component from their mixture by fractional crystallization (acetanilideurea, Benzoic acid-oxalic acid).	Laboratory glasswares and equipment for extraction, separation, distillation, fractional distillation and crystallization Magnetic Stirrer with Hot Plate Distillation Unit Glass Distillation apparatus Condensers Soxhlet apparatus
<u>3</u>	Study of number of components in the organic mixture by TLC. Purification of an organic compound by	TLC chromatographic accessories UV Chamber for TLC Automatic Kjeldahl Nitrogen

	column chromatography Estimation of nitrogen in samples Synthesis of nanoparticles	Analyser Laboratory ball mill for nanoparticle synthesis
4	Estimation of Iron in water colorimetrically. Determination of molar absorptivity of Fe ³⁺ . Verification of Beer Lambert's law and determination of strength of unknown solution. Conductometric titration using a strong base. Determination of dissociation constant of a weak acid potentiometrically. Determination of flash point and fire point of oil by Pensky Martin apparatus. Determine the specific and molecular rotation of an optically active substance like cane sugar at a number of concentrations. Determine the concentration of a given solution of an optically active substance by polarimetric measurement. To determine the molecular weight of a polymer by viscosity measurements. Determine the refractive index of given liquid by Abbe's refractometer and find the specific and molar refraction. Determination of concentration of given KCl solution by refractive index measurements.	Photoelectric Colorimeter Digital Potentiometer Digital Conductivity Meter pH Meter with Glass Electrode Abbe Refractometer Polari meter Viscometer Pensky Martin apparatus

10. Timelines for activities listed at 3-5 in each academic session indicating no. of proposed courses, no. of beneficiaries

Activity	1st Year	2nd Year	3rd Year
Inclusion of new experiments	√		
Training for faculty and laboratory staff	√	√	√
Training for undergraduate students		√	√
Conducting workshops /hands- on-training	√	√	

11. Outreach activities for school teachers and college teachers

Demonstration of experiments for school students
Training for school teachers to develop their basic experimental skills in chemical sciences.
Practical classes for students and research scholars to acquire skills in organic synthesis, water quality analysis and polymer characterization.

III. DEPARTMENT OF GEOLOGY

B.1. Executive Summary

Geology is the study of the structure, components and various exogenic & endogenic processes of the Earth. It deals with not only basic geologic principles but also economic mineral resources, petroleum & natural gas deposits and geomorphic features of the Earth. The study provides to the students basic knowledge of the Earth, and insights into various kinds of geological studies with an understanding how geology relate to the existence, development and welfare of human beings on the Earth.

Geology being basically a field subject, practical training on various aspects of geology is of utmost importance in Undergraduate training programme. At, present practical training is given to students with the limited facilities available especially with respect to study of satellite imageries and aerial photography. Similarly, a good collection of minerals and rocks have been procured. But some of the minerals and rocks are lacking. Good display facility is needed to arrange the rocks and minerals in a systematic way. Field training is an integral part of all the three years of undergraduate programme. Due to lack of funding this is limited. The funding under STAR scheme will help to overcome these shortcomings and so relevant. With the financial support under Star college scheme, state of the art training in remote sensing, mineralogy, petrology and structural geology can be imparted to the students. With funding for field study, detailed field training can be imparted to students par with those of national institutes.

B.2 Specific Objectives

The primary objective is to improve the existing facilities for practical works in the department and provide excellent field training for the undergraduate students in geology. The following are the specific objectives

- i) Procure satellite imageries and aerial photographs to provide basic skills in remote sensing.
- ii) Develop a good collection of minerals and rock and systematically arrange them in display tables to enhance the interest in students in mineralogy and petrology. Excellent training can be given with such good collection in practical identification of minerals and rocks in the field.
- iii) Full fledged optical lab with polarizing microscope and complete collection of thin sections of minerals and rocks is a basic requirement to provide state of art training in identification of minerals and rocks under microscope.
- iv) Elaborate field training of students during all the three years of the undergraduate programme would be boost to their practical training and would broaden their understanding on various aspects of geology. Workshops on emerging trends in geology would give an opportunity to acquaint with recent developments in geology.
- v) In addition the department is committed to implant the basic concepts of environmental geology for sustainable development of natural resources.

B.3 Measures to be adopted to enhance the skills of students

- Subscribe scientific journals of Geology and Geosciences
- Regular conduction of study tours and fieldworks
- Attend seminars and conferences

- Interaction with experts in various fields of Geology
- Visit to renowned geoscientific institutes and university departments

B.4. Measures to be undertaken to upgrade skills of faculty by participation in faculty improvement programme

- Attending workshops in geosciences & geo-informatics, and faculty development programmes conducted by various scientific institutions and universities
- Participation in geoscientific seminars and conferences
- Interaction with experts in specific fields of Geology

B.5. Appropriate modifications proposed in curriculum to cover laboratory exposure to student and IPR 7 biosafety issues.

Curriculum was recently revised (March 2017). All the faculty members were involved in these processes. Further modifications planned include:

- Incorporation of micropalaenotology and its application
- More number of practical papers (equal number of theory and practical papers)
- Incorporation of practical papers related to environmental issues like water quality and quantity, solid waste management

B.6. Techniques to be included for hand on training to students, No. of beneficiaries

- Practical on the basic skills in remote sensing.
- Practical sessions on megascopic identification of minerals, rocks and fossils
- Practical sessions on microscopic identification of minerals, rocks and fossils
- Occasional field training
- Workshops on emerging trends in geology to learn the latest techniques in geology

B.7. Proposed activities for laboratory staff

Training will be given to lab staff in identifying and scientifically displaying the mineral, rock and fossil specimens.

B.8. Involvement of visiting faculty (details of lecture and practical to be covered in each department)

The experts in the various fields will be the resource persons for the workshop planned for all the three years. The entire UG students from parent department and selected students from the neighboring department will benefit from this. Alumni working in eminent institutes in India and abroad regularly visit the department, interact with the students, motivate them and appraise of the latest developments in their respective fields.

B.9 Additional practicals proposed to be undertaken by the college (within prescribed curriculum of the university), practicals which could not be conducted earlier due to lack of equipment or costly consumables. New equipment proposed to be purchased to be correlated with new additional practicals.

Practicals prescribed in the syllabus are broadly covered at present. However, due to the lack of sufficient number of satellite imageries, aerial photographs, crystal models, minerals, rocks and fossils practicals are less efficient. With the new input, the practicals will be conducted more effectively. The following modifications of existing practical sessions are proposed:

- At present interpretation of satellite imageries and aerial photographs are limited to one satellite imagery and a hand few aerial photographs (stereopairs). With the

more number of satellite imageries and aerial photographs, more exercise can be undertaken.

- ii) Interpretation of soft copy satellite imageries is not possible right now. With the purchase of soft copies this will be carried out.
- iii) Application of GIS techniques on soft copies of satellite imagery imageries will be an additional exercise. The students will thus be introduced to the GIS software and its application in geological studies.
- iv) The basics of crystallography will be made easy and comprehensive with the new acrylic models purchased.
- v) The newly purchased minerals (especially, the rare rock forming minerals and ore minerals) helps the students to get acquainted with even the rare minerals.
- vi) Additional rocks (hand specimen and thin section) will help to conduct the practical sessions in petrology more effectively.
- vii) Identificatin and familiarization of fossils is required to understand their distribution over geologic past. The fossil collection is poor at present. With the purchase of new fossils the complete list of fossils can be made available for the practicals.
- viii) The display of minerals, rocks and fossils scientifically in the display table would help the students to familiarize the samples.

B.10. Timelines for activities listed at 3-5 in each academic session indicating no. of proposed courses, no. of beneficiaries:Time line for Measures to be adopted to enhance the skills of students

	First year		Second year		Third year	
	Odd sem.	Even sem.	Odd sem.	Even sem.	Odd sem.	Even sem.
Field study covering neighbouring state*	Yes		Yes		Yes	
Participation in seminars/workshop**	Yes	Yes	Yes	Yes	Yes	Yes
One day field works***	Yes	Yes	Yes	Yes	Yes	Yes

*Duration will be one week to two weeks** Number of seminars/workshop attending may vary according to events organized within the state *** Minimum number of two trips every semester.

Time line for Measures to be undertaken to upgrade skills of faculty

Refresher course- Two faculty every year

Short term course- Two faculty every year

Seminars/Conferences- At least three faculty every year

Interaction with experts- As and when experts visit the department (minimum one visit every two months) and during conferences, seminars and workshop.

Time line to modify curriculum

Curriculum is modified as per the directions of the Mahtama Gandhi University. Normally revision of curriculum is done every four years. Being the sole post graduate geology department under Mahtama Gandhi university, all the staff member are involved in the curriculum revision, as subject experts.

B.11. Proposed outreach activities for school teachers and college teachers per year.

In recent years, numbers of colleges have started undergraduate course in geology under Mahatma Gandhi University. Most of these departments lack proper lab facilities. Outreach programmes will target these college teachers. Geology is being taught at schools as part of geography and the teachers lack a proper training on various aspects of geology. Outreach programmes will be beneficial for these teachers as well. The list of activities planned is given below:

- i) Workshop for schools teachers across the state on the identification of mineral and rocks.
- ii) Workshop for college teachers on the megascopic and microscopic techniques in identification of mineral and rocks.
- iii) Expert lectures by the members of faculty on the various natural disasters like landslides, earthquake, draught, coastal erosion to teachers.
- iv) Organizing geology exhibition at schools and colleges.
- v) Hands on training for school teachers on toposheet interpretation and map reading.
- vi) Familiarization of geologic instruments like Brunton compass, clinometers stereoscope and polarizing microscope, reflecting microscope to teachers at school.
- vii) Practical training on water quality analysis for teachers.
- viii) Workshop for teachers to familiarize fossils.

Part B

Department of Mathematics

1. Executive summary : Mathematics

Department of Mathematics, Government College, Kottayam would like to get the assistance from the DBT to develop the quality of undergraduate educational programme. The scope of the subject is very wide in the sense that it finds application in almost all branches of Arts, Science and Engineering. The Department aims to make students equipped with skills for learning Mathematics in an advanced manner which leads one to pursue higher studies leading to research. The department also prepares students to apply the latest advancements in technology that helps a better understanding of the subject. The department is planning to improve its computer lab and smart class facilities with the addition of new hardware and software which facilitates the learning of the subject in a comprehensive way.

2. Specific objectives (not more than one page) Mathematics

- Understanding the subject in theory and practice
- Understanding the subject through hands on training.
- Design of new experiments
- Understanding the scope interdisciplinary relevance of the subject.
- Enhancement of student dissertation or project work which provides a platform for research in future.
- Strengthen the collaboration with other departments in the project and dissertation work
- Technical training for staff and students to improve the use of technology in mathematical learning.
- Development of communication skill of the students by peer learning system
- To create interest for research among students

- Provide exposure to the students through institutional visit, interaction with scientists
- Extension and outreach activities.

3. Measures to be adopted to enhance bench skills of students, project work, summer training & industrial training (department wise); No. of beneficiaries in each.

- Visit to academic institutions of repute/industries – 10 students per year
- Participation in academic contests- 5 per year
- Lectures by visiting faculty/scientists-5 per year
- Conducting workshops and hands on training.

4. Measures to be undertaken to upgrade skills of faculty by participation in faculty improvement programme

- Training programmes at academic colleges, universities and national research institutes.
- Strengthening of scientific and research collaboration with through research projects.
- Participation in the seminars and workshops
- Deliver invited talks in national and international seminars
- Submission of more research projects to funding agencies like , UGC, DST , DBT , State Government etc.
- Training/ workshop on research writing and elimination of plagiarism.

5. Appropriate modifications proposed in curriculum to cover laboratory exposure to students and IPR & biosafety issues (details thereof department wise)

Classes on recent advances in technology useful for mathematical learning

Workshops on Computational Softwares

Hands on training in Computational Softwares

Training on research writing to students

6. Techniques to be included for hands on training to students (department wise); No. of beneficiaries in each.

- Scientific Documentation- 24 per year
- Computational Software Training(Python, SAGE, R,, Mathematica etc.)-24 per year
- Training on softwares like GEOGEBRA -25 per year
- Proposed activities for laboratory staff.
- Software skill development

8. Involvement of visiting faculty (details of lecture & practicals to be covered in each department)

- Stochastic Processes
- Topology
- Algebra and Analysis

9. Additional practicals proposed to be undertaken by the college (within prescribed curriculum of the university), practicals which could not be conducted earlier due to lack of equipment or costly consumables. New equipment proposed to be purchased to be correlated with new additional practicals.

We propose to conduct lab training on the following softwares to all our students by increasing the capacity of our computer lab.

- LaTeX
- Programming in C, C++.
- GEOGEBRA, Python

10. Timelines for activities listed at iii-v in each academic session indicating no. of proposed courses, no. of beneficiaries

Activity	1 st Year	2 nd Year	3 rd Year
Modification of curriculum	✓		
Training for faculty and laboratory staff	✓	✓	✓
Training for undergraduate students		✓	✓

11. Outreach activities for school teachers and college teachers.

- Arranging talks on recent discoveries and developments in Mathematics
- Software Training in Computational Softwares can be given to school and college teachers

V. DEPARTMENT OF PHYSICS

1. **Executive summary: Physics**

Post graduate and research department of Physics Government College Kottayam seeking assistance from the DBT to improve the quality of undergraduate physics education. The indepth knowledge of the principle and working of devices and structures, the various phenomena of Physics and their application potential are vital for the students in their future. The scope and opportunity of the subject is vast and, an opportunity to conduct the experimental laboratory works in a sophisticated and a scientific manner, get chance to interact with eminent scientists and teachers, conduct project work which can be published in standard research journals, visiting of institutes of repute are planned in this programme. The process of research in the subject become interdisciplinary and the collaboration with the other beneficiary departments greatly help the students to select, and conduct their dissertation work successfully. The above mentioned orientation help the students to develop a critical and analytical thinking and expected to become more competent in their the understanding of research problems of practical importance in their younger age itself which contribute in the development of the nation in a greater way.

2. Specific objectives (not more than one page) Physics

- Strengthen the laboratory work by providing hands on experience of latest practical and experimental techniques using sophisticated and improvised instruments.
- Development of virtual lab systems to study and design the new experiments
- Understanding the subject through hands on experiments and develop a Standard operation of Procedure (SOPs)
- Understanding the scope interdisciplinary relevance of the subject to study the higher study/ research opportunities

- To create interest for research
- Enhancement of the students dissertation or project work in to publishable standard in journal of repute
- Strengthen the collaboration with other departments in the project and dissertation work
- Technical training for laboratory staff to improve the efficacy of lab management.
- Training of students in the safe and effective laboratory management
- Development of communication skill of the students by peer learning system, seminar and project presentations
- Provide exposure to the students through institutional visit, interaction with scientists
- Extension and outreach activities.

3. Measures to be adopted to enhance bench skills of students, project work, summer training & industrial training (department wise); No. of beneficiaries in each.

- Visit to academic institutions of repute/industries – 10 students per year
- Presentation of project report in national and international seminars-10 per year
- Lectures by visiting faculty/scientists-10 per year
- Conducting workshops on laboratory experiments

4. Measures to be undertaken to upgrade skills of faculty by participation in faculty improvement programme

- Training programmes at academic colleges, universities and national research institutes.
- Strengthening of scientific and research collaboration with IISc , IUAC, INUP etc through research projects.
- Participation in the seminars and workshops/inrenships
- Deliver invited talks in national and international seminars
- Submission of more research projects to funding agencies like UGC, DST , DBT , State Government etc.
- Training/ workshop on research writing and elimination of plagiarism.

5. Appropriate modifications proposed in curriculum to cover laboratory exposure to students and IPR & biosafety issues (details thereof department wise)

- Classes on safety issues on electricity and laser
- Workshops on good laboratory practices
- Introduction of experiments which has more scientific content and future research perspective
- Introduction of experiments having interdisciplinary relevance like experiments in nanotechnology , nano characterisation.
- Design of dissertation work in collaboration with other departments
- Training on research writing to students

6. Techniques to be included for hands on training to students (department wise); No. of beneficiaries in each.

- Laser experiments- 25 per year
- Virtual lab– all students -75 per year
- Laser based photonic experiments -25 per year
- Experiments on material science -25 per year
- Nano material synthesis and characterisation -10 [for dissertation work]

7. Proposed activities for laboratory staff.

- Electronic equipment maintenance and training on electronic component assembly and wiring

- Training on the working of devices like CRO, millimetre maintenance
- Computer hardware/software maintenance
- Laser based experiments, training on precautions and good laboratory practices
- Training on first aid, handling of emergency situations
- Training on stock maintenance and equipment/component keeping

8. Involvement of visiting faculty (details of lecture & practical's to be covered in each department)

- Photonics and fiber optics
- Computational Physics
- Nanotechnology and characterisation
- Electronics and semiconductor physics
- Research methodology and technical writing

9. Additional practicals proposed to be undertaken by the college (within prescribed curriculum of the university), practical which could not be conducted earlier due to lack of equipment or costly consumables. New equipment proposed to be purchased to be correlated with new additional practical.

