DST

INSPIRE INTERNSHIP SCIENCE CAMP

January 03 to January 07, 2020

Sponsored by

Department of Science & Technology, Govt. of India

New Delhi

SOUVENIR

Organized by

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE, DURG C.G.

(REACCREDITED BY NAAC WITH "A+" GRADE III-CYCLE)

(SELECTED FOR UGC "CPE" SCHEME PHASE-III)

(INCLUDED IN STAR COLLEGE SCHEME OF DBT, NEW DELHI)

(SELECTED FOR PREPARATION OF NATIONAL HIGHER EDUCATION QUALIFICATION FRAMEWORK BY MHRD, NEW DELHI)

SECURED 1ST RANK IN C.G. STATE IN MUKHYAMANTRI PANCHMUKHI YOJANA 2016-17

SECURED 1ST RANK IN DURG DISTRICT IN SWACHHATTA COMPETITION 2019-20

STATUE OF SWAMI VIVEKANAND IN COLLEGE CAMPUS

MAIN BUILDING OF OUR COLLEGE

ORGANIZING COMMITTEE

Dr. R. N. Singh
Coordinator & Principal

Dr. Anil Kumar
Assistant Coordinator

Dr. Ajaya Singh
Assistant Coordinator

Dr. Prashant Shrivastav
Assistant Coordinator

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Contents

डॉ. अरुणा पल्टा
कुलपति

Dr. Aruna Palta
Vice Chancellor

हेमचंद यादव विश्वविद्यालय
रायपुर नाका, दुर्ग (छ. ग.)–491001

HEMCHAND YADAV UNIVERSITY
RAIPUR NAKA, DURG (C. G.)-491001
Office-0788-2359800
E-Mail- vicechancellor@durguniversity.ac.in

Date: 26.12.2019

MESSAGE

It gives me immense pleasure to know that the Govt. V. Y. T. PG. Autonomous College, Durg (C. G.) is organizing an **INSPIRE Internship Science Program from 3rd to 7th January 2020.**

Around 200 High School science students are likely to participate in this event. Such programmes help the students to learn and understand Basic Sciences in depth and motivate them to become Scientists in future.

In my capacity, as Vice Chancellor of Hemchand Yadav University, Durg, I take the privilege to extend my Best wishes and Blessings to all the students who will surely participate in this event with great zeal and vigour.

I wish this event a great success.

Dr. Aruna Palta
(Vice–Chancellor)

To,
The Principal
Govt. V. Y. T. PG. Autonomous College, Durg (C. G.),
Dist.- Durg (CG.)

From the Principal's Desk

With a glorious history of 61 years Govt. V.Y.T. PG. Autonomous College, Durg has scaled new heights in academics, sports and cultural activities. The college has carved a niche for itself on the academic map of India, being accredited **A+** by NAAC Bengaluru. It has now become a centre of excellence for students from rural and urban areas.

The college is known for its excellent infrastructure with state of art science labs for research and teaching. At present the college caters more than 5800 students from different streams. Recently our college has been selected in UGC prestigious scheme 'Paramarsh". Under this scheme our college will play role of mentor for different Government and private colleges.

The college is privileged to organize the prestigious **INSPIRE Science Internship Camp** for the fourth time from 03 January to 07 January 2020. INSPIRE (Innovation in Science Pursuit for Inspired Research) is an innovative programme developed, managed and sponsored by the Department of Science & Technology, New Delhi, to attract talent to the excitement and study of science at an early age, and to help the country build the required critical resource pool for strengthening, expanding the science & technology system and research & development base. With the above aim in mind the college has invited the toppers and meritorious students of Chhattisgarh from the various boards like CGBSE, ICSE and CBSE. About 70% of the participants are from the remote areas of Chhattisgarh like Surajpur, Bacheli, Dantewada, Kawardha, Sukma, Bhanupratapur, Vishrampur, Sarguja, Korba and Jagdalpur. The basic segment of the camp will include lecture-cum-interactive sessions by national and international mentors of repute in their subjects like Physics, Chemistry, Botany, Zoology, Mathematics, Geology, Microbiology and Biotechnology. In consonance with the vision of digital and clean India, various competitions will be organized during the camp. Students who participated in the camp organized last year passed their examination with flying colours. Through this camp the aim of DST to inspire students in the field of basic sciences and to incline them towards scientific research is fulfilled.

I hope the students will get a boost to their inclination towards basic sciences and are able to form an even clearer picture about their career path. Above all I wish All participants gain knowledge and cherish great memories.

Good luck to one and all !

(Prof. R.N.Singh)
Principal
Tel. 0788-2359688
Mob. 9300119083
E.mail-pprinci2010@gmail.com

About Inspire....

The strength of the innovation infrastructure of a nation has enormous significance in the competition among emerging knowledge economies. The realization of Vision 2020 calls for action and a well designed innovation infrastructure.

Generation and nurturing of a human talent pool capable of utilizing and developing first principles in science is both a pre-condition and integral part of such an innovation infrastructu re. An India specific model for attracting talent with an aptitude for research and innovation, for a career in Basic & Natural sciences is required. INSPIRE is an innovative programme developed by the Department of Science & Technology to attract talent to the excitement and study of science at an early age, and to help the country build the required critical resource pool for strengthening and expanding the S&T system and R&D base. It is a programme with long term foresight.

"Innovation in Science Pursuit for Inspired Research (INSPIRE)" is an innovative programme sponsored and managed by the Department of Science & Technology for attraction of talent to Science. The basic objective of INSPIRE is to communicate to the youth of the country the excitements of creative pursuit of science, attract talent to the study of science at an early age and thus build the required critical human resource pool for strengthening and expanding the Science & Technology system and R&D base.

A striking feature of the programme is that it does not believe in conducting competitive exams for identification of talent at any level. It believes in and relies on the efficacy of the existing educational structure for identification of talent.