<u>Sl No</u>	<u>Name of the experiments</u>	<u>Apparatus proposed</u>
<u>1</u>	1. Measurement of Stefan's constant, 2. Thermal behavior of an electric bulb (filament/torch light bulb). 3. Planck's constant using LEDs of at least 4 different colours. 4. Diode as a temperature sensor	Stefan's constant measurement apparatus Power meters, optical components , lasers , optical fibers
<u>2</u>	5. Characteristics of LED (Optical and electrical) 6. Characteristics of photodiode (Optical and electrical), 7. Characteristics of solar cell (Optical and electrical) 8. Numerical Aperture of an optical fiber- laser based 1. Bending losses of an optical fiber- laser based Single slit diffraction using laser- slit width.2. Laser- Width of a ircular Aperture 9. Diffraction patterns of single slit using laser source and measurement of its intensity variation using photodiode	Lasers, power meters, accessories Detectors
<u>3</u>	10. Determination of Band gap of semiconductor using diode equation (heating/cooling) 11. Determination of Band gap of a semi conductor using four probe method 12. Determination of Band gap using thermistor. 13. Determination of Dielectric constant of a thin sheet-	<i>Multipurpose sample holder and cell for high temperature four probe</i> and dielectric measurement of metallic, semi conducting and dielectric samples. Thin films , pellets and liquids. Rotary pump for isolation of the sample holder

	14. Determination of Dielectric constant of a liquid 15. Resistivity of Semiconductor -Four probe	
4	16. Band gap determination –absorption spectrum analysis- direct band gap material. 17. Band gap determination –absorption spectrum analysis- indirect band gap material	<u>Accessories of UV-Vis Spectrophotometer</u> <u>Cells, cuvettes and sample holders</u>
	18. Diffraction patterns of single slit using laser source and measurement of its intensity variation using photodiode. 19. Diffraction patterns of double slit using laser source and measurement of its intensity variation using photodiode 20. Photo sensor and comparison with incoherent source – Sodium light. 21. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light 22. Characterisation of solar cell	Experimental setup to demonstrate photoelectric effect Digital laboratory thermometer Solar cell characterization apparatus

10. Timelines for activities listed at 3-5 in each academic session indicating no. of proposed courses, no. of beneficiaries

Activity	1st Year	2nd Year	3rd Year
Inclusion of new experiments	√		
Training for faculty and laboratory staff	√	√	√
Training for undergraduate students		√	√
Conducting workshops /hands- on-training	√	√	

11. Outreach activities for school teachers and college teachers.

- Arranging demonstration programme on recent discoveries, developments in physics
- Demonstration of experiments for school children
- Training for school teachers in experimental physics
- Training on students and research scholars on solar cell fabrication technologies, nano synthesis and characterisation.

VI. DEPARTMENT OF ZOOLOGY

Technical Details of the Proposed Program

1. Half page executive summary indicating relevance and expected outcome

Under the star college scheme the department of zoology will train the students in basic molecular biology techniques and bioinformatics. The thrust area is

DNA bar coding and the students will be trained to identify microbes and other fauna by generating by generating DNA bar codes

2. Specific objectives (not more than one page)

- a. To train the students in basic molecular biological techniques.
- b. To enable the students to identify microbes and other fauna by generating DNA bar codes.

3. Measures to be adopted to enhance bench skills of students, project work, summer training & industrial training (department wise); No. of beneficiaries in each.

As a part of the curriculum students have to do individual projects or group project (not more than three members). With the support under this scheme, all these projects will be carried out at molecular levels and the main focus will be on identification of local fauna and microbes based on DNA bar codes. The students will also be trained in various molecular techniques like isolation DNA from various sources, primer designing, PCR, plasmid isolation, restriction digestion, transformation of bacteria and cloning of DNA fragments.

4. Measures to be undertaken to upgrade skills of faculty by participation in faculty improvement programme

As a part of the programme training will be provided to the faculty in molecular biological techniques by experts from neighbouring research institutions.

5. Appropriate modifications proposed in curriculum to cover laboratory exposure to students and IPR & biosafety issues (details thereof department wise)

Inclusion more molecular biological techniques like DNA bar coding and DNA cloning in the syllabus. IPR and biosafety issues given more importance in next syllabus revision.

6. Techniques to be included for hands on training to students (department wise); No. of beneficiaries in each.

Sl. No	Technique	No of beneficiaries
1	Isolation of pure cultures of bacteria	24 (Final year students)
2	Bacterial DNA isolations	24
3	PCR amplification of 16S rDNA	24
4	Sequencing of 16S rDNA (external)	24
5	Identification of isolates through BLAST	24
6	Isolation of DNA from fishes and insects	24
7	Generation of DNA bar codes PCR and DNA sequencing	24
8	Restriction digestion	24
9	Bacterial transformation	24
10	TA cloning and blue white selection	24

7. Proposed activities for laboratory staff.

Laboratory staffs will be trained in GLP and proper maintenance of instruments.

8. Involvement of visiting faculty (details of lecture & practicals to be covered in each department)

Dr. Radhakrishnan EK, Assistant Professor in Microbiology, MG University Kottayam, working in molecular microbiology will visit the department and provide proper guidance. In addition to this Dr. Remakanthan K, Assistant Professor of Botany, University

College, Thiruvananthapuram and Dr. Maju TT, Assistant Professor of Botany, Govt. College, Pattambi will visit our department upon our request. All of them are experts in molecular biology techniques.

9. Additional practicals proposed to be undertaken by the college (within prescribed curriculum of the university), practicals which could not be conducted earlier due to lack of equipment or costly consumables. New equipment proposed to be purchased to be correlated with new additional practicals.

Sl. No	Name of experiment
1	Isolation of pure cultures of bacteria
2	Bacterial DNA isolation
3	PCR amplification of 16SrDNA an sequencing
4	DNA bar coding of insect/fish
5	Isolation of plasmid DNA
6	Restriction digestion of DNA
7	Agarose gel electrophoresis
8	TA cloning and blue white selection

10. Timelines for activities listed at 3-5 in each academic session indicating no. of proposed courses, no. of beneficiaries

Activity	1 st year	2 nd year	3 rd year
Procurement of equipment and standardization of laboratory procedures	✓		
Training for faculty and laboratory staff		✓	✓
Conduct of practical and projects involving molecular biology techniques for under graduate students		✓	✓

11. Proposed outreach activities for school teachers and college teachers per year.

Workshop on molecular biological techniques will be conducted for college and school teachers in second and third years.

PART- C:**Department wise Budget Requirement:****C.I . DEPARTMENT OF BOTANY**

Sl.No	List of Equipment (Non-recurring)	Amount			
1	Camera attached stereo zoom microscope	85,000/-			
2	Stereoscopic microscope	17000/-			
3	Herbarium cabinet (4 nos)	130000/-			
4	Rotary microtome	68000/-			
5	Mounting table with genus folder and species folder	70,000/-			
6	Plant press (metallic frame)	60000/-			
7	Student stereo microscope (5 nos)	70000/-			
	Total	500000/- (Five Lakhs only)			
	Sl. No.	Ist Year	IInd Year	IIIrd Year	Total
	Non Recurring (not exceeding 5 lakhs)* List of minor laboratory equipment, (per department) with cost (attached)	5 lakhs	Nil	Nil	5
	Recurring (consolidated, not exceeding 2 lakhs)	2	2	2	6
	Total	7	2	2	11

Total Rs.11, 00,000/- (Rupees eleven lakhs only) for Department of Botany

C.II DEPARTMENT OF CHEMISTRY

Sl No	Equipment	Unit Price (Rs)	Quantity	Amount (lakhs)	
1	TLC chromatographic accessories	2000	4	0.08	
2	Automatic Kjeldahl Nitrogen Analyser	100000	1	1	
4	Laboratory ball mill for nanoparticle synthesis	190000	1	1.9	
5	Magnetic Stirrer with Hot Plate	6500	2	0.13	
6	Photoelectric Colorimeter	20000	2	0.4	
7	UV Chamber for TLC	15000	1	0.15	
8	Digital Potentiometer	10000	2	0.2	
9	Digital Conductivity Meter	10000	2	0.2	
10	pH Meter with Glass Electrode	5000	1	0.05	
11	Abbe Refractometer(occurring 0.001)	10000	2	0.2	
12	Polari meter	12000	2	0.24	
13	Distillation Unit	10000	1	0.1	
14	Organic synthesis glass apparatus	8000	1	0.08	
15	Glass Distillation apparatus	5000	2	0.1	
16	Condensers	8000	1	0.08	
17	Soxhlet apparatus	3000	3	0.09	
	Total			500,000 (Rupees five lakhs only)	
	Sl. No.	Ist Year	IInd Year	IIIRD Year	Total
	Non Recurring (not exceeding 5 lakhs)* List of minor laboratory equipment, (per department) with cost (attached)	5 lakhs	Nil	Nil	5
	Recurring (consolidated, not exceeding 2 lakhs)	2	2	2	6
	Total	7	2	2	11

C.III DEPARTMENT OF GEOLOGY

FIRST YEAR: NON - RECURRING LIST OF EQUIPMENT'S

Sl No.	Items required	Unit price (Rs. approx)	Qty required	Total cost (approx. Rs)
1	Rock thin sections in glass slides (representing igneous, metamorphic and sedimentary rocks)	1000.00	25 sections	25000.00
2	Rock hand specimens in glass slides (representing igneous, metamorphic and sedimentary rocks)	500	60	30000.00
3	Display Table for Rock hand specimens	25000	2	50000.00
4	Mineral thin sections in glass slides	1000.00	25 sections	25000.00
5	Mineral hand specimens	500	60	30000.00
6	Display Table for Mineral hand specimens	25000	2	50000.00
7	Crystal model with acrylic body (showing axis and plane)	7	100	7000.00
8	Arial Photographs and Satellite Imageries			80000.00
9	Pocket stereoscope	1000	20	20000.00
10	Toposheets and Storage Almirah		1 Set	40000.00
11	Brunton Compass	1000	10	10000.00
12	Geological Hammer	1000	8	8000.00
13	Fossils		50	10000.00
14	Binocular Paleontological Microscope	75000.00	1	75000.00
15	Magnetic stirrer	5000.00	1	5000.00
16	Books	25000		25000.00
17	Journal display table			10000.00
Total				5,00,000.00

Total Rs. 5,00,000/- (Rupees Five Lakhs only)

Sl. No.	Ist Year	IInd Year	IIIrd Year	Total
Non Recurring (not exceeding 5 lakhs)* List of minor laboratory equipment, (per department) with cost (attached)	5 lakhs	Nil	Nil	5
Recurring (consolidated, not exceeding 2 lakhs)	2	2	2	6
Total	7	2	2	11

Total Rs.11, 00,000/- (Rupees eleven lakhs only) for Department of Geology

C.IV DEPARTMENT OF MATHEMATICS

Sl.No	Item description	Quantity	Rate	Expected Cost
1	Desktop Computers	7	40,000	2,80,000
2	Digital Lecture System	1	20,000	20,000
3	LCD Projector, Screen & Fixing	2	50,000	1,00,000
4	Toshiba E Studio-257	1	1,00,000	1,00,000
	TOTAL			5,00,000/-
Sl. No.	Ist Year	IInd Year	IIIrd Year	Total
Non Recurring (not exceeding 5 lakhs)* List of minor laboratory equipment, (per department) with cost	5 lakhs	Nil	Nil	5
Recurring (consolidated, not exceeding 2 lakhs)	2	2	2	6
Total	7	2	2	11

Total Rs.11, 00,000/- (Rupees eleven lakhs only) for Department of Mathematics

C.V. DEPARTMENT OF PHYSICS

Sl No.	Item	Specifications	Rate	Quantity	Total
1	Precision Spectrometer	0.5 minute Least count	12000	2	24000
2	Travelling microscope	0.001cm least count both in horizontal and vertical movements	7500	2	15000
3	Travelling microscope for Newton's rings/ cornu's spiral airwedge experiment	0.001cm least count in horizontal	9000	2	18000
4	Experimental setup to demonstrate photoelectric effect	To study photoelectric effect and obtain Planck's constant	96000	1	96000
5	<i>Multipurpose sample holder and cell for high temperature four probe and dielectric measurement Rotary pump for isolation of the sample holder</i>	Measurement of dielectric constant and conductivity metallic, semi conducting and dielectric samples. Thin films , pellets and liquids.	80000	1	80000
6	<i>Rotary pump</i>	Evacuation of high temperature experimentsetc	30000	1	30000
7	Digital laboratory thermometer	Measurement range: up to 300°C .Accuracy:+1°C, Resolution:0.1°C	2000	2	4000
8	Dye for pelletizing unit Stainless steel	To make the material science sample in the form of pellets	6000	1	6000

	Mirror polished	for dielectric and conductivity studies.			
9	Solar cell characterization apparatus	I-V characteristics of a solar cell. fill factor, short circuit current, open circuit voltage	30000	1	30000
10	Diode laser	3 mW, 650nm	6000	1	6000
11	Diode laser	5 mW, 650nm	8000	1	8000
12	Diode laser	5mW, 532 nm	10000	1	10000
13	Optical fiber characterization –rail based apparatus- complete set	To study NA of single and multi mode fibers, bending loss, V number- instrument including, fibers, source, detectors etc	58000	1	58000
14	DC Regulated Variable Dual Power Supply	0-+/-15V, 1A	2500	2	5000
15	DC Regulated Variable Dual Power Supply	0-+/-30V, 2A	2500	2	5000
16	Regulated fixed DC power supply	With +/-5V, +/-12V, and +/-15V outputs	2500	2	5000
17	Stefan’s constant measurement apparatus	Determination of Stefan’s constant by a black body radiator by measuring voltage, current, temperature etc	20000	1	20000
18	Desktop computer With software	Virtual lab demonstration, IT oriented classes, E –content development	40000	2	80000
	Total amount	Rupees five lakhs only			500,000/-

Sl. No.	Ist Year	IInd Year	IIIrd Year	Total
Non Recurring (not exceeding 5 lakhs)* List of minor laboratory equipment,	5 lakhs	Nil	Nil	5
Recurring (consolidated, not exceeding 2 lakhs)	2	2	2	6
Total	7	2	2	11

Rupees 11,00,000/ (eleven thousand only) department of Physics

C.VI . DEPARTMENT OF ZOOLOGY

Department wise Budget Requirement: (Rs in lakhs)

Sl. No	Item description	No	Price	
1	Variable volume micropipettes	4 No.	95,000.	
2	Horizondal electrophoresis unit	1	25,000.	
3	Power pac for electrophoresis unit	1	95,000.	
4	Bacteriological incubator shaking	1	1,95,000. *	
5	pH meter	1	40,000.	
6	Illuminated compound Microscope	2 No	50,000.	
(Total)			5,00,000.	
Sl. No.	Ist Year	IInd Year	IIIrd Year	Total
Non Recurring (not exceeding 5 lakhs)* List of minor laboratory equipment, (per department) with cost	5 lakhs	Nil	Nil	5
Recurring (consolidated,not exceeding 2 lakhs)	2	2	2	6
Total	7	2	2	11

Total Rs.11, 00,000/- (Rupees eleven lakhs only) for Department of Zoology

* The department not so far equipped with bacteriological incubator and is very essential for microbial culture.