COLLEGE AT A GLANCE

Government Vishwanath Yadav Tamaskar Post-Graduate Autonomous College, Durg is a leading higher education institution in Chhattisgarh. It is affiliated to Durg University, Durg. The college has been conferred with the status of autonomy by the UGC since 1989. The college accredited with **grade "A^+" (with CGPA of 3.58)** by NAAC in Third cycle, and has been recognized by UGC as **'College with Potential for Excellence' (CPE)**, receiving the grant under IIIrd Phase of the scheme. Five departments from faculty of Science and one from Social Science have been identified by UGC under CPE scheme as highly rated departments. The institute has been shortlisted and recognized under **DBT Star College Scheme** by the Department of Biotechnology (DBT) Govt. of India, under this scheme 6 departments from faculty of Science have been selected for providing financial support. The department of Chemistry was recognized under **Funds for improving Science and Technology Infrastructure (FIST)** Scheme by department of Science and Technology, Govt. of India. The college has the distinction of being one of the 20 prominent institutions across the country to have been selected for providing suggestions on **National Higher Education Qualification Framework (NHEQF)** of India.

The college offers UG and PG courses in Science, Arts and Commerce streams, equipped with 21 teaching departments, including 16 PG departments, 104 faculty members and 14 recognized research centres, namely Hindi, English, History, Political Science, Sociology, Economics, Commerce, Physics, Chemistry, Botany, Zoology, Geology, Mathematics, and Biotechnology. Department of Physics, Chemistry, Maths, Botany, Microbiology, Biotechnology, Geology have research collaborations with national & international institutes of high repute. Many of the departments render paid as well as free consultancy services for sharing their knowledge resources for the benefit of institutions and society. The college houses study centres of IGNOU and Pt. Sundarlal Sharma Open University.The college had a humble start with just two rooms that hosted. Arts and Science faculty, at the local *Hindi Bhawan*. The foundation stone of the present building was laid by the then Chief Minister of Madhya Pradesh Dr. Kailash Nath Katju in November, 1958. It was shifted to its present campus of 21.75 acres, in 1962. Since then the college is continuously growing in terms of infrastructure and learning resources in its journey towards excellence.

The college served as a major resource to provide man-power to Bhilai Steel Plant. This led to a breakthrough in socio-economic transformation of this region. Presently the college is one of the biggest Govt. Colleges in Chhattisgarh, a **Lead College** of Durg district that provides administrative and academic support and guidance to 56 colleges of the district. The college has student strength of 5248 in the current session. It holds the unique opportunity of being a mixed bowl of urban, tribal & rural students, majority of them being first generation learners. **The college, since its inception, is serving the society in a significant way by providing higher education to first generation learners.**

This institution holds high repute in the field of academics as well as in sports. A large number of students from this college are holding prestigious and distinguished positions. Many of them are serving the society with their significant contribution in the field of administration, public services, education, art and literature, sports, business and entrepreneurship.

The institute has excelled in the field of research, consultancy, extension and collaboration remarkably in the last five years. Our faculty have organized 58 National and International Conferences, successfully completed 47 major and minor research projects. They have published 16 Books and contributed in editing works of various journals apart from acting as members of Editorial Boards of 24 journals. Our faculty have participated in 780 Seminars, Symposia and Conferences and published 432Internation, 168 National research papers in peer reviewed high impact factor journals. 221 research students have been enrolled in last five years under the supervision of 38 research guides for pursuing their Ph.D. Faculty have also signed and are working under purview of 06 MoUs and 06 foreign visits.

The research scholars have bagged a number of fellowships conferred by various agencies viz.-- DST-Women Scientist Fellowship, UGC-Post Doctoral Fellowship, Maulana Azad Fellowship, Rajiv Gandhi National Fellowship, Indira Gandhi Single Girl Child Fellowship, CSIR-UGC-NET-JRF Fellowship, GATE and Fellowship of Biotech Consortium of India Limited. At state level also they have awarded with **Young Scientist Award**, Best Paper Presentation Award etc. The college is solitary institution amongst hundreds of colleges in Chhattisgarh and M.P. selected under **Star College Scheme** by Deptt. of Biotechnology, Govt of India. Recently in the year 2019-20 our college has been selected in UGC prestigious Paramarsh Scheme. Under this Scheme our College will play role of mentor for other government and private Colleges regarding NAAC accreditation.

The College has a well defined and independent system for student support and mentoring. The system works in close association with all the stakeholders to ensure all round development of the students. The Parent Teacher Student Association (PTSA) has been formed where teachers are assigned 70 to 80 students and act as mentors to them. The Institution also engages students in various extracurricular activities, the most popular amongst them being sports, cultural activities, NCC, NSS, and Youth Red Cross. Students are also actively engaged in winning laurels at various seminars, conferences and workshops at national and international levels.

To orient and engage one of the largest group of community is not an easy task, so the college fraternity has taken initiatives to inculcate awareness and also sensitize the community towards societal issues through Innovative Practices under the auspices of **Academia-Community Interface Programme (ACIP).**

For better academic and administrative functioning, the institution has introduced a variety of best practices, amongst these three best practices are:

1) ***Academic Mentoring of Schools (AMS)*:** This practice was introduced in 2011 keeping in view to promote collaborative engagements between the institution and the government schools in the neighbourhood. The objective behind adopting it aims at transferring of academic expertise and skilled resources and provide institutional assistance to upgrade and facilitate these schools with good academic and intellectual help to empower them to keep pace with the fast changing global and local scenario.

2) ***Promotion Of Quality Culture Amongst Colleges (PQCC):*** Promotion of Quality Culture amongst Colleges was initiated and introduced with an aim and desire to build a "knowledge Society" around creating quality consciousness among the colleges in the state. The world has transformed into a global village. Upcoming market economies, new technologies and emerging trends set a challenge to educational institutions. In order to meet these challenges and thrive, sharing of knowledge and expertise has become the dire need of all the institutions. The college has taken a lead by implementing this practice successfully. Various efforts at developing strategies and measures for implementation of quality education and quality culture within campuses have also been assured through the formation of the **'District Quality Circle'.**

3. ***Efforts to resolve societal problems*** – Our college has under taken initiatives for various problem of society with the aim to serve society. We are working for various societal problems viz. Sickle cell anamia, Thalassemia, organic and inorganic pollution analysis, monitoring of river health of the state, training to youth for their career like mushroom cultivation.