C.VII. FUND FOR MENTORING AND MONITORING

- An integrated internal review system is planned with collaboration with the IQAC of the college
- Publication of the Summary of project work of Undergraduate students
- Familiarisation of the science departments to the First year students from all science departments. This enable the skill development of students in interdisciplinary field and awareness
- Conduct seminars for the presentation of the dissertation work by students in college level and intercollegiate level
- Seeking advice from dignitaries through mentoring

Sl no	Item	Ist year	2 nd year	3 rd year	total
1	PUBLICATION OF DISSERTATION	0.05	0.05	0.05	0.15
2	SEMINARS /PROGRESS PRESENTATIONS	0.2	0.2	0.2	0.6
3	MENTORING	0.1	0.1	0.05	0.25
	TOTAL	0.35	0.35	0.3	1.00 lakhs

TOTAL ONE LAKH ONLY FOR MENTORING MONITORING

CONSOLIDATED EXPENDITURE: DEPARTMENT WISE

Sl No	Department	Budget in lakhs		
		Non-recurring	Recurring (Three years)	Total
1	BOTANY	5.00	6.00	11.00
2	CHEMISTRY	5.00	6.00	11.00
3	GEOLOGY	5.00	6.00	11.00
4	MATHEMATICS	5.00	6.00	11.00
5	PHYSICS	5.00	6.00	11.00
6	ZOOLOGY	5.00	6.00	11.00
	MENTORING AND MONITORING			1.00
	TOTAL	30.00	36.00	67.00

TOTAL AMOUNT: RUPEES SIXTY SEVEN LAKHS ONLY



GOVERNMENT COLLEGE KOTTAYAM

NATTAKOM P O,

KOTTAYAM DISTRICT, KERALA-686013

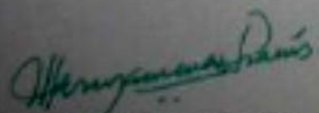
(Affiliated to Mahatma Gandhi University, Kottayam

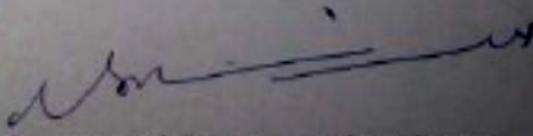
Re-accredited by NAAC with "A" grade)

PHONE :0481-2363116, FAX: 0481-2363116

Email: gckottayam@gmail.com, website: <http://gckottayam.ac.in>

Total budget for all departments	Rs.67,00,000/- (Rupees Sixty seven lakhs only)
Total non-recurring :	Rs.30,00,000/- (Rupees thirty lakhs only)
Total recurring :	Rs.36,00,000/- (Rupees thirty six lakhs only)
Mentoring and monitoring	Rs.1,00,000/- (Rupees one lakhs only)


**Signature of the executive authority
of the institute/University with seal**


Signature of Programme Coordinator

Date :10.07.2017
**Principal
Government College
Kottayam**



Dr. SAJEEV US
Assistant Professor
Department of Physics
Govt. College, Kottayam

ANNEXURE 1

PART C

THE LIST OF RECURRING ITEMS PROPOSED BY THE DEPARTMENTS

C. 1 DEPARTMENT OF BOTANY

1st year			
Sl. No	Description of items	Amount	Total
1	Chemicals, glass wares, specimens	1,40,000.00	2,00,000.00
2	Contingency	20,000.00	
3	Visits, projects , seminars	40,000.00	
2nd year			
1	Chemicals and kits	1,20,000.00	2,00,000.00
2	Contingency	20,000.00	
3	Visiting faculty lectures and training for teachers (other institution)	30,000.00	
4	Students Projects	20,000.00	
5	Visit to academic institutions/industry	10,000.00	
3rd year			
1	Chemicals	1,20,000.00	2,00,000.00
2	Contingency	20,000.00	
3	Project work of students	20,000.00	
4	Visiting faculty lectures and training for teachers from other institutions	30,000.00	
5	Visit to academic institutions/industry	10,000.00	

C.2 DEPARTMENT OF CHEMISTRY

Sl No.	Item	Year I	Year 2	Year 3	Total
		Rs	Rs	(Rs)	
1	Software's	5000	5000	5000	15000
2	Atomic and molecular models	10000	10000	10000	30000
3	Crystal models	15000	15000	15000	45000
4	Spares for electrical apparatus , Hood, Distilled water for UPS, etc	20000	20000	20000	60000
5	Chemicals	40000	40000	40000	120000
6	Glasswares	40000	40000	40000	120000
7	Accessories for equipment	15000	15000	15000	45000
8	Stationery and office expenses	5000	5000	5000	15000
9	For conducting seminars, workshops, training programme, In-house hands-on training for college teachers, School teachers.	20000	20000	20000	60000
10	Industrial and institutional visits for students	20000	20000	20000	60000
11	Training of students	10000	10000	10000	
		200000	200000	200000	6,00,000
TOTAL RUPEES SIX LAKHS ONLY					

C. 3 DEPARTMENT OF GEOLOGY

RECURRING - FIRST YEAR

Sl No.	Items required	Amount	Remarks
1	Field Training and Project work	1,10,000.00	Study tour and Geological field mapping is part of syllabus of B.Sc. Geology. Study tour is compulsory for all three batches (1, 2 and 3 year)
2	Workshop on 'Emerging Trends in Fluid Inclusion Studies'	60,000.00	Participants are students and members of faculty from different disciplines of science from various colleges and university departments offering Geology/ Environmental Science
3	Maintenance of Mineralogy and Petrology Lab	5,000.00	Maintenance of Microscopes and purchase of accessories
4	Journals	10,000.00	Journals pertaining to geology
5	Faculty Enrichment Programme	15,000.00	Covers expenditures (TA, DA, Registration fees, course fees, etc) for participating seminars, conferences, workshops by members of faculty

	TOTAL	2,00,000.00
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RECURRING - SECOND YEAR

Sl No.	Items required	Amount	Remarks
1	Field Training and Project work	1,10,000.00	Study tour and Geological field mapping is part of syllabus of B.Sc. Geology. Study tour is compulsory for all three batches (1, 2 and 3 year)
2	Workshop on 'Emerging Trends in Fluid Inclusion Studies'	60,000.00	Participants are students and members of faculty from different disciplines of science from various colleges and university departments offering Geology/ Environmental Science
3	Maintenance of Mineralogy and Petrology Lab	5,000.00	Maintenance of Microscopes and purchase of accessories
4	Journals	10,000.00	Journals pertaining to geology
5	Faculty Enrichment Programme	15,000.00	Covers expenditures (TA, DA, Registration fees, course fees, etc) for participating seminars, conferences, workshops by members of faculty
	TOTAL	2,00,000.00	

RECURRING - THIRD YEAR

Sl No.	Items required	Amount	Remarks
1	Field Training and Project work	1,10,000.00	Study tour and Geological field mapping is part of syllabus of B.Sc. Geology. Study tour is compulsory for all three batches (1, 2 and 3 year)
2	Workshop on 'Emerging Trends in Fluid Inclusion Studies'	60,000.00	Participants are students and members of faculty from different disciplines of science from various colleges and university departments offering Geology/ Environmental Science
3	Maintenance of Mineralogy and Petrology Lab	5,000.00	Maintenance of Microscopes and purchase of accessories
4	Journals	10,000.00	Journals pertaining to geology
5	Faculty Enrichment Programme	15,000.00	Covers expenditures (TA, DA, Registration fees, course fees, etc) for participating seminars, conferences, workshops by members of faculty
	TOTAL	2,00,000.00	

C.4 DEPARTMENT OF MATHEMATICS

Sl.No	Item description	First year	Second year	Third year	Total
1	Journals & Books	50,000	50,000	50,000	150000
2	Short Term Training Program, advanced soft wares	60000	60000	60000	180000
3	Maintenance of computer lab, software up gradation	30000	30000	30000	90000
4	Extention activities , seminars , visits	60000	60000	60000	180000
5	Publication of project reports , research	15000	15000	15000	45000
6	Consumables/stationary	5000	5000	5000	15000
	TOTAL	2,00,000	2,00,000	2,00,000	6,00,000

C.5 DEPARTMENT OF PHYSICS

Sl No.	Item	Rate	Quantity required	Total
1	Software's	5000	3 years	15000
2	Mechanics and thermal experiments Components and consumables	10000	3 years	30000
3	Components for optical instruments	10000	3 years	30000
4	Electronic components like bread board , Batteries for MultiMate's ICs, Distilled water for UPS,	20000	3 years	60000
5	Chemicals, substrates for thin films like electrodes etc for the material Science and nano science experiments	50000	3 years	150000
6	Analysis charge , in-house facilities, equipment maintenance	20000	3 years	60000
7	Analysis charges, students Dissertation	20000	3 years	60000
8	Stationary and office expenses	5000	3 years	15000
9	For conducting seminars, workshops, training programme, In-house hands-on training for college teachers, School teachers.	20000	3 years	60000
10	Virtual instrumentation , softwares and training	10000	3 years	30000
	Training of students	10000	3 years	30000
11	Students institutional visit visit	20000	3 years	60000
		2,00,000	3 years	6,00,000

C. 6 DEPARTMENT OF ZOOLOGY

1st year			
Sl. No	Description of items	Amount	Total
1	Chemicals, kits and glass wares	1,60,000.00	2,00,000.00
2	Contingency	20,000.00	
3	DNA sequencing charges	20,000.00	
2nd year			
1	Chemicals and molecular biology kits	1,20,000.00	2,00,000.00
2	Contingency	20,000.00	
3	Visiting faculty lectures and training for teachers (other institution)	30,000.00	
4	DNA sequencing charges	20,000.00	
5	Visit to academic institutions/industry	10,000.00	
3rd year			
1	Chemicals and molecular biology kits	1,20,000.00	2,00,000.00
2	Contingency	20,000.00	
3	DNA sequencing charges	20,000.00	
4	Visiting faculty lectures and training for teachers from other institutions	30,000.00	
5	Visit to academic institutions/industry	10,000.00	

ANNEXURE II

PART A- SECTION C

DETAILS OF FACULTY & LIST OF PUBLICATIONS

Statistics of the qualifications of faculty members in science departments

SL NO	NAME OF THE DEPARTMENT	NUMBER OF TEACHERS	MALE	FEMALE	PH.D HOLDERS	*M.PHIL/ M.TECH	PERSUING PHD
1	BOTANY	4	1	3	1	0	2
2	CHEMISTRY	6	2	4	2	3	2
3	GEOLOGY	7	6	1	3	1	1
4	MATHEMATICS	4	4	0	3	0	0
5	PHYSICS	9	6	3	4	1	2
6	ZOOLOGY	5	2	3	3	0	1
	TOTAL	35	21	14	16	5	8

- PHD WITH M.PHIL NOT COUNTED

PART A –SECTION C – LIST OF PUBLICATIONS OF FACULTY MEMBERS

C.1 DEPARTMENT OF BOTANY

1. Anwar, K., & Haneef, J. (2015). Ethnobotanical plants used for postnatal care by traditional practitioners from Kozhikode district, Kerala, India. 2015, 5(4), 570-581
2. Haneef, J. Parvathy, M., Sithul, H., & sreeharshan, S. (2012). Bax translocation mediated mitochondrial apoptosis and caspase dependent photosensitizing effect of *Ficus religiosa* on cancer cells. PloS one 7(7), e40055

C.2 DEPARTMENT OF CHEMISTRY –PAST 3 YEARS List of Publications in Peer reviewed journals (last three years)

1. JyotishkumarParameswaranpillai, Sisanth Krishnan Sidhardhan, P. Harikrishnan, Jürgen Pionteck, SuchartSiengchin, AparnBeenaUnni, Anthony Magueresse, Yves Grohens, NisharHameed, Seno Jose, Morphology, thermo-mechanical properties and surface hydrophobicity of nanostructured epoxy thermosets modified with PEO-PPO-PEO triblock copolymer, *Polymer Testing* 59 (2017) 168-176. Publishers: Elsevier, Impact factor: 2.24

2. Seno Jose, Sabu Thomas, Jyotishkumar P., AbiSanthoshAprem, J. Karger-Kocsis. Dynamic Mechanical Properties of Immiscible Polymer Systems with and without Compatibilizer, *Polymer Testing*, 44 (2015), 168-176. Publishers: Elsevier, Impact factor: 2.24
3. Jyotishkumar Parameswaranpillai a, Vivek Kumar Dubey, K.S. Sisanth, Seno Jose, Ajesh K. Zachariah, Suchart Siengchin, Nisa V. Salim, Nishar Hameed, Tailoring of interface of polypropylene/polystyrene/carbon nanofibre composites by polystyrene-block-poly(ethylene-ran-butylene)-block polystyrene, *Polymer Testing* 51 (2016) 131-141, Publishers: Elsevier, Impact factor: 2.24
4. Jyotishkumar Parameswaranpillai, Sisanth Krishnan Sidhardhan, Seno Jose, Nisa V. Salim, Suchart Siengchin, Jürgen Pionteck, Anthony Magueresse, Yves Grohens, Nishar Hameed, Micro phase separated epoxy/poly(ϵ -caprolactone)-block poly (dimethylsiloxane)-block-poly(ϵ -caprolactone)/4,4'-diaminodiphenylsulfone systems: Morphology, viscoelasticity, thermo-mechanical properties and surface hydrophobicity, *Polymer Testing* 55 (2016) 115-122. Publishers: Elsevier, Impact factor: 2.24
5. Jyotishkumar Parameswaranpillai, Sisanth Krishnan Sidhardhan, Seno Jose, Nishar Hameed, Nisa V. Salim, Suchart Siengchin, Jürgen Pionteck, Anthony Magueresse, Yves Grohens, Miscibility, phase morphology, thermo-mechanical, viscoelastic and surface properties of PCL modified epoxy systems: Effect of curing agents, *Ind. Eng. Chem. Res.*, 55 (2016), 10055-10064. Publishers: American Chemical Society, Impact factor: 2.567
6. Seno Jose, Jyotishkumar Parameswaranpillai, Bejoy Francis, AbiSanthoshAprem, and Sabu Thomas, Thermal degradation and crystallization characteristics of multiphase polymer systems with and without compatibilizer, *AIMS Materials Science*, 3 (2016) 1177-1198.
7. Jyotishkumar P., George Joseph, Seno Jose and Nishar Hameed. Miscibility, UV resistance, thermal degradation and mechanical properties of PMMA/SAN blends and their composites with MWCNTs, *J. Appl. Polym. Sci.*, 133, (2016), 43628. Publishers: Wiley, Impact factor: 1.786.
8. Jyotishkumar P., George Joseph, K. P. Shinu, Seno Jose, Nisa V. Salim and Nishar Hameed. Development of hybrid composites for automotive applications: effect of addition of SEBS on the morphology, mechanical, viscoelastic, crystallization and thermal degradation properties of PP/PS-xGnP composites, *RSC Advances*, 5, (2015) 25634-25641. Publishers: Royal Society of Chemistry, Impact factor, 3.84.
9. Jyotishkumar P., George Joseph, Seno Jose and Nishar Hameed. Phase morphology, thermomechanical, and crystallization behavior of uncompatibilized and PP-g-MAH compatibilized polypropylene/polystyrene blends, *Journal of Applied Polymer Sciences*, 132, (2015) 42100. Publishers: Wiley, Impact factor: 1.786.
10. Seno Jose, Sabu Thomas, Indose Aravind, J. Karger-Kocsis. Rheology of multiphase polymer blends with and without reactive compatibiliser: evaluation of interfacial tension using theoretical predictions, *International Journal of Plastic Technology*, Springer, 18, (2015), 223-240. Publishers: Springer
11. Jyotishkumar P., George Joseph, K.P. Shinu, P.R. Sreejesh, Seno Jose, Nisa V. Salim, Nishar Hameed, The role of SEBS in tailoring the interface between the polymer matrix and exfoliated graphene nanoplatelets in hybrid composites, *Materials Chemistry and Physics* 163 (2015) 182-189, Publishers: Elsevier, Impact factor: 2.259
12. Jyotishkumar P., George Joseph, K.P. Shinu, P.R. Sreejesh, Seno Jose, Nisa V. Salim, Nishar Hameed, High performance PP/SEBS/CNF composites: Evaluation of mechanical, dynamic mechanical, thermal degradation and crystallization properties, *Polymer Composites* (2015) DOI 10.1002/pc.23830. Publishers: Elsevier, Impact factor: 1.632.

C 3. DEPARTMENT OF GEOLOGY - LIST OF PUBLICATIONS

1. **K. Anto Francis**, Praveen Kurian Thomas and P.S. Jyothilakshmi, 2015 Geochemistry of a granite stock near Kottayam, Kerala. *Abstract National Workshop on 'Continental Crust & Cover Sequences of The Precambrian Indian Shield'* NCESS Thiruvananthapuram, p.56., January 20-21, 2015,
2. Noble Jacob, **Anto Francis**, K. Tirumalesh and Sanjukta A. Kumar (2014) Isotope Hydrochemical Investigation for Assessing the Contamination in Vembanad Wetland, Kerala- *Abstract MG University during December 2014*.
3. “**Continental crustal blocks and reactivated structural lineaments of Laccadive Ridge, southwest continental margin of India**”. Paper presented at Third UGC SAP DRS II Seminar on “Shear zones and crustal blocks of southern India”, 15 & 16 February 2016, Department of Geology, University of Kerala, Thiruvananthapuram, Kerala, India.
4. Thomas, P.K., et al. *Role of hydrothermal activity in uranium mineralisation in Palnad Sub-basin, Cuddapah Basin, India*. Journal of Asian Earth Sciences 91 (2014) 280–288

C 3. DEPARTMENT OF MATHEMATICS - LIST OF PUBLICATIONS

1. Varghese Jacob , Srinivas R. Chakravarthy and A. Krishnamoorthy (2012) :On a Customer Induced Interruption in a service system. Stochastic Analysis and Applications, 30 : 6, 949--962, DOI: 10.1080/07362994.2012.704845, Taylor & Francis, USA. ISSN 0736-2994
2. Krishnamoorthy, A and Varghese Jacob. (2012) : Analysis of Customer Induced Interruption in a multi server system. Neural, Parallel and Scientific Computations , 20, 153--172. Dynamic publishers, Inc, Georgia, USA ISSN 1061-5369.
3. Dudin, A.N., Varghese Jacob and Krishnamoorthy, A. (2013), A multi-server queueing system with service interruption, partial protection and repetition of service. Annals of Operations Research, DOI 10.1007/s10479-013-1318, 3, Springer, New York, USA. ISSN 0254-5330.
4. Varghese Jacob and Krishnamoorthy, A. (2014) :Analysis of customer induced interruption and retrial of interrupted customers. American Journal of Mathematical and Management Sciences. DOI 10.1080/01966324.2015.1042562, Taylor & Francis, USA. ISSN 01966324.
5. Jayaprasad, P. N and Johnson, T.P. (2012), Reversible Frames, Journal of Advanced Studies in Topology, Vol.3, No.2, (2012) 7-13.
6. Jayaprasad, P. N and Johnson, T.P. (2012), Automorphism Group of Finite frames, International Journal of Algebra and Statistics, Vol.1:2 (2012), 118-123.(3). Jayaprasad, P. N (2013)
7. On Singly Generated Extension of a Frame. Bulletin of Allahabad Mathematical Society, Vol 28,Part 2 (2013), 183-193.
8. Bloomy Joseph (2012) Some properties of Product closure spaces. Bulletin of Kerala Mathematical Association, Vol. 9, No. 2, (2012), 337-341.
9. Bloomy Joseph (2013), A Note on mappings between closure and monotone spaces. Bulletin of Kerala Mathematical Association, Vol. 10, No. 2, (2013), 117-121.
10. Bloomy Joseph (2014), A Note on Fuzzy closure and fuzzy convexity spaces. Bulletin of Kerala Mathematical Association, Vol. 11, No. 1, (2014), 117-121.

DEPARTMENT OF PHYSICS –LIST OF RECENT PUBLICATIONS

1. R PRAGASH, GIJO JOSE, N V UNNIKRISHNAN, C SUDARSANAKUMAREnergy Transfer and thermal studies of Pr³⁺ doped cerium oxalate crystals. Bulletin of Material Science July 2011 Vol.34.955-962 1.2 ,
2. R Pragash, NV Unnikrishnan, C Sudarsanakumar , Spectroscopic properties of Pr³⁺ ions doped Er₂(C₂O₄)₃.nH₂O. Pramana, Dec.2011 Vol.77 p.1119-1126 0.8 ,

3. R Pragash, C Sudarshana kumar, Quantum Efficiency of Nd³⁺ doped Ce₂(C₂O₄)₃.8H₂O crystals grown by hydrosilica gel method. Proceedings of the National conference on recent Advances in Material science.2006.p.27-29
1. Jinchu.I, Jyothi.R, N.Pandurangan, **K.S.Sreelatha**, K.Achuthan and C.O.Sreekala, ‘Anthraquinones-A probe to enhance the photovoltaic properties of DSSCs’. IJECE 6 August, 2016).
2. Jinchu.I, Rosmin Elsa Mohan, **Sreelatha.K.S** and C.O.Sreekala, ‘Photovoltaic Parameters of DSSCs Using Natural Dyes with TiO₂ Nanopowder and Nanofiber as Photoanodes: A Comparative Study’. IEEE Explorer, 978-1-4673-9939-5/16. 3.pp:4154-4157.
3. Krishnakumar.G, Neethu Balakrishnan, Seethal.S.pillai, **K.S.Sreelatha** and Jinchu.I. “Spin coated TiO₂ nanoparticle as a Matrix for Perovskite Solar cells”. IEEE Explorer, 978-1-4673-9939-5/16.pp: 3773-3775.
4. Lakshmi. R, Krishnakumar.G, Lyjo.K.Joseph, Jinchu.I, Sreelatha K.S, Lawsons dye complex: an efficient sensitizer for Dye Sensitized Solar Cells. IEEE Explorer, 978-1- 4673-9939-5/16. Pp: 4636-4638.
5. Amalrani George, Thanseema.A.P, Jinchu.I, C.O.Sreekala, and **K.S Sreelatha**. ‘Device Stability Study of Dye sensitized solar cells Incorporated with MWCNTs’. IEEE explorer, 978-1-4673-9939-5/16. 5.pp:4631-4635.
6. Anju Ramachandran, **Jinchu.I** and C.O.Sreekala. ‘Studies on Polymer based Counter Electrodes for DSSC Application’. IEEE explorer, 978-1-4673-9939-5/16. pp:4628-4630.
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8. Jinchu, C.O Sreekala, U.S. Sajeev, K. Achuthan, **K.S. Sreelatha** “Photoanode Engineering Using TiO₂ Nanofibers for Enhancing the PhotovoltaicParameters of Natural Dye Sensitised Solar Cells” **Journal of nano and electronic physics, Vol. 7 No 4, 04002(4pp) (2015)**
9. Rosmin Elsa Mohan, M.Sivakumar and **K.S.Sreelatha** et al., Modelling evanescent field components in metal-oxide core waveguides for nonlinear applications, **Mater. Res. Bull.**, [http:// dx.doi. org/ 10.1016 / j.materresbull.2015. 02.026](http://dx.doi.org/10.1016/j.materresbull.2015.02.026) (2015)
10. . R. E. Mohan, M.Sivakumar, **K.S.Sreelatha**, Comparison of wave evolution in triangular index planar waveguides using different metal oxide cores, **International Journal of Engineering and Innovative Technology**, Vol.3, Issue 10, pp 281-285 (2014)
11. R. E. Mohan, M.Sivakumar, K.S.Sreelatha, *Modeling of complex solitary waveforms for micro width doped ZnO waveguides*, **International Journal of Modern Nonlinear Theory and Application**, 1, 130-134 (2012)
12. Jinchu.I, A.Bharathkumar Sharma,C.O.Sreekala, **K.S.Sreelatha** and K.Achuthan, “Enhanced Photovoltaic Performance of the Dye Sensitized Solar Cell using Natural Dyes with Surface Modification of the Photoanode”**Materials Science Forum Vol. 771 (2014) pp 159-168 © (2014) Trans Tech Publications, Switzerland doi:10.4028/www.scientific.net/MSF.771.159****
13. Sreekanth Ma K.hadeva, J.C. Fan, Anis Biswas, **K.S.Sreelatha**, L.Belova, R.Puzniak and K.V.Rao, “ Magnetism of amorphous and nanocrystallized Dc sputter deposited MgO Thinfilms”, **Nanomaterials 2013**, 3, 486-497; doi:10.3390/nano3030486 (www.mdpi.com/journal/nanomaterials)**
14. Sreekanth Ma K.hadeva, Zhi-yong Quan, AnastasiaRhiazanova, **K.S.Sreelatha**, L.Belova, R.Puzniak and K.V.Rao,” Suppression of Ferromagnetic in Thick co-sputtered Mg films doped with Mn”, Pro MRS Symp.S: Nanaostructured Metal oxides for advanced Applications, Proc. Vol 1552©2013, Materials Research Society, (Cambridge Journals-online, DOI .1557/OPL.2013.611)**

15. Jinchu I, C.O.Sreekala and **K.S.Sreelatha**, “Dye Sensitized Solar Cell using Natural Dyes as Chromophores –Review”, *Materials Science Forum* Vol. 771 (2014) pp 39-51© (2014) *Trans Tech Publications, Switzerland*, doi:10.4028/www.scientific.net/MSF.771.39**
16. Sreekanth K. Mahadeva, Zhi-Yong Quan, J. C. Fan, **K. S. Sreelatha**, L. Belova, Roman Puzniak and K. V. Rao. “Room Temperature Ferromagnetism and Aging effects in $Mn_xMg_{(1-x)}O$ thin films deposited in (Ar+O₂) atmosphere” Manuscript (2013)**
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21. C.O.Sreekala, P.F.Saneesh, **K.S.Sreelatha**, A.Krishnashree and M.S.Roy, “Organic Bulk heterojunction Solar cell based on Rosebengal: ncTiO₂ and Parameter Extraction by Simulation,”*Advanced Materials Research — Mems, Nano and Smart Systems*. 403-408, 4304(2012)*www.scientific.net/AMR.403-408.4304
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23. Lakshmi Parameswar, **K.S. Sreelatha** and K.Babu Joseph “*Coupled beam propagation through Photorefractive Media*”, **International Journal of Nonlinear Optical Physics (IJNOP)** **20** 99 (2011) (World Scientific, Singapore).**
24. C.O. Sreekala, K.B.S. Pavan Kumar, **K.S. Sreelatha**, M.S.Roy “Improvement in Conversion Efficiency of Dye-sensitized solar cells using Functionalized Multi-wall carbon Nanotubes in the TiO₂ sensitization process” presented and published in International Conference in nanotechnology for Sustainable Energy-2010, organized by European Science Foundation (ESF), 04-09 July 2010, Innsbruck, Austria, pp*
25. **K.S.Sreelatha**, Lakshmi Parameswar and K.Babu Joseph “Optical Computing and solitons” **Journal of American Institute of Physics(AIP)** (2008), (pp-294)
<http://proceedings.aip.org/proceedings/cpcr.jsp>*
26. **K.S.Sreelatha** and K.Babu Joseph, “Wave propagation through 2D lattice” *Chaos, Solitons and Fractals***11**(2000)711-719##
27. **K.S.Sreelatha** and K.BabuJoseph, “On the integrability of a perturbed nonlinear Schrodinger Equation”, *Chaos Solitons and Fractals* **9**(1998)1865-1874
28. **BOOKS/CHAPTERS IN BOOK**
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30. **Nonlinear Dynamics: Integrability and Chaos (Narosa, 2000), Lax pair formulation in Higher dimensions**”, K.S.Sreelatha and K.Babu Joseph
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PART A

E- CURRICULUM OF ALL DEGREE COURSES

LINK TO THE WEBSITE OF MAHATMA GANDHI UNIVERSITY, KOTTAYAM IS
GIVEN BELOW

1. B.SC BOTANY

[https://www.mgu.ac.in/files/Botany%20\(MODEL%20I,%20model%20II,model%20II\)--2017.pdf](https://www.mgu.ac.in/files/Botany%20(MODEL%20I,%20model%20II,model%20II)--2017.pdf)

2. B.SC CHEMISTRY

https://www.mgu.ac.in/files/B_Sc_%20Chemistry%202017.pdf

3. B.SC GEOLOGY

https://www.mgu.ac.in/files/B_Sc_%20Geology%202017.pdf

4. B.SC MATHEMATICS

<https://www.mgu.ac.in/files/B%20Sc%20Mathematics-2017.pdf>

5. B.SC PHYSICS

<https://www.mgu.ac.in/files/BSc%20Physics%20--2017.pdf>

6. B.SC ZOOLOGY

https://www.mgu.ac.in/files/B_Sc_%20Zoology%202017.pdf

NB: It is not able to attach the whole curriculum of all 6 courses as email attachment due to the very large file size.

1. *List of experiments included in the syllabus other than B.Sc Botany course were given in the hard copy of the proposal. The complete curriculum of B.Sc Botany is given under.*

B Sc BOTANY PROGRAMME – MODEL I

PROGRAMME DESIGN

The UG programme in Botany (Model - I) must include (a) Common courses*, (b) Core courses (c) Complementary Courses (d) Open courses (e) Choice based courses and (f) Project work. No course shall carry more than 4 credits. The student shall select any one Open course in Semester V offered by different departments in the same institution. The number of courses for the restructured programme should contain 12 compulsory core courses, 1 open course, 1 choice based elective course from the frontier area of the core courses, 6 core practical courses, 1 project work, 8 complementary courses and 2 complementary practical courses. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

PROGRAMME STRUCTURE: SUMMARY OF COURSES AND CREDITS

Sl. No.	Course type	No. of courses	Total credits
1	Common course I - English	6	22
2	Common course II – Additional language	4	16
3	Core + Practical	12 + 6	46
4	Complementary I + Practical	4 + 2	14
5	Complementary II + Practical	4 + 2	14
6	Open course	1	3
7	Programme elective (Choice based core course)	1	3
8	Project work	1	2
Total		43	120
Total credits		120	
Programme duration		6 Semesters	
Minimum attendance required		75%	

***Course:** a segment of subject matter to be covered in a semester. Each course is designed variously under lectures/tutorials/laboratory or fieldwork/seminar/project/practical training/ assignments/evaluation etc., to meet effective teaching and learning needs.

B Sc BOTANY PROGRAMME – MODEL I

SEMESTER-WISE DISTRIBUTION OF COURSES AND CREDITS

Course Title	Hrs/ week	Credits	Course Title	Hrs/ week	Credits
SEMESTER I			SEMESTER II		
Common course – English 1	5	4	Common course – English 3	5	4
Common course – English 2	4	3	Common course – English 4	4	3
Common course – Additional language course 1	4	4	Common course – Additional language course 2	4	4
Core course 1 + Practical	4	3	Core course 2 + Practical	4	3
1 st Complementary course – Zoology course 1 + Practical	4	3	1 st Complementary course – Zoology course 2 + Practical	4	3
2 nd Complementary course – Chemistry/Biochemistry course 1 + Practical	4	3	2 nd Complementary course - Chemistry/Biochemistry course 2 + Practical	4	3
Total	25	20	Total	25	20
SEMESTER III			SEMESTER IV		
Common course – English 5	5	4	Common course – English 6	5	4
Common course – Additional language course 3	5	4	Common course – Additional language course 4	5	4
Core course 3 + Practical	5	4	Core course 4 + Practical	5	4
1 st Complementary course – Zoology course 3 + Practical	5	4	1 st Complementary course – Zoology course 4 + Practical	5	4
2 nd Complementary course – Chemistry/Biochemistry course 3 + Practical	5	4	2 nd Complementary course – Chemistry/Biochemistry course 4 + Practical	5	4
Total	25	20	Total	25	20
SEMESTER V			SEMESTER VI		
Core course 5 + Practical	5	4	Core course 9 + Practical	5.5	4
Core course 6 + Practical	5.5	4	Core course 10 + Practical	5	4
Core course 7 + Practical	5.5	4	Core course 11 + Practical	6.5	4
Core course 8 + Practical.	5	4	Core course 12 + Practical	5	4
Open course	4	3	Programme elective - Choice based core course	3	3
Total	25	19	Project work	--	2
			Total	25	21

B Sc BOTANY PROGRAMME – MODEL I

COMBINATION OF CORE AND COMPLEMENTARY COURSES AND SEMESTER-WISE DISTRIBUTION

Sem.	Course category	Course code	Course title	Instr. hrs.*		Credits
				Th.	Pr.	
I	Core	BO1CRT01	Methodology of Science and an Introduction to Botany	36	36	2 + 1
II	Core	BO2CRT02	Microbiology, Mycology and Plant Pathology	36	36	2 + 1
III	Core	BO3CRT03	Phycology and Bryology	54	36	3 + 1
IV	Core	BO4CRT04	Pteridology, Gymnosperms and Paleobotany	54	36	3 + 1
V	Core	BO5CRT05	Anatomy, Reproductive Botany, Microtechnique	54	36	3 + 1
	Core	BO5CRT06	Research methodology, Biophysics and Biostatistics	54	45	3 + 1
	Core	BO5CRT07	Plant Physiology and Biochemistry	54	45	3 + 1
	Core	BO5CRT08	Environmental sciences and Human Rights	54	36	3 + 1
	Open	BO5OPT01	1. Agri-based microenterprises	72	--	3
	Open	BO5OPT02	2. Horticulture and Nursery management	72	--	3
	Open	BO5OPT03	3. Ecotourism	72	--	3
VI	Core	BO6CRT09	Genetics, Plant Breeding and Horticulture	54	45	3 + 1
	Core	BO6CRT10	Cell and Molecular Biology	54	36	3 + 1
	Core	BO6CRT11	Angiosperm morphology, Taxonomy and Economic Botany	72	45	3 + 1
	Core	BO6CRT12	Biotechnology and Bioinformatics	54	36	3 + 1
	Elective	BO6PET01	1. Agribusiness	54	--	3
	Elective	BO6PET02	2. Plant Genetic Resources Management	54	--	3
	Elective	BO6PET03	3. Phytochemistry and Pharmacognosy	54	--	3
	Project	BO6PRT01	Investigatory project work done individually or in groups	--	--	2
I	Compl. 1	BO1CMT01	Cryptogams, Gymnosperms and Plant Pathology	36	36	2 + 1
II	Compl. 2	BO2CMT02	Plant Physiology	36	36	2 + 1
III	Compl. 3	BO3CMT03	Angiosperm Taxonomy and Economic Botany	54	36	3 + 1
IV	Compl. 4	BO4CMT04	Anatomy and Applied Botany	54	36	3 + 1

* 18 instructional hours is equal to one teaching hour per week

SEMESTER I

Core course 1

Code: BO1CRT01

METHODOLOGY OF SCIENCE AND AN INTRODUCTION TO BOTANY

(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Understand the universal nature of science
- Demonstrate the use of scientific method
- To lay a strong foundation to the study in Botany
- Impart an insight into the different types of classifications in the living kingdom.
- Appreciate the world of organisms and its course of evolution and diversity.
- Develop basic skills to study Botany in detail.