DST
INSPIRE INTERNSHIP SCIENCE CAMP 2020
Date 03 January – 07 January 2020

List of Committees

Programme Coordinator- Dr. R.N. Singh, Principal
Assistant Coordinator – Dr. Anil Kumar, Professor Zoology
Assistant Coordinator – Dr. Ajaya Singh, Professor Chemistry
Assistant Coordinator – Dr. Prashant Shrivastava, Assistant Professor Geology

प्राचार्य द्वारा गठित समितियों की सूची

Core Committee

Name	Department	Contact Number
Dr. R.N. Singh	Principal	93001-19083
Dr. M. A. Siddhiqui	HOD, Maths	98271-73652
Dr. Rajendra Choubey	HOD, Sociology	98271-95449
Dr. Anupama Asthana	HOD, Chemistry	98271-62574
Dr. Jagjeet Kaur Saluja	Professor, Physics	99777-17571
Dr. A.K. Khan	Professor, Economics	98274-70364
Dr. Ranjana Shrivastava	HOD, Botany	94792-27004
Dr. Purna Bose	HOD, Physics	94241-08171
Dr. Kanti Choubey	HOD, Zoology	94252-46227
Shri Ashutosh Sao	Registrar	9981289030

Sub Committee

Scientific Sessions

Name	Department	Contact Number
Dr. Anil kumar	Professor, Zoology	98274-91253
Dr. Ajaya Singh	Professor, Chemistry	94062-07572
Dr. R.S. Singh	Professor, Physics	7415222198
Dr. Pragya Kulkarni	Asstt. Professor Botany	98261-42086
Dr. S.D. Deshmukh	Asstt. Professor, Geology	9329112268
Dr. Rakesh Tiwari	Asstt. Professor, Maths	98265-23228
Dr. Usha Sahu	Asstt. Professor, Zoology	75871-68720
Dr. V.S. Geete	Asstt. Professor, Chemistry	94252-44857

Application receiving/Selection of participants/Printing etc.

Name	Department	Contact Number
Dr. Prashant Shrivastava	Asstt. Professor, Geology	98271-78920
Dr. Mausumi Dey	Asstt. Professor, Zoology	96853-34627
Dr. Sanju Sinha	Asstt. Professor, Zoology	98279-45397

Inauguration/valedictory and library visit

Name	Department	Contact Number
Dr. Anupama Asthana	HOD, Chemistry	98271-62574
Dr. Jagjeet Kaur Saluja	Professor, Physics	99777-17571
Dr. Upma Shrivastava	Asstt. Professor, Chemistry	89627-82515
Dr. Vijay Laxmi Naidu	Asstt. Professor Botany	70006-19219
Dr. K. Padmavati	Asstt. Professor Economics	94241-31422
Dr. Anupama kashyap	Asstt. Professor, Chemistry	98279-58247
Dr. Jyoti Dharkar	Asstt. Professor, History	98262-34240
Shri Vinod Ahirwar	Librarian	94241-14401

Accommodation (Durg and Bhilai)

Name	Department	Contact Number
Dr. O.P. Gupta	Professor, Commerce	99261-70704
Dr. I.S. Chandrakar	Professor, Geography	9301256592
Dr. Sapana Sharma	Asstt. Professor, Sociology	98934-67679
Dr. Alka Mishra	Asstt. Professor, Zoology	79877-76939
Dr. Sanju Sinha	Asstt. Professor, Zoology	98279-45397
Dr. Dilip Sahu	Asstt. Professor, Computer Science	79873-09098
Dr. Abhishek Misra	Asstt. Professor, Physics	79856-29641
Shri Jainendra Diwan	Asstt. Professor, Sanskrit	93995-39019

Food & Catering

Name	Department	Contact Number
Dr. Abhinesh Surana	Professor, Hindi	98274-92040
Dr. Shankar Nishad	Professor, Hindi	90396-30820
Dr. Thansingh Verma	Assistant Professor, Hindi	94062-72857
Dr. Rakesh Tiwari	Asstt. Professor, Mathematics	98265-23228
Dr. Nutan Rathore	Asstt. Professor, Chemistry	94061-17335
Dr. Sapna Sharma	Asstt. Professor, Sociology	98934-67679
Dr. A.K. Pandey	Asstt. Professor, History	87707-75754
Dr. Durgesh Kotangale	Asstt. Professor, Computer Science	93298-80989

Finance/T.A./D.A. Payment to resources persons/students

Name	Department	Contact Number
Dr. H.P. Singh Saluja	Professor, Commerce	98263-39195
Dr. Padmavati	Professor, Maths	94255-57653
Dr. Shikha Agrawal	Professor, Economics	98279-35586
Dr. S.D. Deshmukh	Asstt. Prof. of Geology	9329112268
Dr. Anita Shukla	Asstt. Prof. of Physics	97556-34741
Dr. Usha Sahu	Asstt. Professor, Zoology	75871-68720
Shri Radhe Lal Yadav	Hostel Warden	93004-14459
Shri Satyendra Soni	Account Section	93038-11125

Medical Aid/Health Service

Name	Department	Contact Number
Dr. O.P. Gupta (NCC)	Professor & Head, Commerce	99261-70704
Dr. Sapana Sharma (NCC)	Asstt. Professor, Sociology	98934-67679
Dr. Meena Maan (NSS)	Asstt. Professor, English	98279-46117
Dr.Tarlochan Kaur (YRC)	Asstt. Professor, English	98278-95972
Dr. Rachita Shrivastava	Asstt. Professor, Psychology	8882239226

Media Publicity/Press

Name	Department	Contact Number
Dr. Prashant Shrivastava	Asstt. Professor, Geology	98271-78920
Dr. Anupama kashyap	Asstt. Professor, Chemistry	9179041787