Module 1: Introduction to science and the methodology of science (4 hrs)

Scientific method: steps involved - observation and thoughts, formulation of hypothesis; inductive reasoning - testing of hypothesis; deductive reasoning - experimentation - formulation of theories and laws.

Module 2: Experimentation in science (4 hrs)

Selection of a problem - searching the literature – designing of experiments - selection of variables, study area, and a suitable design. Need of control, treatments and replication. Mendel's experiments as an example of moving from observations to questions, then to hypothesis and finally to experimentation. Ethics in science.

Module 3: Origin and evolution of life (10 hrs)

Origin of life on earth from molecules to life - Oparin's hypothesis, Haldane's hypothesis, Miller-Urey experiment, Panspermia, origin of cells and the first organisms. Evolutionary history of Biological diversity – fossil record; geological time scale – major events in each era. Evidences of evolution; theories of evolution - Lamarck, Wallace, Charles Darwin, Hugo De Vries. Neo-Darwinism – major postulates - isolation, mutation, genetic drift, speciation.

Module 4: Diversity of life and its classification (12 hrs)

Diversity of life: two kingdom classification (Carolus Linnaeus, 1735); phylogenetic classification (August W Eichler, 1878); five kingdom classification (R H Whittaker, 1969). Three domains, six kingdom classification, (Carl Woese, 1990) – criteria for classification, general characters of each kingdom. The three domains of life: Archaea, Bacteria, Eucarya – general characters of each.

Diversity of plants: study the salient features of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

Module 5: Basic Botanical skills (6 hrs)

Light microscope: dissection and compound microscope – parts and uses. Preparation of specimens for light microscopy - collection and preservation of plant specimens; killing and fixing; killing agents - formalin, ethyl alcohol; fixing agents - Carnoy's fluid, Farmer's fluid, FAA; herbarium (brief study only). Whole mounts and sections – hand sectioning – TS, TLS, RLS. Staining plant tissues: purpose; stains - safranin, acetocarmine, crystal violet. Temporary and permanent mounting, mountants.

SEMESTER II

Core course 2 Code: BO2CRT02
MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY
(Theory 36 hrs; Practical 36 hrs; Credits 2 + 1)

Objectives:

- Understand the world of microbes, fungi and lichens
- Appreciate the adaptive strategies of the microbes, fungi and lichens
- To study the economic and pathological importance of microorganisms

MICROBIOLOGY (Theory 9 hrs; Practical 9 hrs)

Module 1: Introduction (1 hr)

Introduction to microbiology, scope of microbiology.

Module 2: Bacteria (4 hrs)

Bacteria: general characters and classification based on staining, morphology and flagellation. Ultra structure of bacteria. Reproduction - binary fission. Genetic recombination in bacteria - conjugation, transformation and transduction. Economic importance of bacteria.

Module 3: Viruses (2 hrs)

General characters of viruses, viroids and prions. Structure of TMV and Bacteriophage (λ). Multiplication of λ phage – lytic and lysogenic cycle.

Module 4: Applied microbiology (2 hrs)

Isolation and culture of bacteria; media used – general purpose and selective media, applications of bacterial culture (brief study only). Role of microbes: in producing antibiotics, wine, vinegar, curd – role in N_2 fixation, as biofertilizers – role in food spoilage (Brief study only).

PRACTICAL (9 hrs)

1. Gram staining - curd, root nodules.
2. Isolation of microbes from soil through serial dilution and streak plate method.
3. Demonstrate the culture of bacteria.
4. Microbes and type of fermentation - wine, vinegar, curd.

MYCOLOGY (Theory 18 hrs; Practical 18 hrs)

Module 5: Introduction, classification and types of fungi (13 hrs)

General characters of fungi. Classification of fungi - Ainsworth (1973). Distinguishing characters of the different classes of fungi with special reference to reproductive structures and life history of the genera mentioned in each group:

Myxomycotina – *Physarum*; Mastigomycotina – *Albugo*; Zygomycotina - *Rhizopus*; Ascomycotina – Hemiascomycetes - *Saccharomyces*; Plectomycetes - *Penicillium*; Pyrenomycetes – *Xylaria*; Discomycetes - *Peziza*; Basidiomycotina – Teliomycetes – *Puccinia*; Hymenomycetes – *Agaricus*; Deuteromycotina – *Fusarium*.

Module 6: Economic importance of fungi (3 hrs)

Useful and harmful effects of fungi - medicinal, industrial, agricultural, food, genetic studies, spoilage, fungal toxins and diseases. Mycorrhiza: ecto- and endomycorrhiza, significance.

Module 7: Lichens (2 hrs)

General characters, types, general internal structure. Economic and ecological significance of lichens. Structure, reproduction and life cycle of *Parmelia*.

PRACTICAL (36 hrs)

1. Design an experiment to verify a given hypothesis.
2. Conduct a survey-based inquiry on a given topic (To test the validity of a given hypothesis. E.g., all angiosperm parasites are Dicot plants).
3. Select an important classical experiment and find out the different elements of the methodology of science (e.g., Robert Koch experiment).
4. Conduct field surveys to identify and collect plant specimens to appreciate the diversity of plant kingdom. Submit five preserved specimens (in bottles and/or herbarium) belonging to diverse groups.
5. Identification of plants with vascular elements, plants which produce flowers, fruits, seeds, cone, sporophyll, embryos and study their salient features.
6. Prepare temporary, stained hand sections (TS, TLS, RLS) of plant specimens appropriate for light microscopic studies.

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PRACTICAL (18 hrs)

1. Micropreparation and detailed microscopic study of *Rhizopus*, *Albugo*, *Saccharomyces*, *Penicillium*, *Xylaria*, *Peziza*, *Puccinia*, *Fusarium* and *Parmelia*.
2. Staining and microscopic observation of endomycorrhizal fungus.
3. Investigation of fungal succession on cow dung.

PLANT PATHOLOGY (Theory 9 hrs; Practical 9 hrs)**Module 8: Plant disease development (3 hrs)**

History of plant pathology. Classification of plant diseases on the basis of causative organism and symptoms. Host parasite interaction - defence mechanisms in host, mechanism of infection, transmission and dissemination of diseases.

Module 9: Common plant diseases (4 hrs)

Study of following diseases with emphasis on symptoms, cause, disease cycle and control: Bunchy top of Banana, Bacterial blight of Paddy, Root wilt of Coconut, Abnormal leaf fall of Rubber, Root knot disease of Pepper, Leaf mosaic disease of Tapioca, Citrus canker.

Module 10: Control of diseases (2 hrs)

Prophylaxis - quarantine measures, seed certification; Therapeutic - physical therapy, chemotherapy; Biological control and its significance. Fungicides - Bordeaux mixture. Tobacco and Neem decoction (Brief study only).

PRACTICAL (9 hrs)

1. Identify the diseases mentioned in the syllabus with respect to causative organisms and symptoms
2. Submit herbarium preparations of any three of the diseases mentioned.
3. Learn the technique of preparing Bordeaux mixture, Tobacco and Neem decoction.

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Core course 3 **Code: BO3CRT03**
PHYCOLOGY AND BRYOLOGY
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- To study the evolutionary importance of Algae as progenitors of land plants
- Understand the unique and general features Algae and Bryophytes and familiarize it
- To study the external morphology, internal structure and reproduction of different types of Algae and Bryophytes
- Realize the application of Phycology in different fields

PHYCOLOGY **(Theory 36 hrs; Practical 27 hrs)**

Module 1: Introduction to Phycology and classification of Algae (9 hrs)

Introduction: general characters, habitat diversity, range of thallus structure and pigments in algae; structure of algal flagella. Different types of life cycle and alternation of generations in algae. Classification: by Fritsch (1945); brief introduction to the modern classification by Lee (2009) [up to divisions].

Module 2: Type study (18 hrs)

Salient features, thallus structure and reproduction of algae in the following groups with special reference to the type(s) mentioned: Cyanophyceae - *Nostoc*; Chlorophyceae - *Volvox*, *Oedogonium*, *Cladophora*, *Chara*; Xanthophyceae – *Vaucheria*; Bacillariophyceae - *Pinnularia*; Phaeophyceae – *Ectocarpus*, *Sargassum*; Rhodophyceae - *Polysiphonia*.

Module 3: Artificial culture and economic importance of Algae (9 hrs)

Algal culture: isolation, cultivation and preservation of micro- and macro-algae. Economic importance of algae: algae as food, SCP, fodder, green manure, role in N₂ fixation, medicine and biofuels. Commercial products from Algae - carrageenin, agar-agar, alginates and diatomaceous earth. Role of algae in pollution studies: as indicators of pollution and as bioremediation agents. Eutrophication – algal bloom; harmful and toxic algal blooms – neurotoxins and parasitic algae.

PRACTICAL (27 hrs)

1. Conduct a field visit to any one of the ecosystems rich in Algae to experience algal diversity. Submit a report with photographs.
2. Make micropreparations of vegetative and reproductive structures of the types mentioned in the syllabus.
3. Algal Culture: isolation and cultivation of micro- and macro-algae in suitable growth media (Demonstration only).
4. Familiarizing the technique of algal collection preservation.

BRYOLOGY (Theory 18 hrs; Practical 9 hrs)

Module 4: General introduction and classification of bryophytes (4 hrs)

Introduction, general characters and classification of bryophytes by Rothmaler (1951); a very brief account of systems and classifications by Goffinet *et al* (2008).

Module 5: Type study (12 hrs)

Distribution, morphology, anatomy, reproduction and life cycle of the following types (developmental details are not required): Hepaticopsida - *Riccia*, *Marchantia*; Anthocerotopsida - *Anthoceros*; Bryopsida - *Funaria*. Evolution of gametophyte and sporophyte among Bryophytes.

Module 6: Economic importance (2 hrs)

Economic importance of Bryophytes – biological, ecological, medicinal and as potting material.

PRACTICAL (9 hrs)

1. Study the habit, anatomy of thallus and reproductive structures of *Riccia*, *Marchantia*, *Anthoceros*, and *Funaria*.

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SEMESTER IV

Core course 4 Code: BO4CRT04
PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand the diversity in habits, habitats and organization of various groups of plants.
- To impart an insight into the modern classifications in lower forms of plants.
- Understand the evolutionary trends in Pteridophytes and Gymnosperms.
- Study the anatomical variations in vascular plants.
- Understand the significance of Paleobotany and its applications.

PTERIDOLOGY (Theory 27 hrs; Practical 27 hrs)

Module 1: General introduction and classification of Pteridophytes (5 hrs)

Introduction, general characters and classification of Pteridophytes up to classes by Smith (1955) and a very brief account of the classification by Christenhusz *et al.*, 2011.

Module 2: Type study (18 hrs)

Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): Psilophyta - *Psilotum*; Lycopphyta - *Lycopodium*, *Selaginella*; Sphenophyta - *Equisetum*; Pterophyta - *Pteris*, *Marsilea*. Stellar evolution in Pteridophytes; Heterospory and seed habit.

Module 3: Economic importance (4 hrs)

Importance of Pteridophytes: medicinal, ornamental, as biofertilizer.

PRACTICAL (27 hrs)

1. Habit, TS of stem, LS of strobilus and sections of special structures of the following types: *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris*, *Marsilea*.

GYMNOSPERMS (Theory 18 hrs; Practical 9 hrs)

Module 4: General introduction and classification of Gymnosperms (5 hrs)

Introduction, General characters, classification of Gymnosperms by Sporne (1965) and a very brief account of the classification by Christenhusz *et al* (2011).

Module 5: Type study (11 hrs)

Distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required): Cycadopsida – *Cycas*; Coniferopsida – *Pinus*; Gnetopsidae – *Gnetum*. Affinities of Gymnosperms with Pteridophytes and Angiosperms.

Module 6: Economic importance of Gymnosperms (2 hrs)

Uses of Gymnosperms: as food, medicine, in industry and as ornamental plants.

PRACTICAL (9 hrs)

1. Study of the habit, TS of leaf and stem, morphology of reproductive structures of *Cycas*, *Pinus* and *Gnetum*.

PALEOBOTANY (Theory 9 hrs)

Module 6: Fossils (6 hrs)

Introduction to paleobotany and its significance. Fossil formation, types of fossils. Study of fossil Bryophyte - *Naiadita lanceolata*; fossil Pteridophytes – *Rhynia*, *Calamites*; fossil Gymnosperm – *Williamsonia*. Applied aspects of Paleobotany - exploration of fossil fuels.

Module 7: Paleobotany in India (3 hrs)

Brief study of the fossil deposits in India. Important Indian Paleobotanical Institutes, contributions of Indian Paleobotanists - Birbal Sahni.

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Core course 5 **Code: BO5CRT05**
ANATOMY, REPRODUCTIVE BOTANY AND MICROTECHNIQUE
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Imparting an insight into the internal structure and reproduction of the most evolved group of plants, the Angiosperm.
- Understand the individual cells and also tissues simultaneously
- Understand the structural adaptations in plants growing in different environment.
- Understand the morphology and development of reproductive parts.
- Get an insight in to the fruit and seed development.
- Understand the techniques used to preserve and study plant materials.

ANATOMY (Theory: 27 hrs. Practical: 18 hrs)

Module 1: Structure and composition of plant cells (8 hrs)

Cell wall: structure of cell wall; sub-microscopic structure - cellulose, micelle, micro fibril and macro fibril; structure and function of plasmodesmata, simple and bordered pits; different types of cell wall thickening in treachery elements; extra cell wall thickening materials. Growth of cell wall - apposition, intussusception. Non-living inclusions in plant cells: food products, secretory products, excretory (waste) products - nitrogenous and non nitrogenous.

Module 2: Organization of tissues (9 hrs)

Tissues: meristematic tissue – characteristic features, functions and classification. Theories on apical organization - apical cell theory, histogen theory, tunica-carpus theory. Permanent tissues - structure and function of simple and complex tissues. Secretory tissues: external secretory tissue - glands and nectaries; internal secretory tissues - laticifers.

Tissue systems: epidermal tissue system - epidermis, cuticle, trichome; stomata – structure, types; bulliform cells. Ground tissue system - cortex, endodermis, pericycle, pith and pith rays. Vascular tissue system - structure of xylem and phloem, different types of vascular bundles and their arrangement in root and stem.

Module 3: Plant body structure (6 hrs)

Primary structure of stem, root and leaf (dicot and monocot). Normal secondary growth in dicot stem and root. Periderm: structure and development - phellum, phellogen, phellogerm, bark, and lenticels. Anomalous secondary thickening: *Bignonia* stem, *Boerhaavia* stem and *Dracaena* stem.

Module 4: Wood anatomy (4 hrs)

Basic structure of wood - heart wood, sap wood; hard wood, soft wood; growth rings and dendrochronology; porous and non-porous wood; ring porous and diffuse porous wood, tyloses. Reaction wood: tension wood and compression wood.

PRACTICAL (18 hrs)

1. Study of cell types and tissues.
2. Non-living inclusions - starch grains, cystolith, raphides, aleurone grains.
3. Primary structure of stem, root and leaf - Dicots and Monocots.
4. Dissect and identify the stomatal types - anomocytic, anisocytic, paracytic and diacytic.
5. Secondary structure of dicot stem and root.
6. Anomalous secondary structure of *Bignonia* stem, *Boerhaavia* stem, and *Dracaena* stem.

REPRODUCTIVE BOTANY (Theory 18 hrs; Practical 9 hrs)

Module 5: Introduction (2 hrs)

Introduction to embryology, floral morphology - parts of flower.

Module 6: Microsporangium and male gametophyte (4 hrs)

Microsporangium: structure and development of anther, microsporogenesis, dehiscence of anther, structure of pollen. Male gametophyte development.

Module 7: Megasporangium and female gametophyte (6 hrs)

Megasporangium: types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous. Megasporogenesis – female gametophyte – structure of a typical embryo sac, types of embryo sacs - monosporic (*Polygonum* type), bisporic (*Allium* type) and tetrasporic (*Peperomia* type).

Module 8: Fertilization (2 hrs)

Mechanism of pollination, agents of pollination, germination of pollen grains; double fertilization.

Module 9: Endosperm and embryo (4 hrs)

Endosperm: types – cellular, nuclear and helobial. Embryogeny, structure of dicot and monocot embryo, seed formation. Polyembryony.

PRACTICAL (9 hrs)

1. Dissect and display parts of different types of flowers.
2. Identification of C.S. of anther, embryo sac and embryo.
3. Identification of various anther types - monothealous, dithealous.
4. Identify the different types of ovules.

MICROTECHNIQUE (Theory 9 hrs; Practical 9 hrs)

Module 6: Preservation of plant specimens, sectioning and mounting (9 hrs)

Introduction to microtechnique: killing and fixing - purpose. Dehydration - purpose, agents used - ethyl alcohol. Sectioning: hand sections, serial section; Microtome - rotary, sledge (application only). Staining technique: principle of staining; stains - hematoxylin, fast green, acetocarmine; vital stains - neutral red, Evans blue; mordants - purpose with examples. Types of staining - single staining, double staining. Mounting and mounting media – purpose, mounting media - glycerine, DPX, Canada balsam. Use of permanent whole mounts; permanent sections; maceration, smear and squash preparation.

PRACTICAL (9 hrs)

1. Familiarize preparation and use of stains, fixatives and mounting media.
2. Preparation of smears and squash.
3. Demonstration of microtome sectioning.
4. Maceration and identification of tracheary elements.
5. Preparation of single stained hand sections (Permanent – demonstration only).

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Core course 6 Code: BO5CRT06
RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS
Theory: 54 hrs; Practical: 45 hrs; Credits: 3 + 1)

Objectives:

- To equip the students to conduct independent research and prepare research reports.
- To make the students acquaint with different tools and techniques used in research work.
- To equip the students with basic computer skills necessary for conducting research.
- To enable the students to have enough numerical skills necessary to carry out research.

RESEARCH METHODOLOGY (Theory 18 hrs; Practical 18 hrs)

Module 1: Introduction (4 hrs)

Objectives of research. Types of research - pure and applied. Identification of research problem. Review of literature: purpose, literature sources – names of reputed National and International journals in life science (2 international & 3 national); reprint acquisition - INSDOC, INFLIBNET.

Module 2: Process of research (7 hrs)

Conducting research: define the problem, identify the objective, design the study, collection of data, analysis and interpretation. Preparation of research report: preparation of dissertation - IMRAD system - preliminary pages, introduction and review of literature, materials and methods, results, discussion, conclusion and bibliography.

Module 3: Use of computer in research (7 hrs)

Introduction to MS - WINDOWS and LINUX, application of MS WORD - word Processing, editing tools (cut, copy, paste), formatting tools. MS EXCEL - creating worksheet, data entry, sorting data. Statistical tools (SUM, MEAN, MEDIAN and MODE). Preparation of graphs and diagrams (Bar diagram, pie chart, line chart, histogram). MS-POWERPOINT - presentation based on a biological topic; inserting tables, charts, pictures. Open source and free alternatives to MS Office: Libre Office, Open Office (brief study). Search engines: Google.com; meta search engine – dogpile.com; academic search - Google scholar. Educational sites related to biological science - Scitable, DNai.

PRACTICAL (18 hrs)

1. Prepare outline of a dissertation (IMRAD system).
2. Prepare a list of references (not less than 10) on a topic in biological science.
3. Review the literature on a given topic.
4. Collect information on a topic related to biological science using the internet.

5. Make a report based on the collected information from the internet (using MS-WORD).
6. Prepare tables/charts/graphs using EXCEL.
7. Prepare a worksheet using a set of data collected and find out the SUM.
8. Prepare a PowerPoint presentation based on the report in Experiment 4.

BIOPHYSICS (Theory 18 hrs; Practical 9 hrs)

Module 4: Introduction (2 hrs)

Introduction to biophysics; branches of biophysics - molecular, cellular, membrane and biomedical instrumentation (scope only).

Module 5: Biophysical instrumentation (16 hrs)

Principle, working and applications of the following:

Microscopy: compound microscope, phase-contrast microscope and electron microscope – SEM. Colorimeter, spectrophotometer. Centrifuge: ultracentrifuge. Chromatography: paper, thin layer and column. Electrophoresis, PAGE. pH meter. Haemocytometer.

PRACTICAL (9 hrs)

1. Measurement of pH and adjusting pH using pH meter.
2. Separation of plant pigments using TLC.
3. Determination of the concentration of a sample solution using colorimeter.
4. Demonstration of column chromatography.
5. Count the number of cells/spores using Haemocytometer.

BIOSTATISTICS (Theory 18 hrs; Practical 18 hrs)

Module 6: Introduction

Introduction, statistical terms and symbols (Brief study only). Sampling: concept of sample, sampling methods - random and non random sampling. Collection and representation of data: diagrammatic and graphic representation - line diagram, bar diagram, pie diagram, histogram, frequency curve. Measures of central tendency: mean, median, mode, (discrete and continuous series). Measures of dispersion: standard deviation. Distribution patterns: normal distribution, binomial distribution. Tests of significance: Chi-square test - uses, procedure.

PRACTICAL (18 hours)

1. Collect numerical data, tabulate and represent in different types of graphs and diagrams mentioned in the syllabus.
2. Problems related to mean, median, mode, standard deviation and Chi-square test.

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Core course 7 Code: BO5CRT07
PLANT PHYSIOLOGY AND BIOCHEMISTRY
(Theory 54 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Acquire basic knowledge needed for proper understanding of plant functioning.
- Familiarize with the basic skills and techniques related to plant physiology.
- Understand the role, structure and importance of the bio molecules associated with plant life.

PLANT PHYSIOLOGY (Theory 36 hrs; Practical 27 hrs)

Module 1: Water relations (6 hrs)

Plant water relations - diffusion, imbibition, osmosis, OP, DPD, TP; water potential - concepts and components (pressure potential, gravity potential, osmotic potential and matric potential). Absorption of water - active and passive, pathway of water movement - apoplastic and symplastic pathway. Ascent of sap - cohesion-tension theory. Transpiration - types, mechanism, theories (Starch-sugar, Proton-K⁺ ion exchange), significance; antitranspirants. Guttation.

Module 2: Mineral nutrition (3 hrs)

Role of major and minor elements in plant nutrition, deficiency symptoms of essential nutrients; mineral uptake - passive (ion exchange) and active (carrier concept).

Module 3: Photosynthesis (12 hrs)

Photosynthetic pigments, photo excitation - fluorescence, phosphorescence; red drop and Emerson enhancement effect. Photosystems - components and organization; cyclic and non-cyclic photophosphorylation; carbon assimilation pathways - C₃, C₄ plants - Kranz anatomy, CAM. Photorespiration. Factors affecting photosynthesis - Blackmann's law of limiting factors.

Translocation of solutes: pathway of phloem transport, mechanism - pressure flow, mass flow hypothesis; phloem loading and unloading.

Module 4: Respiration (8 hrs)

Respiration: anaerobic and aerobic; glycolysis, Krebs's cycle, mitochondrial electron transport system - components, oxidative phosphorylation, ATPase, chemiosmotic hypothesis. RQ - significance. Factors affecting respiration.

Module 5: Plant growth and development (5 hrs)

Plant hormones: their physiological effect and practical applications - auxins, gibberellins, cytokinins, ABA, and ethylene. Plant movements: tropic movements - geotropism and phototropism; nastic movements - seismonastic and nyctinastic movements. Physiology of flowering - phytochrome, photoperiodism, vernalization.

Module 6: Stress physiology (2 hrs)

Concepts of plant responses to abiotic stresses (water, salt, temperature), biotic stress (pathogens). Allelopathy.

PRACTICAL (27 hrs)**Core Experiments (any four compulsory):**

1. Determination of osmotic pressure of plant cell sap by plasmolytic/weighing method.
2. Compare the stomatal indices of hydrophytes, xerophytes and mesophytes (any two).
3. Separation of plant pigments by TLC/Paper chromatography.
4. Measurement of photosynthesis by Wilmott's bubbler/any suitable method.
5. Estimation of plant pigments by colorimeter.

Demonstration experiments:

1. Papaya petiole osmoscope.
2. Demonstration of tissue tension.
3. Relation between transpiration and absorption.
4. Necessity of chlorophyll, light and CO₂ in photosynthesis.
5. Simple respiroscope.
6. Respirometer and measurement of RQ.
7. Fermentation.
8. Measurement of transpiration rate using Ganong's potometer/Farmer's potometer.

BIOCHEMISTRY (Theory 18 hrs; Practical 18 hrs)**Module 4: Water (3 hrs)**

Physical and chemical properties of water, acids and bases; pH - definition, significance; measurement of pH – colorimetric, electrometric (brief study only). Buffers: buffer action, uses of buffers.

Module 5: Carbohydrates (3 hrs)

General structure and functions; classification - mono (glucose and fructose), di (maltose and sucrose) and polysaccharides (starch and cellulose).

Module 6: Proteins (4 hrs)

General structure and classification of amino acids - peptide bond; structural levels of proteins - primary, secondary, tertiary and quaternary; functions of proteins.

Module 7: Lipids (2 hrs)

General features and roles of lipids, types of lipids; fatty acids - saturated and unsaturated; fatty acid derivatives - fats and oils; compound lipids (brief study only).

Module 8: Enzymes (6 hrs)

Classification and nomenclature, mechanism of action. Enzyme kinetics, Michaelis-Menten constant (brief study only). Regulation of enzyme action. Factors affecting enzyme action.

PRACTICAL (18 hrs)

1. General test for carbohydrates - Molisch's test, Benedict's tests, Fehling's test.
2. Colour test for starch - Iodine test.
3. Colour tests for proteins in solution – Xanthoproteic test, Biuret test, Million's test, Ninhydrin test.

4. Action of various enzymes in plant tissues: peroxidase, dehydrogenase.
5. Quantitative estimation of protein using colorimeter.

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Core course 8 Code: BO5CRT08
ENVIRONMENTAL SCIENCE AND HUMAN RIGHTS
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Acquaint the student with the significance of Environmental Science.
- Make the students aware about the extent of the total biodiversity and the importance of their conservation.
- Help the student to design novel mechanisms for the sustainable utilization of natural resources.
- Enable the students to understand the structure and function of the ecosystems.
- Enable the students to understand various kinds of pollution in the environment, their impacts on the ecosystem and their control measures
- Make the students aware about various environmental laws in India and the role of various movements in the protection of nature and natural resources.

ENVIRONMENTAL SCIENCE (48 hrs)

Module 1: Introduction to ecology (8 hrs)

Ecology: introduction, definition, scope and relevance; sub-divisions of ecology - autecology, synecology and ecosystem ecology.

Population: population size, density, natality, mortality, age, rate of natural increase, growth form and carrying capacity, population interactions between species - competition, parasitism, predation, commensalism, protooperation, mutualism, neutralism.

Community: community concept, biotic community, species diversity, species richness, dominance; growth forms and structure, trophic structure, ecotone, edge effect, habitat, ecological niche, micro-climate, ecological indicators, keystone species.

Module 2: Ecosystems (10 hrs)

Structure and function of ecosystems, ecosystem components: abiotic - atmosphere, climate, soil, water; biotic - producers, consumers, decomposers. Productivity - primary and secondary - gross and net productivity - homeostasis in the ecosystem. Concept of energy in ecosystems - energy flow, food chain, food web, trophic levels, trophic structure and ecological pyramids - pyramid of numbers, biomass, energy. Nutrient cycles - biogeochemical cycles of C and N₂.

Ecosystem development: ecological succession, process, climax community, hydrosere, xerosere. Adaptations of plants to environment - xerophytes, hydrophytes, epiphytes, halophytes, mangroves.

Module 3: Biodiversity and its conservation (10 hrs)

Biodiversity: definition, types, examples – endemism - hot spots; hot spots in India - Western Ghats as hot spot. Wetlands and their importance. Biodiversity loss - IUCN threat categories, Red data book; causes and rate of biodiversity loss - extinction, causes of extinction. Conservation: methods - *in-situ*, *ex-situ*. Joint Forest management - people's participation in biodiversity conservation: community reserve, eg. Kadalundi-vallikkunnu. Remote sensing and GIS: introduction, principle, application of remote sensing and GIS in environmental studies and biodiversity conservation (brief account). Ecotourism: ecotourism centers in Kerala - Thenmala and Thattekkad WLS.

Module 4: Environmental pollution (10 hrs)

Environmental studies - definition, relation to other sciences, relevance. Environmental pollution - introduction, definition; Air pollution - air pollutants, types, sources, effect of air pollution on plants and humans, control measures; Water pollution – common pollutants, sources, impact, control measures; water quality standards - DO and BOD; eutrophication. Soil Pollution - causes, sources, solid waste, biodegradable, non-biodegradable, management of solid waste, composting, e – waste. Environmental issues - global warming, greenhouse effect, climate change - causes and impact, ozone layer depletion. Carbon sequestration.

Module 5: Conservation of nature (10 hrs)

Global conservation efforts - Rio Earth summit - Agenda 21, Kyoto protocol, COP15 (15th Conference of the parties under the UN framework convention on climate change) and Paris protocol - major contributions. Conservation strategies and efforts in India and Kerala.

Organizations, movements and contributors of environmental studies and conservation: organizations - WWF, Chipko, NEERI; contributors - Salim Ali, Sunder Lal Bahuguna, Madhav Gadgil, Anil Agarwal, Medha Patkar, Vandana Siva (brief account only).

Environmental Legislation and Laws: Environment (protection) Act 1986, Air (protection and control of pollution) act, 1981 Water (protection and control of pollution) Act, 1974, Wildlife (protection) Act, 1972, Forest (conservation) Act, 1980, Biological Diversity Act (2002) [brief account only].

Module 6: Human rights (6 hrs)

Introduction, meaning, concept and development. Three generations of human rights - civil and political rights, economic, social and cultural rights. Human Rights and United Nations: contributions; main human rights related organizations - UNESCO, UNICEF, WHO, ILO; Declarations for women and children, Universal declaration of human rights. Human rights in India: fundamental rights and Indian constitution, rights for children and women, scheduled castes, scheduled tribes, other backward castes and minorities.

Environment and human rights: right to clean environment and public safety; issues of industrial pollution; prevention, rehabilitation and safety aspect of new technologies such as chemical and nuclear technologies, issues of waste disposal, protection of environment. Conservation of natural resources and human rights: reports, case studies and policy formulation. Conservation issues of Western Ghats – Madhav Gadgil committee report, Kasturi Rangan report. Over-exploitation of ground water resources, marine fisheries, sand mining etc.

PRACTICAL (36 hrs)

1. Estimation of CO₂, Cl, and alkalinity of water samples (Titrimetry)
2. Determination of pH of soil and water.
3. Assessment of diversity, abundance, and frequency of plant species by quadrat method (Grasslands, forests).
4. Study of the most probable number (MPN) of Coliform bacteria in water samples.
5. EIA studies in degraded areas (Sampling, Line transect, Quadrat).
6. Ecological adaptations in xerophytes, hydrophytes, epiphytes, halophytes and mangroves.

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OPEN COURSES

Open course 1 Code: BO5OPT01 AGRI-BASED MICROENTERPRISES (Theory 72 hrs; Credits 3)

Objectives:

- Provide basic information about the business opportunities in plant sciences.
- Inform the student about sustainable agriculture and organic farming.
- Inculcate an enthusiasm and awareness about ornamental gardening, nursery management and mushroom cultivation.

Module 1: Organic farming and composting techniques (9 hrs)

Advantages of organic manures and fertilizers. Composition of fertilizers – NPK content of various fertilizers. Common organic manures – bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost. Preparation of compost - aerobic and anaerobic - advantages of both; vermicompost - preparation, vermiwash. Biofertilizers: definition, types – *Trichoderma*, *Rhizobium*, PGPR. Biopesticides – Tobacco and Neem decoction. Biological control.

Module 2: Horticulture and Nursery management (18 hrs)

Soil components. Preparation of potting mixture. Common Garden tools and implements. Methods of plant propagation - by seeds - advantages and disadvantages. Vegetative propagation - advantages and disadvantages. Natural methods of vegetative propagation. Artificial methods - cutting, grafting,

budding and layering. Use of growth regulators for rooting. Gardening - types of garden - ornamental, indoor garden, kitchen garden, vegetable garden for marketing.

Module 3: Food spoilage and preservation techniques (9 hrs)

Causes of spoilage. Preservation techniques - asepsis, removal of microorganisms, anaerobic conditions and special methods – by drying, by heat treatment, by low temperature storage and by chemicals (Food Additives). Preparation of wine, vinegar and dairy products.

Module 4: Mushroom cultivation and Spawn production (9 hrs)

Types of mushrooms - button mushroom, oyster mushroom and milky mushroom, poisonous mushroom – methods of identification. Spawn – isolation and preparation. Cultivation milky mushrooms – using paddy straw and saw dust by polybag. Value added products from mushroom – pickles, candies, dried mushrooms.