Water, Generator, Electricity, Sound, Seminar Hall preparation

Name	Department	Contact Number
Dr. S.N. Jha	Professor, Commerce	7004624093
Dr. Shankar Nishad	Professor, Hindi	90396-30820
Dr. S.R. Thakur	Asstt. Professor, Commerce	94255-57121
Prof. Durgesh Kotangale	Asstt. Professor, Computer Science	9329880989
Shri Vinod Ahirwar	Librarian	94241-14401
Shri Abdul Mehmood	Sports Officer	98938-10236
Shri Radhe Lal Yadav	Hostel Warden	9300414459
Shri Sanjay Yadav	Head Clerk	6263587921
Shri Ganga Prasad	Store Keeper In charge	-

Cultural Programme

Name	Department	Contact Number
Dr. Anupama Asthana	HOD, Chemistry	98271-62574
Dr. K. Padmawati	Asstt. Professor Economics	94241-31422
Dr. Jyoti Dharkar	Asstt. Professor, History	98262-34240
Dr. Meena Maan	Asstt. Professor, English	98279-46117
Dr. Krishna Chatterjee	Asstt. Professor, Hindi	98261-34807
Dr. Anupama Kashyap	Asstt. Professor, Chemistry	91790-41787

Momento/Welcome/Certificate Writing/Certificate Distribution

Name	Department	Contact Number
Dr. Sunitha Mathew	Asstt. Professor, Chemistry	94241-08409
Dr. K. Padmawati	Asstt. Professor Economics	94241-31422
Dr. Jyoti Dharkar	Asstt. Professor, History	98262-34240
Ms. Mausumi Dey	Asstt. Professor, Zoology	95849-34627
Shri Vinod Ahirwar	Librarian	94241-14401

Lab Visit Committee

Name	Name of Lab	Contact Number
Dr. M.A. Siddhiqui	Mathematics lab	9827173652
Dr. Anupama Asthana	Chemistry lab	98271-62574
Dr. Purna Bose	Physics lab	94252-46227
Dr. Jagjeet Kaur Saluja	Computer lab	99777-17571
Dr. Ranjana Shrivastava	Botany lab	94792-27004
Dr. Kanti Chaubey	Zoology lab	94241-08171
Dr. Anil Kumar	Biotechnology Lab	98274-91253
Dr. Pragya Kulkarni	Microbiology Lab	98261-42086
Dr. S.D. Deshmukh	Geology Lab	9329112268

Leader of Sub groups

Group	Group Name	Prof. In charge	Associate In char
Group-A	Dr. A.P.J. Kalam Group	Dr. V.S. Geete	Dr. Sanju Sinha
Group-B	B1-Dr. Shantiswarup Bhatangar Group	Dr. Shakeel Hussain	Dr. Alka Mishra
Group-C	C1-Dr. C.V.Raman Group	Dr. Anita Shukla	Dr. Mousmi Dey
Group-D	D1-Dr. Meghnath Saha Group	Dr. Dilip Sahu	Dr. Vijay Laxmi Naidu Dr. Satish Sen

Committee for Concept inception

Name	Department	Contact Number
Dr. Jagjeet Kaur Saluja	Professor, Physics	99777-17571
Dr. Ajay Pillai	Asstt. Prof. Chemistry	94252- 45612
Dr.V.S. Geete	Asstt. Professor, Chemistry	94252- 44857
Dr. Rakesh Tiwari	Asstt. Professor, Mathematics	98265- 23228
Dr. Mausmi Dey	Asstt. Professor, Zoology	95849- 34627
Dr. Shriram Kunjam	Asstt. Professor, Botany	94063-78794
Dr. Vijay laxmi Naidu	Asstt. Professor, Botany	70006- 19219
Dr. Abhishek Kumar Misra	Asstt. Professor, Physics	94517- 57987

Committee for Students Feedback Collection

Name	Department	Contact Number
Dr. Upma Shrivastava	Asstt. Professor, Chemistry	89627-82515
Dr. S.D. Deshmukh	Geology Lab	9329112268
Dr. Anupama kashyap	Asstt. Professor, Chemistry	98279-58247
Dr. Shakeel Hussain	Asstt. Professor, Political Science	83197-35275
Dr. Anshumala Chandangar	Asstt. Professor, Economics	90091-09019
Dr. Rekha Gupta	Asstt. Professor, Microbiology	89826-08438

Help desk/Registration counter (Members will be present at 8.00 AM on 03 Jan. 2020 in Library reading room for students registration)

S.No.	Group Name	Professor Incharge
1	Group A - **Dr. A.P.J. Kalam Group**	Dr. V.S. Geete
		Dr. Usha Sahu
		Dr. Sanju Sinha
2	Group B - **Dr. Shanti Swarup Bhatnagar group**	Dr. Shakeel Hussain
		Dr. Alka Mishra
		Dr. Neetu Rai
3	Group C - **Dr. C.V.Raman Group**	Dr. AbhishekMisra
		Dr. Mousmi Dey
		Dr. Nidhi Sharma
4	Group D - **Dr. Meghnath Saha Group**	Dr. Dilip Sahu
		Dr. Vijaylaxmi Naidu
		Dr. Siteshwari Chandrakar

Committee for Trip to Science Centre Raipur on 5 January 2020 (After Lunch)

Group A

Name	Department	Contact Number
Dr. Upma Shrivastava	Asstt. Professor, Chemistry	70004 - 92982
Dr. Prashant Shrivastava	Asstt. Professor, Geology	98271-78920
Dr. Sanju Sinha	Asstt. Professor Zoology	98279-45397

Group B

Name	Department	Contact Number
Dr. S.D. Deshmukh	Asstt. Professor, Geology	93291-12268
Dr. Anshumala Chandangar	Asstt. Professor, Economics	90091-09019
Dr. Satish Sen	Asstt. Professor, Botany	99819-23039
Shri Vinod Ahirwar	Librarian	94241-14401

Group C

Name	Department	Contact Number
Dr. Nutan Rathod	Asstt. Professor, Chemistry	94061-17335
Dr. Alka Mishra	Asstt. Professor, Zoology	74155-34177
Dr. Shri Ram Kunjam	Asstt. Professor, Botany	94063-78794

Group D

Name	Department	Contact Number
Dr. K. Padmavati	Asstt. Professor, Economics	94241-31422
Dr. Jyoti Dharkar	Asstt. Professor, History	98262-34240
Dr. Durgesh Kotangale	Asstt. Professor, Computer Science	9329880989

Committee for Collection of Mentors Feedback Form & Students Feedback Form

Name	Department	Contact Number
Dr. Qamar Talat	Professor, English	94255-65387
Dr.V.S. Geete	Asstt. Professor, Chemistry	94252-44857
Dr. Anita Shukla	Asstt. Professor, Physics	97556-34741
Dr. Abhishek Kumar Misra	Asstt. Professor, Physics	94517-57987
Dr. Dilip Sahu	Asstt. Professor, Computer Application	79873-09098
Dr. Rekha Gupta	Asstt. Professor, Microbiology	89826-08438

Transportation Committee for bus management, Raipur Airport for receiving Resource Persons

Name	Department	Contact Number
Dr. O.P. Gupta	Professor, Commerce	99261-70704
Dr. S.D. Deshmukh	Asstt. Professor, Geology	93291-12268
Dr. Shakeel Husain	Asstt. Professor, Political Science	83197-35275
Dr. Rakesh Tiwari	Asstt. Professor, Mathematics	98265-23228
Dr. Shriram Kunjam	Asstt. Professor, Botany	94063-78794
Prof. Dilip Sahu	Asstt. Professor, Comp. App.	79873-09098
Dr. Anshumala Chandangar	Asstt. Professor, Economics	90091-09019

Committee for Night Stay Bakliwal Bhawan, B Market- Sector-6, Bhilai

Name	Department	Contact Number	Date of Stay
Prof. Durgesh Kotangale	Asstt. Professor, Computer Science	9329880989	03.01.2020
Prof. Jainendra Diwan	Asstt. Professor,Sanskrit		
Dr. Alka Mishra	Asstt. Professor, Zoology	79877-76939	04.01.2020
Dr. Sanju Sinha	Asstt. Professor Zoology	98279-45397	
Dr. Dilip Sahu	Asstt. Professor,Comp. Appli.	79873-09098	05.01.2020
Dr. Abhishek Kumar Misra	Asstt. Professor, Physics	94517-57987	
Dr. Janendra Diwan	Asstt. Professor, Sanskrit	93995-39019	06.01.2020
Dr. Rajneesh Umre	Asstt. Professor, Hindi		

Govt. V.Y.T. PG. Autonomous College, Durg (C.G.)
Time Table of Activities
DST INSPIRE Internship Science Camp 2020
January 03 - January 07, 2020

Time	03 January	Time	04 January	05 January	06 January	07 Ja
8.30 to 9.30 AM	Break Fast	8.00 to 9.00 AM	Break Fast	Break Fast	Breakfast	Brea
10.00 AM to 11.30 AM	Inaugural Session	9.00 to 10.30 AM	Lecture	Lecture (9.00 to 10.00 AM)	Lecture	Lec
		10.30 to 12.00 AM	Lecture	Lecture (10.00 to 11.00 AM)	Lecture	Lec
11.30 to 12.00 Noon	High Tea	12.00 to 1.30 Noon	Lecture		12.00 to 1.00 PM New Innovative Ideas Presentation by students	Lab
		1.30 to 2.30 PM	Lunch	Lunch (11.00 to 12.00 Noon)	1.00 PM to 2.00 PM Lunch	Lu
12.00 to 1.30 PM	Lecture	2.30 to 5.00 PM	Lab Visit	At 12.00 noon departure of students for Visit to Science Centre Raipur	Lab Visit 2.00 to 5.30 PM	2.30 t P Collec Feedba stud & Distrib T.A stud
		5.00 to 5.30 PM				
1.30 to 2.30 PM	Lunch	6.00 PM to 7.30 PM	Cultural Programme by Participating School students and students of Govt. V.Y.T. PG Autonomous College. Durg			3.30 Valed func
2.30 to 3.30 PM	Lab Visit					
3.30 to 4.45 PM						
4.45 to 5.30 PM						
8.00 PM	Dinner	8.00 PM	Dinner	Dinner	Dinner	Din

Govt. V.Y.T. PG. Autonomous College, Durg (C.G.)

SCHEDULE OF PROGRAM

DST INSPIRE Internship Science Camp 2020

3rd January (Friday) to 7th January (Tuesday), 2020

Day	Session- I (09:30 am to 11:00 am)	Session- II (11:30 am to 01:00 pm)		Lunch (01:00 pm to 02 pm)	Session- III (02:00 pm to 05:30 pm)	Break (05:30 pm to 06:00 pm)	Pre Dinner Discussion (06:00 pm to 07:00 pm)
03-01-2020 Friday	Dr. T.N. Rao Hyderabad Chemistry	Dr. N.S. Gajbhiya Nagpur Physics			Lab work Group- A, B, C, D		Will be organized by Department of Chemistry
04-01-2020 Saturday	**09:30 am to 11:00 am**	**11:00 am to 12:30 pm**	**12:30 pm to 01:30 pm**		**Lunch (01:30 pm to 02:30 pm)**		Department of Physics and Mathematics
	Dr. Dharmendra Singh Roorkee Physics	Dr. Anupam Basu Burdwan Biology/ Dr. Sanjivini Gharege Mumbai Maths	Dr. N.B. Singh New Delhi Chemistry				
05-01-2020 Sunday	Dr. Man Singh Ahmadabad Chemistry	Dr. Sanjay Deshmukh Mumbai Biology/ Dr. Prajapati Ahmadabad Maths			Visit to Science City Centre, Raipur		Department of Botany & Zoology& Geology
06-01-2020 Monday	**09:30 am to 11:00 am**	**11:00 am to 12:30 pm**	**12:30 pm to 01:30 pm**		**Lunch (01:30 pm to 02:30 pm)**		Department of Biotechnology & Microbiology
	Dr. Atul Verma Ahmadabad Physics	Dr. Sanjay J. Dhoble Nagpur Physics	Dr. P.K. Sharma Jodhpur Chemistry				
07-01-2020 Tuesday	Dr. R.B. Bapat ISI, Delhi Mathematics/ Dr. Dhiraj Kumar New Delhi Biology	Dr. Alok Srivastav Chandigarh Chemistry			Lab work Group- A, B, C, D	Valedictory & Certificate Distribution	

Note-

1. Students will be divided into four groups for practical works.
   A- Chemistry; B- Physics; C-Maths; D- Biology
2. Inaugural function will be organized on first day from 10:30 am to 12:00 Noon.
3. Valedictory function & Certificate distribution will be organized on last day from 3:00 pm onward.
4. Feed back/ TA-DA distribution will be carried out during pre-dinner discussion.

Laboratory visits

- Botany Department.....
- Biotechnology Department.....
- Chemistry Department.....
- Geology Department.....
- Mathematics Department.....
- Microbiology Department....
- Physics Department.....
- Zoology Department.....

DEPARTMENT OF BOTANY

Established in the year 1958 with undergraduate course and postgraduate course was started in the year 1972. The eminent professors of the department made great contribution in research field, Dr. S.K. Sharma in taxonomy, Dr. Choudhary in Plant pathology, Dr. Karkoon in Plant pathology & microbiology, Dr. P.C. Panda in Plant physiology and Dr. J.N. Verma in Plant pathology. The department has well equipped laboratories with projection facilities. It has a track record of producing university rank holders who are pursuing education and research in the institutes of higher learning in India. The department organizes Doctoral Degree and nature walks, field trips, botanical excursions, industrial visits.

Faculty

Name – Dr. Ranjana Shrivastava
Designation - Professor and Head

Name – Smt. Gayatri Pandey
Designation - Assistant Professor

Name - Dr. K.I. Toppo
Designation - Assistant Professor

Name - Dr. G.S. Thakur
Designation - Assistant Professor

Name - Dr. Pragya Kulkarni
Designation - Assistant Professor & Prof. Incharge Microbiology

Name - Dr. Shriram Kunjam
Designation - Assistant Professor

Name – Dr. Vijay Laxmi Naidu
Designation - Assistant Professor

Name – Dr. Satish Sen
Designation - Assistant Professor

Name – Deepika Dhruwe
Designation - Assistant Professor (Guest Faculty)

Objective: Study the different stages of mitosis cell division on root tip

Materials required

a. Onion plant with root
b. Feulgen stain
c. 1 N HCl
d. Scissors
e. Forceps
f. Razor blade
g. Pasture pipette
h. 1.5 ml microfuge tubes
i. Dissection probe with wooden back
j. Microscopic slides and cover slips
k. Water bath
l. Light Microscope

Theory

A process by which a parent cell divides into two or more daughter cells is called cell division. Cell division is a small part of the cell cycle. In normal eukaryotic cells, the type of cell division is known as mitosis.

In eukaryotes, DNA replication is followed by a process called mitosis which separates the chromosomes in its cell nucleus into two identical sets, in two individual nuclei.. Mitosis is followed by cytokinesis. The process of Mitosis is divided into four stages: Prophase, Metaphase, Anaphase and Telophase.

Prophase: During this stage, the chromosomes super coil, condense and become visible for first time during the cell cycle. The spindle fibers start forming. The nuclear membrane starts disintegrating.

Metaphase: During this stage, the spindle fibers reach and attach to centromere of each sister chromatids. The chromosomes align along the center plane of the cell. The nuclear membrane disintegrates completely.

Anaphase: During this stage, the centromeres start splitting and the sister chromatids begin to migrating towards the opposite poles of the cell.

Telophase: During this stage, the chromosomes are clustered on the either end of the cell. The nuclear membrane starts reforming. The cell plate (new cell wall) starts to form between the two daughter nuclei. This will be followed by cytokinesis.

Mitotic Index

The percentage of cells undergoing mitosis or it is defined as the ratio of no. of cells i the dividing phase to the total number of cells observed. This will help to identify the region c most mitotic activities. Mitotic index helps us to quantify the cell division. Mitotic inde decreases with increasing distance from root tip. That means gradual decrease in cell divisio as it moves from the zone of cell division to the zone of cell elongation. The meristemati region in the root tip is the actively growing region and thus the mitotic index is high.

$$\textbf{Mitotic index} = n/N \times 100$$

Procedure

Take the onion plant with newly sprouted roots and cut two root tips using scissors and transfer them into a plastic microfuge tube.

1. Fill 2/3 of the tube with 1N HCl using a dropper.
2. Place the tube in a 60°C water bath and incubate the tube for 12- 15 minutes.
3. Remove the tube from the water bath after the incubation.
4. Discard the HCl from the tube using a Pasture pipette to the running tap water.
5. Add some drops of distilled water into the tube and rinse the root. Then remove th water from the microfuge tube using the Pasture pipette. (Rinse the roots at least thre times).
6. After the washing step add 2-3 drops of Feulgen stain into the tube with root tips an incubate the roots for 12-15 minutes. (During the incubation, the very tip of the roc will begin to turn red as the DNA stains the numerous small actively dividing cells a the time).
7. After the incubation remove the stain using a Pasture pipette.
8. Again rinse the root tips with distilled water. (Rinse the roots at least three times).
9. Transfer a root from the tube to the centre of the microscopic slide and add a drop o water over it.
10. Take a razor blade and cut most of the unstained part of the root.
11. Cover the root tip with a cover slip and then carefully push down on the cover slid with the wooden end of a dissecting probe. (Push hard, but do not twist or push th cover slide sideways). The root tip should spread out to a diameter of about 0.5- 1cm.
12. Observe it under a compound microscope in 10x objective. Scan and narrow down to region containing dividing cells and switch to 40x for a better view.

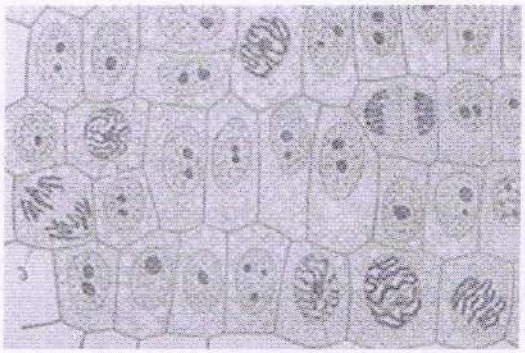


Figure- Mitosis in Onion Root Tip

Objective: To study the stomatal distribution on the upper and lower leaf surfaces and to calculate the stomatal index.

Materials Required:

a. Four O Clock plant
b. Glycerin
c. Safranin Solution
d. Forceps
e. Microscope
f. Glass slide
g. Coverslip
h. Blade
i. Watch glass

Theory

What is Stomata?

Stomata are minute pores found on the epidermis of leaves and young shoots of plants that are used to control exchange of gases. The pore is surrounded by a pair of specialised cells called the guard cells that are responsible in regulating the size of the opening.

Water is released through the stomata into the atmosphere in the form of water vapour through the process called transpiration. Besides this, the exchange of oxygen and carbon dioxide in the leaf also occurs through the stomata.

Distribution of Stomata

Distribution of stomata varies between monocots and dicots, between plant species, and between the underside and top side of the leaves on a plant.

Stomata are found more on plant surfaces thriving under higher light, lower atmospheric carbon dioxide concentrations and in moist environments.

Usually the lower surface of a dicot leaf has a greater number of stomata while in a monocot leaf they are more or less equal on both surfaces. In most of the floating plants, stomata are found only on the upper epidermis.

Calculation of Stomatal Index

The distribution of stomata on the upper and lower surfaces of the leaf can be studied by removing the peels of the leaf from the upper and lower surfaces and observing the same under a microscope.

The count of the number of stomata and epidermal cells in the microscopic field is taken and the stomatal index of each surface of the leaf can be calculated using the following formula:

$$\text{Stomatal index} = \frac{\text{No: of Stomata}}{\text{No: of Stomata + No: of epidermal cells}} \times 100$$

Procedure

- Pluck one fresh leaf of a four-o'clock plant.
- Take two watch glasses and pour some distilled water into the both watch glasses.
- Split the leaf from the four-o'clock plant obliquely.
- Take the peel from the upper surface of the leaf using the forceps.
- Place the peel into a watch glass containing water.
- Take another peel from the lower surface of the leaf using the forceps.
- Place the peel into the other watch glass containing water.
- Using a dropper, take few drops of Safranin solution and put it into the two watch glasses.
- Take two clean glass slides and place the leaf peel on the slides one by one, using a brush.
- Take a blade and cut a small rectangle or square piece from each peel.
- Take some glycerine using a dropper and put one drop of glycerine on both slides.

- Take a cover slip and place it gently on the peel with the help of a needle.
- Take the glass slide and place it under compound microscope.
- Observe under the microscope.
- Count the number of stomata in the peels of both upper and lower epidermis of the leaf appearing in the microscopic field.

Objective: To study the effect of CO_2 on photosynthesis.

Materials required: Wilmott's bubbler, water, twigs of *Hydrilla,* $NaHCO_3$, stopwatch etc.

Principle: The process of photosynthesis is affected by many factors. Blackmans law of limiting factor (1905) states that the rate of a process affected by a number of factors is limited by the pace of the slowest factor. Thus if all the other factors are kept constant, the factor affecting the rate is at minimum. The rate gradually increases with the increase in the amount of this factor till the rate becomes constant. The rate now does not increase even though the amount of this factor is increased because another factor has now become factor in the minimum.

Atmosphere has 0.03% CO_2 from where it is absorbed by the plants. Photosynthesis tolerates considerable fluctuations with the decrease and increase of CO_2, however, with the increase or decrease in the CO_2 concentration, corresponding increase or decrease in photosynthesis takes place. Higher concentration reduces the rate. *Hydrilla* being an aquatic submerged plant releases CO_2 in water which can be observed by evolution of bubbles in water. Rate of photosynthesis can be estimated by rate of evolution of bubbles in water.

Procedure:

1. A wide mouthed bottle is completely filled with tap water, a cork is then fitted at its mouth through which a glass tube wide at its open end is passed so as to dip its lower end in pond water, and thus a Wilmott's bubbler is prepared.

2. Another narrow glass tube open at both the ends is made into a bent jet and introduced into the first glass tube. The twigs of *Hydrilla* are tied at the lower end of this narrow glass tube inside the bottle.

3. The entire set up is kept under sunlight for photosynthesis to occur.

4. For studying the rate of photosynthesis different amount of sodium bicarbonate are added to the pond water.

Observation table:

S. No.	Concentration of $NaHCO_3$	Time taken for 5 bubbles
1.	00g	
2.	5.5g	
3.	1.0g	
4.	2.0g	
5.	3.0g	

Result:

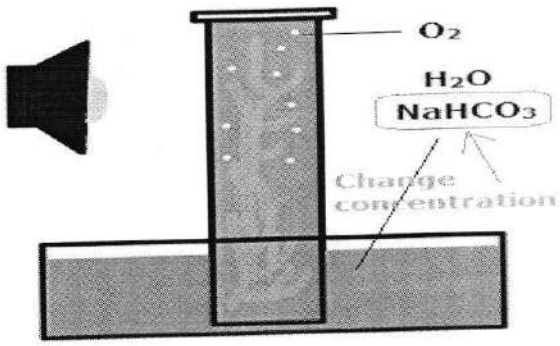
Conclusion:

The rate of evolution of oxygen bubbles is a measure of photosynthetic rate. When no salt is added, bubbles are not evolved. This shows that photosynthesis is not taking place. This is because tap water does not contain sufficient CO_2, the rate of photosynthesis increases with the addition of sodium bicarbonate because it increases the supply of CO_2. The increase in the rate continues till some other factor becomes limiting.

Precautions:

1. The apparatus should be made air tight so as not to allow air bubbles to escape.

2. Evolution of bubbles should be observed carefully.



Explanation

- The rate of photosynthesis **increases linearly** with increasing CO_2 concentration (from point A to B).
- The rate falls gradually, and at a certain CO_2 concentration it stays constant (from point B to C). Here a rise in CO_2 levels has **no effect** as the other factors such as light intensity become limiting.

Objective: Study of different medicinal plants and their uses.

The term "**medicinal plant**" includes various types of plants used in herbalism ("herbology" or "herbal medicine"). It is the use of plants for medicinal purposes, and the study of such uses.

Future of Medicinal Plants

Medicinal plants have a promising future because there are about half million plants around the world, and most of them their medical activities have not investigate yet, and their medical activities could be decisive in the treatment of present or future studies.

Characteristics of Medicinal Plants

Medicinal plants have many characteristics when used as a treatment, as follow:

- **Synergic medicine-** The ingredients of plants all interact simultaneously, so their uses can complement or damage others or neutralize their possible negative effects.

- **Support of official medicine-** In the treatment of complex cases like cancer diseases the components of the plants proved to be very effective.

- **Preventive medicine-** It has been proven that the component of the plants also characterize by their ability to prevent the appearance of some diseases. This will help to reduce the use of the chemical remedies which will be used when the disease is already present i.e., reduce the side effect of synthetic treatment.

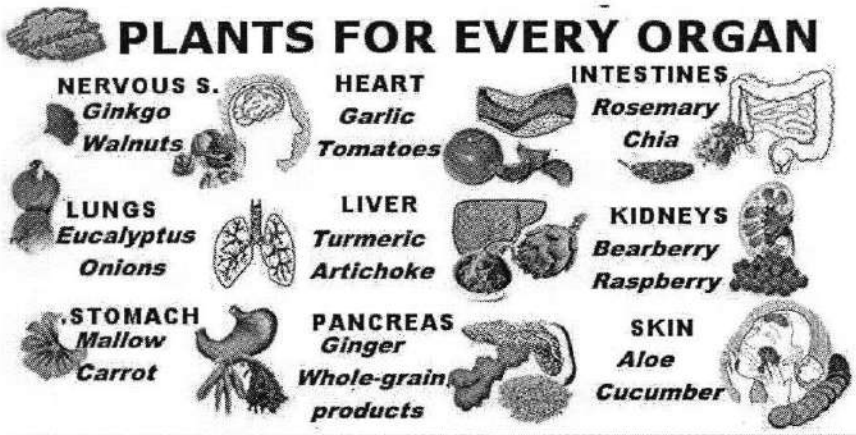
Recently, WHO (World Health Organization) estimated that 80 percent of people worldwide rely on herbal medicines for some aspect of their primary health care needs. According to WHO, around 21,000 plant species have the potential for being used as medicinal plants?

How to choose the suitable plants

It is very important to know **which plant is more interesting for each affected organ**. Although most medicinal plants can be used to cure diseases that affect different parts of the body, there are certain plants that are associated with a particular organ.

The reason for this is due to **its particular effectiveness in healing the organ** in question. For example, aloe vera is often associated with the skin, for its properties to regenerate and heal cuts, wounds, grains and other imperfections.

The following drawing shows some very famous plants and the corresponding organ with which they are associated.



Conclusion

As our lifestyle is now getting techno-savvy, we are moving away from nature. While we cannot escape from nature because we are part of nature. As herbs are natural products they are free from side effects, they are comparatively safe, eco-friendly and locally available. Traditionally there are lot of herbs used for the ailments related to different seasons. There is a need to promote them to save the human lives.

LIST OF MEDICINAL PLANTS AND THEIR USES							
S.N	Botanical name	Family	Common name	Habit	Parts Used	Propagation	Medicinal Us
1	*Abelmoschus moschatus*	Malvaceae	Musk bhendi	Herb	Stem Leaves Root	Seed/Stem cutting	Hysteria, Nerv disorder, Antispasmodi Carminative, Sca
2	*Acorus Calamus*	Acoraceae	Bach	Herb	Rhizom	Rhizome	Amnesia, Hea palpitations, Insomnia, Tetar bronchial asth
3	*Aloe vera*	Liliaceae	Ghritkumari,	Herb	Leaves,	bud	Carminative, S disease, Purgat
4	*Anacyclus pyrethrum*	Asteraceae	Akarkra	Herb	Root, Stem	Seed	Brain tonic, Para Headache, Epile Ophthalmia
5	*Aspragus racemosus*	Liliaceae	Shatavar	Herb	Tuber, Root	Seed/Tuber	Brain disease Weakness, Smal Eye tonic, Ey disease.
6	*Catharanthus roseus*	Apocynaceae	Sadabhar	Herb	Root, leaf	Seed	Diabetic mellit Hypertensio leukemia
7	*Centella asiatica*	Apiaceae	Bramhi	Herb	Whole plant	Seed	Hysteria, Epilepsy,Appet Diarrhea, Filariasis,Ski disorder, wou cleaning,Chro Ulcer Tuberculc Ulcer, Fever
8	*Cissus quadrangularis*	Vitaceae	Hadjod	Herb	:eaves, Stem	Stem cutting	Bone fracture Cough, piles, Ast Scurvy Swellin Digestive troub Wounds
9	*Costus speciosus*	Zingiberaceae	keokand	Herb	Leaves, Rhizome, Root	Seed/ Rhizome	Astringent, stimu Digestive, Fev Cough, Worms, disease
10	*Curcuma longa*	Zingiberaceae	Haldi	Shrub	Rhizome, Flowers	Seed/ Rhizome	Purgative, Astrin Anthelmintic, Fe Diarrhoea, itch

mbopogon citrates	Gramina e	Lemon Grass	Herb	leaves, Grass oil	Stem cuttings	Stomachic tonic, Diaphoretic, Diuretic, Refrigerant,Ringwor m, Antispasmodic, Stimulant,
Gymnema sylvestre	