Module 5: Plant tissue culture and micropropagation (9 hrs)

Concept of totipotency. Micropropagation: different methods – shoot tip, axillary bud and meristem culture; organogenesis, somatic embryogenesis. Infra structure of a tissue culture laboratory. Solid and liquid media - composition and preparation. Sterilization techniques. Explant - inoculation and incubation techniques. Stages of micropropagation – hardening and transplantation. Packaging and transportation of tissue culture regenerated plantlets.

ON HAND TRAINING (18 hrs)

1. Prepare a chart showing the NPK composition of minimum 6 manures and fertilizers.
2. Identification and familiarization of the following organic manures: cow dung (dry), Coconut cake, Vermicompost, neem cake, organic mixture, bone meal.
3. Preparation of potting mixture.
4. Make a vermicompost pit /pot in the campus/ house of the student.
5. Familiarization of common garden tools and implements.
6. Estimation of germination percentage of seeds
7. Demonstrate the effect of a rooting hormone on stem cutting.
8. Demonstration of T budding and air layering on live plants.
9. Familiarization of garden components from photographs.
10. Preparation of vinegar/dairy product (any two) in class or home.
11. Familiarization of different mushrooms and preparation of a polybag of *Pleurotus* using straw/sawdust.
12. Visit to a well established tissue culture lab, nursery and mushroom cultivation unit.

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Open course 2 Code: BO5OPT02
HORTICULTURE AND NURSERY MANAGEMENT
(Theory 72 hrs; Credits 3)

Objectives:

- Understand the importance of horticulture in human welfare.
- Understand the propagation and cultural practices of useful vegetable, fruit and garden plants.
- Understand the impact of modern technologies in biology on horticultural plants.
- Understand the basic concepts of landscaping and garden designing.
- Inculcate interest in landscaping, gardening and flower and fruit culture.

HORTICULTURE (48 hrs)

Module 1: Introduction (10 hrs)

Introduction to horticulture: definition, history; classification of horticultural plants, disciplines of horticulture. Soil: formation, composition, types, texture, pH and conductivity. Garden tools and implements.

Preparation of nursery bed; manures and fertilizers - farm yard manure, compost, vermicompost, biofertilizers; chemical fertilizers - NPK; time and application of manures and fertilizers, foliar spray. Irrigation methods - surface, sub, drip and spray irrigations - advantages and disadvantages - periodicity of irrigation.

Module 2: Propagation of plants (10 hrs)

Propagation of horticultural plants - by seeds; seed development and viability, seed dormancy, seed health, seed testing and certification. Growing seedlings in indoor containers and field nurseries, seed bed preparation, seedling transplanting; advantages and disadvantages of seed propagation.

Vegetative propagation - organs used in propagation - natural and artificial vegetative propagation; methods - cutting, layering, grafting and budding; advantages and disadvantages of vegetative propagation; micropropagation.

Module 3: Gardening (10 hrs)

Gardening - ornamental gardens, indoor gardens, kitchen gardens- terrestrial and aquatic gardens - garden adornments; garden designing; garden components - lawns, shrubs and trees, borders, hedges, edges, drives, walks, topiary, trophy, rockery; famous gardens of India. Landscape architecture - home landscape design, urban planning, parks, landscaping and public buildings, industrial and

highway landscaping. Physical control of plant growth - training and pruning - selection of plant, bonsai containers and method of bonsai formation.

Module 4: Floriculture (6 hrs)

Introduction, commercial floriculture - jasmine, orchid, anthurium, rose, gladiolus; production of cut flowers, quality maintenance, packing, marketing. Flower arrangements - basic styles - upright and slanting - japanese ikebana, dry flower arrangement.

Module 5: Olericulture (4 hrs)

Olericulture - types of vegetable growing - home gardens and market gardens; cultivation practices of leafy vegetable (Amarathus), tuber (Potato), fruit (Tomato), flower (Cauliflower).

Module 6: Pomology (4 hrs)

Pomology - cultivation of fruit crops - mango, banana and pine apple - preparation of land, spacing, planting, irrigation, hormones, harvest and storage. Factors affecting duration of storage. Principles of preservation - temporary and permanent - agents for fruit preservation. Preparation of pickles, jams, jellies and squashes using locally available fruits.

Module 7: Gardening – additional features (4 hrs)

Garden friends - honey bees, ladybirds, frogs, spiders, earthworms, centipedes and millipedes. Garden foes - pests, pathogenic fungi, bacteria, virus. Control measures - pesticides and fungicides; neem tobacco decoction. Hazards of chemical pesticides; equipments used in controlling horticultural pests - sprayers, dusting equipments - sterilization, fumigation.

Weeds - annual, perennial; weed control - prevention, eradication - hand weeding, tillage, burning, mowing, biological control, use of herbicides - selective and non selective - mechanisms involved in herbicidal actions.

NURSERY MANAGEMENT (6 hrs)

Module 1: Nurseries (6 hrs)

Nursery: definition, types; management strategies - planning, layout, budgeting - production unit, sales unit. Plant growing structures - green houses, fernery, orchidarium, arboretium.

ON HAND TRAINING (18 hrs)

1. Preparation of potting mixture of known combination and potting in earthen pots/poly bags.
2. Preparation of nursery beds.
3. Preparation of compost/vermicompost using different substrates.
4. Working knowledge and identification of garden tools and implements.
5. Practical knowledge in different plant propagation techniques listed in syllabus.
6. Cultivation of a vegetable/ornamental plant/fruit crop listed in the syllabus.
7. Practice of different pruning operations (top dressing, shaping and topiary) in the following plants: (1) Bougainvillea (2) Phyllanthus.
8. Visit a well established nursery and submit report.

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stakeholders, linkages, economics, ecotourism auditing. Problems with ecotourism. Carrying capacity of ecotourism. ecotourism facilities – Green report card. Ecotourism management – issues.

Module 8: Ecotourism and livelihood security (4 hrs)

Community, biodiversity conservation and development – Eco-development committees.

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SEMESTER VI

Core course 9 Code: BO6CRT09
GENETICS, PLANT BREEDING AND HORTICULTURE
(Theory 54 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Imparting an insight into the principles of heredity
- Understand the patterns of inheritance in different organisms
- Understand the inheritance pattern of nuclear and extra nuclear genes
- Understand the methods of crop improvement
- Understand the importance of horticulture in human welfare
- Develop skill in gardening technique among students

GENETICS (Theory 27 hrs; Practical 27 hrs)

Module 1: Origin and development of Genetics (3 hrs)

Genetics as a science: origin - experiments of Mendel with *Pisum sativum*, general terminology used in genetics. Principles of inheritance, Mendelian laws - monohybrid and dihybrid cross, test cross and backcross.

Module 2: Exceptions to Mendelism (10 hrs)

Modification of Mendelian ratios: incomplete dominance - *Mirabilis*; Co-dominance - MN blood group in man; Lethal genes – pigmentation in Snapdragon..

Geneic interaction: epistasis, (a) Dominant - fruit colour in summer squashes (b) Recessive - coat colour in mice; Complementary genes - flower colour in sweet pea. Non-epistasis - comb pattern in Fowls. Multiple alleles – ABO blood groups in man; self sterility in *Nicotiana*.

Module 3: Linkage of genes (3 hrs)

Linkage and crossing over: chromosome theory of linkage; crossing over - types of crossing over, mechanism of crossing over. Linkage map - 2 point cross, interference and coincidence.

Module 4: Determination of sex (6 hrs)

Sex determination: sex chromosomes and autosomes; chromosomal basis of sex determination; XX-XY, XX-XO mechanism; sex determination in higher plants (*Melandrium album*). Sex linked

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Open course 3 Code: BO5OPT03
ECOTOURISM
(Theory 72 hrs; Credits 3)

Objectives:

- Make the students to opt various ecotourism programs in the self employment stream
- Make the students aware of the usefulness of ecotourism in the conservation of natural resources.
- Help the students to assess various ecotourism programs

Module 1: Introduction (4 hrs)

Definition, concept, introduction, history, relevance and scope.

Module 2: Key principles and characteristics of ecotourism (4 hrs)

Nature area focus, interpretation, environmental sustainability practice, contribution to conservation, benefiting local communities, cultural respect, customer satisfaction, responsible marketing.

Module 3: Components of Ecotourism (12 hrs)

Travel, tourism industry, biodiversity, local people, cultural diversity, resources, environmental awareness, interpretation, stake holders, capacity building in ecotourism.

Module 4: Ecotourism terms (10 hrs)

Adventure tourism, certification, commercialization chain, cultural tourism, canopy walkway, conservation enterprises, ecosystem, ecotourism activities, ecotourism product, ecotourism resources, ecotourism services, endemism, ecolabelling, ecotourism “lite”, geotourism, greenwashing, stakeholders, sustainable development, sustainable tourism, leakages

Module 5: Ecotourism resources in India and Kerala (14 hrs)

Major ecosystems vegetation types and tourism areas in Kerala. Festivals and events, entertainment, overview, culture, famous destinations, sightseeing, historical monuments, museums, temples, national parks & wildlife sanctuaries, hill stations, waterfalls, rivers, reaches, wildlife watching and bird watching sites, agricultural sites, tribal areas, tribal museums, tribal arts, rural handicrafts, tribal medicines, archeological sites, adventure sports, sacred groves, mountains, etc.

Module 6: Forms of Ecotourism in India and Kerala (8 hrs)

Eco regions, eco places, waterfalls in Kerala and India, eco travel, dos and don't on eco travel, eco trips. Potential of ecotourism in Kerala. Community based ecotourism, ecotourism and NGOs.

Module 7: Ecotourism Planning (16 hrs)

Background, objectives, strategy, design of activities, target groups, opportunities, capacity building, threats, expectations positive and negative impacts, strength and weakness, benefits and beneficiaries,

inheritance: X-linked - Morgan's experiment e.g. eye colour in *Drosophila*, Haemophilia in man; Y-linked inheritance; sex limited and sex influenced inheritance. Pedigree analysis.

Module 5: Quantitative inheritance (2 hrs)

Quantitative characters: polygenic inheritance, continuous variation - kernel color in wheat, ear size in maize.

Module 6: Extra-chromosomal inheritance (2 hrs)

Extra chromosomal inheritance: chloroplast mutation - variegation in 4O'clock plant; mitochondrial mutations in yeast. Maternal effects - shell coiling in snail; infective heredity - kappa particles in *Paramecium*.

Module 7: Population genetics (1 hr)

Concept of population, gene pool, Hardy-Weinberg principle (brief).

PRACTICAL (18 hrs)

1. Students are expected to work out at least two problems each from: monohybrid, dihybrid, back-cross and test cross; all types of modified Mendelian ratios mentioned in the syllabus.

PLANT BREEDING (Theory 13 hrs; Practical 9 hrs)

Module 1: Introduction to plant breeding (1 hr)

Introduction and objectives of plant breeding. Plant breeding centers in Kerala, their achievements – CPCRI, CTCRI, RRII.

Module 2: Plant introduction (2 hrs)

Plant introduction: domestication - centers of origin - procedure of plant introduction - quarantine regulations, acclimatization, agencies of plant introduction in India, major achievements.

Module 3: Selection (2 hrs)

Plant Selection: mass, pure-line, clonal.

Module 4: Hybridization (4 hrs)

Hybridization: types, procedure, important achievements. Heterosis in plant breeding, inbreeding depression, genetics of heterosis and inbreeding depression. Handling segregating generation - pedigree method, bulk method, back cross method. Disease resistance breeding.

Module 5: Mutation breeding and polyploidy breeding (2 hrs)

Mutation breeding: methods, applications and important achievements. Polyploidy breeding: methods and applications.

Module 6: Tissue culture as method in plant breeding (2 hrs)

Application of meristem culture, embryo culture and pollen culture in plant breeding. Role of tissue culture in the creation of transgenic plants.

PRACTICAL (9 hrs)

1. Emasculation and bagging.
2. Demonstration of hybridization in plants.
3. Estimation of pollen sterility/viability.

HORTICULTURE (Theory 14 hrs; Practical 18 hrs)

Module 1: Introduction (3 hrs)

Introduction to horticulture - definition, history. Classification of horticultural plants. Disciplines of horticulture - pomiculture, olericulture, floriculture, arboriculture.

Garden implements - budding knife, secateurs, hedge shear, hand cultivator, sprayers, lawn mower, garden rake, spade.

Irrigation methods: surface, sub, drip and spray irrigations; mist chambers - advantages and disadvantages.

Module 2: Plant propagation: (5 hrs)

Seed propagation: seed testing and certification, seed bed preparation, seedling transplanting, hardening of seedling; advantages and disadvantages of seed propagation. Vegetative propagation: natural and artificial; artificial methods - cutting, layering, grafting and budding, micro-propagation; advantages and disadvantages of vegetative propagation.

Module 3: Gardening (6 hrs)

Types of garden: brief study on ornamental garden, indoor garden, kitchen garden, aquatic garden, vertical garden, medicinal garden, terrace garden, terrarium.

Garden designing: garden components - lawns, shrubs and trees, borders, topiary, hedges, edges, walks, drives.

Physical control of plant growth: training and pruning. Bonsai - selection of plant - bonsai containers and method of bonsai formation.

Plant growing structures: green house, orchidarium, conservatory; Potting mixture – components.

PRACTICAL (18 hrs)

1. Approach grafting (demonstration only), budding (T, patch), air layering.
2. Identification of different garden tools and their uses.
3. List out the garden components in the photograph of the garden given.
4. Visit to established horticultural/agricultural/ornamental/kitchen gardens and observe the components there.

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Core course 10 **Code: BO6CRT10**
CELL AND MOLECULAR BIOLOGY
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand the ultra structure and functioning of cell in the sub-microscopic and molecular level.
- Get an idea of origin, concept of continuity and complexity of life activities.
- Familiarization of life processes.
- Understand the basic and scientific aspect of diversity.
- Understand the cytological aspects of growth and development.
- Understand DNA as the basis of heredity and variation.

CELL BIOLOGY (Theory 27 hrs; Practical 27 hrs)

Module 1: Ultra structure of cell components (8 hrs)

Cell biology through ages: a brief history of cell biology. Cytosol - chemical composition. Composition, structure and function of plasma membrane - fluid mosaic model.

The ultra-structure of a plant cell with structure and function of the following organelles: Endoplasmic reticulum, chloroplasts, Mitochondria, Ribosomes, Dictyosomes, Microbodies - peroxisomes and glyoxisomes, lysosomes and vacuole. Cytoskeleton - microtubules and microfilaments.

Ultra structure of nucleus: nuclear envelope - detailed structure of pore complex, nucleoplasm - composition, nucleolus.

Module 2: Chromosomes (6 hrs)

Chromosomes: introduction, chromosome number, autosomes and allosomes, morphology - metacentric, submetacentric, acrocentric and telocentric. Structure - chromatid, chromonema, chromomere, centromere and kinetochore, telomere, secondary constriction and nucleolar organizer. Chromatin fibres: heterochromatin and euchromatin. Karyotype and ideogram.

Chemical composition of chromatin: histones and non-histones, arrangement of proteins and DNA in chromatin - the 10 nm fibre (nucleosome model), 30 nm fibre (solenoid model) and central axis with radial loops of 300 nm fibre.

Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lamp brush chromosomes), supernumerary chromosomes (B chromosome).

Module 3: Cell division (6 hrs)

Cell cycle - definition, different stages – interphase (G1, S and G2) and division phase. Mitosis: karyokinesis and cytokinesis, significance of mitosis. Meiosis: stages - first meiotic division (reduction division) and second meiotic (equational division), structure and function of synaptonemal complex, significance of meiosis; comparison of mitosis and meiosis.

Module 4: Chromosomal aberrations (4 hrs)

Numerical: heteroploidy; euploidy – haploidy; polyploidy – autopolyploidy, allopolyploidy (*Raphanobrassica*); aneuploidy - monosomy, trisomy (Fruit morphology in *Datura*), nullisomy (*Triticum*). Numerical chromosomal abnormalities in man: Down's syndrome, Klinefelter's syndrome, Turner's syndrome.

Structural: deletion (Cri-du-chat syndrome), duplication (Bar eye in *Drosophila*), inversions (paracentric and pericentric) and Translocations (Robertsonian translocation).

Module 5: Mutation (3 hrs)

Mutation: definition, importance. Types of mutations: somatic and germinal; spontaneous and

induced; chromosomal and gene or point mutations. Molecular basis of mutation: frame shift, transition, transversion and substitution. Mechanism of mutation induction: base replacement, base alteration, base damage, errors in DNA replication. Mutagens: physical - non-ionizing and ionizing radiations; chemical - base analogs, alkylating agents, deaminating agents.

PRACTICAL (27 hrs)

1. Make acetocarmine squash preparation of onion root tip to identify mitotic stages.
2. Study the mitotic index of onion root tip cells (Demonstration only).
3. Study of the different stages of meiosis and identification of different substages of prophase I using photomicrographs or pictures.
4. Identify and study the chromosomal anomalies, patterns and karyotype in man such as Down's syndrome, Turner's syndrome and Klinefelter's syndrome.

MOLECULAR BIOLOGY (Theory 27 hrs; Practical 9 hrs)

Module 6: The genetic material (8 hrs)

Molecular biology: a brief historical prelude. Identification of DNA as genetic material: direct evidences – transformation experiment by Avery *et al.*; Hershey and Chase Experiment. Evidences for RNA as genetic material in some viruses.

Nucleic acids: DNA and RNA, important features of Watson and Crick model of DNA; Chargaff's rule. Alternate forms of DNA - comparison of A, B and Z forms. Structure and function of different types of RNA - tRNA, mRNA, rRNA, snRNA, miRNA.

Module 7: Replication of DNA (4 hrs)

Semiconservative replication of DNA - Messlson and Stahl's experiment; process of semiconservative replication with reference to the enzymes involved in each step.

Module 8: Gene expression (8 hrs)

Gene expression: concept of gene, split genes, one gene one enzyme hypothesis, one gene one polypeptide hypothesis, the central dogma, reverse transcription. Details of transcription in prokaryotes and eukaryotes; hnRNA, splicing, release of mRNA. Translation - initiation, elongation and termination. Genetic code and its features, wobble hypothesis.

Module 9: Regulation of gene expression (5 hrs)

Regulation of gene expression in prokaryotes: operon concept, inducible and repressible systems, negative control and positive control. Lac operon, catabolic repression. Tryptophan operon, attenuation. Regulation in eucaryotes (brief account only).

Module 10: Genetics of cancer (2 hrs)

Genetic basis of cancer – brief description of proto-oncogenes and oncogenes, tumour suppressor genes; characteristics of cancer cells.

PRACTICAL (9 hrs)

6. Work out elementary problems based on DNA structure, replication, transcription and translation and genetic code.

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Core course 11 Code: BO6CRT11
ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY
(Theory 72 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Acquaint with the aims, objectives and significance of taxonomy.
- Identify the common species of plants growing in Kerala and their systematic position.
- Develop inductive and deductive reasoning ability.
- Acquaint with the basic technique in the preparation of herbarium.
- Familiarizing with the plants having immense economic importance.

ANGIOSPERM MORPHOLOGY

Module 1: Leaf, Inflorescence and Fruit morphology (13 hrs)

Leaf Morphology: types, venation, phyllotaxy. Morphology of flower: flower as modified shoot; detailed structure of flowers - floral parts - their arrangement, relative position - symmetry, aestivation and placentation types - cohesion and adhesion. Floral diagram and floral formula. Inflorescence: racemose types - simple raceme, corymb, umbel, spike, spadix, head and catkin; cymose types - simple cyme; monochasial - scorpioid and helicoid, dichasial and polychasial; special type - cyathium, hypanthodium, verticillaster, thyrsus and panicle. Fruits: simple - fleshy, dry - dehiscent, schizocarpic, indehiscent, aggregate, multiple (sorsosis and syconus).

TAXONOMY

Module 2: Principles of Plant systematics (12 hrs)

Aim, scope, significance and components of taxonomy. Types of classification - artificial (brief account), natural – Bentham and Hooker (Detailed account) and Phylogenetic (Brief account). Angiosperm phylogeny group system (introduction only). Plant nomenclature - binomial, ICBN/ICN principles - rule of priority and author citation. Interdisciplinary approach in taxonomy -

Cytotaxonomy and Chemotaxonomy. Herbarium technique – importance of herbarium; preparation of herbarium and their preservation. Important herbaria in India, BSI.

Module 3: Detailed study of families (30 hrs)

Study the following families of Bentham and Hooker's System with special reference to their vegetative and floral characters; special attention should be given to common and economically important plants within the families: Annonaceae, Nymphaeaceae, Malvaceae, Rutaceae, Anacardiaceae, Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Combretaceae, Myrtaceae, Cucurbitaceae, Umbelliferae (Apiaceae), Rubiaceae, Compositae (Asteraceae), Sapotaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Labiatae (Lamiaceae), Amaranthaceae, Euphorbiaceae, Orchidaceae, Palmae (Arecaceae), Graminae (Poaceae).

ECONOMIC BOTANY AND ETHNOBOTANY (Theory 9 hrs; Practical 9 hrs)

Module 4: Economic botany (12 hrs)

Study the following groups of plants with special reference to the botanical name, family and morphology of the useful part and uses: Cereals - Rice, Wheat; Millets Ragi; Pulses - Green gram, Bengal gram, Black gram; Sugar yielding plants – Sugarcane; Fruits - Apple, Pineapple, Orange, Mango and Banana; Vegetables - Bittergourd, Ladies finger, Carrot and Cabbage; Tuber crops - Tapioca; Beverages - Tea, Coffee; Oil yielding plants - Ground nut, Coconut, Gingelly; Spices – Cardamom, Pepper, Cloves, Ginger; Timber yielding plants - Teak wood and Rose wood; Fibre yielding plants - Coir, Jute, Cotton; Rubber yielding plants - Para rubber; Gums and Resins - White damer, Gum Arabic, Asafoetida; Insecticide yielding Plants - Tobacco and Neem.

Module 5: Ethnobotany (5 hrs)

Introduction, scope and significance of ethnobotany. Study of the following plants used in daily life by tribals and village folks for food, shelter and medicine: Food - *Artocarpus heterophylla*, *Corypha*; Shelter - *Bambusa*, *Ochlandra* and *Calamus*; Medicine – *Curcuma longa*, *Trichopus zeylanicus* and *Alpinia galanga*.

PRACTICAL (45 hrs)

1. Identify the following inflorescence and fruits with reference to their morphological specialities: (a) Inflorescence - simple raceme, spike, corymb, head, simple cyme, cyathium and hypanthodium. (b) Fruits - simple - (fleshy) - berry drupe, pepo, hesperidium. Dry indehiscent - nut. Dry dehiscent - legume, capsule (loculicidal). Aggregate.
2. Preparation of floral formula and floral diagram from floral description (of families studied).
3. Identify the families mentioned in the syllabus by noting their vegetative and floral characters.
4. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one flower from each family.
5. Prepare herbarium of 25 plants with field notes.
6. Conduct field work for a period of not less than 5 days under the guidance of a teacher and submit field report.
7. Study the finished products of plants mentioned in the syllabus of economic botany with special reference to the morphology of the useful part, botanical name and family.
8. Identify and describe the ethnobotanical uses of the items mentioned in the syllabus.

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Core course 12 Code: BO6CRT12
BIOTECHNOLOGY AND BIOINFORMATICS
(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand the current developments in the field of Biotechnology and Bioinformatics.
- Equip the students to carry out plant tissue culture.
- Introduce the vast repositories of biological data knowledge.
- Equip to access and analyze the data available in the databases.

BIOTECHNOLOGY (36 hrs)

Module 1: Plant tissue culture (6 hrs)

Biotechnology - an overview; plant tissue culture - basic concepts, totipotency, differentiation, de-differentiation and re-differentiation. Tissue culture media: components, role of plant growth regulators in tissue culture. Preparation of MS medium; sterilization of equipments, glassware and culture medium, surface sterilization of explants.

Module 2: Applications of plant tissue culture (10 hrs)

Micropropagation, methods - axillary bud proliferation, adventitious regeneration – shoot organogenesis and somatic embryogenesis - direct and indirect; meristem culture. Stages of micropropagation, hardening and transplantation. Advantages and disadvantages of micropropagation - somaclonal variations. Embryo culture, callus and cell suspension culture, *in vitro* production of haploids - anther and pollen culture; uses of haploids. Protoplast culture: isolation of protoplast, culture methods, applications; protoplast fusion - cybrids. Artificial seeds, advantages and disadvantages. *In vitro* production of secondary metabolites; cell immobilization, bioreactors (brief study only).

Module 3: Recombinant DNA technology and its applications (10 hrs)

Steps in rDNA technology, cloning vectors and their desirable properties; plasmids, cosmids, phage vectors, Phasmids, YAC and BAC; structure and applications of pBR322, M13 and Ti plasmid. Cutting and joining of DNA molecules - Restriction endonucleases and ligases - ligation techniques. Transformation and selection of transformants - using antibiotic resistances markers and complementation.

Achievements of recombinant DNA technology: in medicine (Human insulin and gene therapy); in agriculture – Bt cotton; in environmental cleaning - super bugs.

Module 4: Techniques in rDNA technology (10 hrs)

DNA isolation, agarose gel electrophoresis, southern hybridization, autoradiography. DNA finger printing and its applications. PCR and its applications. DNA sequencing by Sanger's dideoxy method. Uses of refrigerated centrifuges, UV trans-illuminator, gel documentation system and Laminar Air Flow chamber (brief account only).

GENOMICS AND BIOINFORMATICS (18 hrs)**Module 4: Genomics (4 hrs)**

A brief account on genomics and proteomics; major findings of the following genome projects – *E. coli*, Human, *Arabidopsis thaliana*.

Module 5: Basic bioinformatics (7 hrs)

An introduction to bioinformatics, objectives and applications of bioinformatics. Biological data bases: types - primary, secondary and composite databases; nucleotide sequence databases – NCBI (GenBank), EMBL, DDBJ; Protein Sequence databases - SWISS-PROT, PIR; Protein structure database – PDB; bibliographic database – PubMed.

Module 6: Sequence analysis and molecular phylogeny (7 hrs)

Sequence analysis tools - BLAST and FASTA, Molecular visualisation tool - RASMOL (basic commands), Sequence alignment - Scoring matrices, global and local alignment, Pairwise and multiple sequence alignment; common software used in alignment - CLUSTAL W & CLUSTAL X. Molecular phylogeny - homologs, orthologs and paralogs; phylogenetic tree - rooted and unrooted tree, advantages of phylogenetic tree, use of PHYLIP software.

PRACTICAL (36 hrs)

1. Preparation of nutrient medium – Murashige and Skoog medium (Demonstration only).
2. Sterilization and inoculation of plant tissue in culture media.
3. Establishing shoot tip, axillary bud cultures (Demonstration only).
4. Immobilization of whole cells or tissues in sodium alginate.
5. Isolation of DNA from plant tissue.
6. Agarose gel electrophoresis of the isolated DNA (Demonstration only).
7. Familiarise the instruments included in the syllabus such as Autoclave, laminar air flow chamber, UV- trans-illuminator, PCR machine, Electrophoresis apparatus, centrifuge etc. and prepare short notes with diagrammatic sketch or photographs.

8. Familiarizing GENBANK, DDBJ, ENA, SWISS-PROT and PDB databases (Demonstration only).
9. Analysis of structural features of proteins using RASMOL.
10. Local alignment of sequences using BLAST (Demonstration only).
11. Retrieving a few research papers related to genetic engineering from PubMed (Demonstration only).

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CURRICULUM OF B.SC MATHEMATICS IS GIVEN UNDER

CURRICULUM FOR B.Sc MATHEMATICS MODEL

I (UGCBCS 2017)

Course Structure

Total Credits:-120 (Eng:22+S.Lang:16+Complementary:28+open:4+Core:51)

Total hours:-150 (Eng:28+S.Lang:18+Complementary:36+open:4+Core:65)

Sl: No	Semester	Papers	Hours	Credits	Internal Marks	External Marks	Total Marks
1	I	English I	5	4	20	80	100
		English/Common course I	4	3	20	80	100
		Second Language I	4	4	20	80	100
		Mathematics Core Course - 1	4	3	20	80	100
		Complimentary I Course - 1 (Statistics)	4	3	20	80	100
		Complimentary 2 Course - 1 (Physics Theory/ Computer)	2 (T)	2	10	60	70
	2 (P)		0				
Total			25	19			570
2	II	English II	5	4	20	80	100
		English/Common course II	4	3	20	80	100
		Second Language II	4	4	20	80	100
		Mathematics Core Course- 2	4	3	20	80	100
		Complimentary I Course -II (Statistics)	4	3	20	80	100

OPEN COURSE DURING THE FIFTH SEMESTER

Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MM5OPT01: History of Indian Mathematics	4	3	3 hrs
MM5OPT02: Applicable Mathematics	4	3	3 hrs
MM5GET03: Mathematical Economics	4	3	3 hrs

CHOICE BASED COURSE DURING THE SIXTH SEMESTER

Title of the Course	No. of contact hrs/week	No. of Credit	Duration of Exam
MM6CBT01: Operations Research	4	3	3 hrs
MM6CBT02: Basic Python Programming And Typesetting in LaTeX	4	3	3 hrs
MM6CBT03: Numerical Analysis	4	3	3 hrs

		Complimentary2 Course-II (Physics/ Computer)	2 (T)	2	10	60	70
			2 (P)	2	20	40	60
		Total		25	21		
3	III	English III	5	4	20	80	100
		Sec. Lang./Common course I	5	4	20	80	100
		Mathematics Core Course – 3	5	4	20	80	100
		Complimentary1 Course – II (Statistics)	5	4	20	80	100
		Complimentary2 Course –II (Physics Theory/ Computer)	3 (T)	3	10	60	70
			2 (P)	0			
Total		25	19			470	
4	IV	English IV	5	4	20	80	100
		Sec. Lang./Common courseII	5	4	20	80	100
		Mathematics Core Course – 4	5	4	20	80	100
		Complimentary1 Course III	5	4	20	80	100
		Complimentary2 Course III (Physics/ Computer)	3 (T)	3	10	60	70
			2 (P)	2	20	40	60
Total		25	21			530	
5	V	Mathematics Core Course – 5	6	4	20	80	100
		Mathematics Core Course – 6	6	4	20	80	100
		Mathematics Core Course – 7	5	4	20	80	100
		Human Rights and Mathematics for Environmental studies	4	4	20	80	100
		Open Course	4	3	20	80	100
		Total		25	19		
6	VI	Mathematics Core Course – 9	5	4	20	80	100
		Mathematics Core Course-10	6	4	20	80	100
		Mathematics Core Course-11	5	4	20	80	100
		Mathematics Core Course-12	5	4	20	80	100

		Choice Based Course	4	3	20	80	100
		Project	0	2	20	80	100
	Total		25	21			600

English:

Sem ester	Title of the Course	Number of hours per week	Total Credits	Total hours/ semester	University Exam Duration	Marks	
						Internal	External
1	English I	5	4	90	3 hrs	20	80
	English /Common course I	4	3	72	3 hrs	20	80
2	English II	5	4	90	3 hrs	20	80
	English /Common course II	4	3	72	3 hrs	20	80
3	English III	5	4	90	3 hrs	20	80
4	English - IV	5	4	90	3 hrs	20	80

Second Language:

Seme ster	Title of the Course	Number of hours per week	Total Credits	Total hours/ semester	University Exam Duration	Marks	
						Internal	External
1	Second Language I	4	4	72	3 hrs	20	80
2	Second Language II	4	4	72	3 hrs	20	80
3	Sec. Lang/ Common course I	5	4	90	3 hrs	20	80
4	Sec. Lang/ Common course II	5	4	90	3 hrs	20	80

MATHEMATICS CORE COURSES

Semester	Title of the Course	Number Of hours	Total Credits	Total hours/ semester	University Exam Duration	Marks	
						Internal	External
I	MM1CRT01: Foundation of Mathematics	4	3	72	3 hrs	20	80
II	MM2CRT02: Analytic Geometry, Trigonometry and Differential Calculus	4	3	72	3 hrs	20	80
III	MM3CRT03: Calculus	5	4	90	3 hrs	20	80
IV	MM4CRT04: Vector Calculus, Theory of Numbers and Laplace transforms	5	4	90	3 hrs	20	80
V	MM5CRT05: Mathematical Analysis	6	4	108	3 hrs	20	80
	MM5CRT06: Differential Equations	6	4	108	3 hrs	20	80
	MM5CRT07: Abstract Algebra	5	4	90	3 hrs	20	80
	Human rights and Mathematics for Environmental Studies.	4	4	72	3 hrs	20	80
	Open course	4	3	72	3 hrs	20	80
VI	MM6CRT09 : Real Analysis	5	4	90	3 hrs	20	80
	MM6CRT10: Graph Theory and metric spaces	6	4	108	3 hrs	20	80
	MM6CRT11 : Complex Analysis	5	4	90	3 hrs	20	80
	MM6CRT12 : Linear Algebra	5	4	90	3 hrs	20	80
	Choice Based Course	4	4	72	3 hrs	20	80
	MM6PRT01 : Project	-	2	-	-	20	80

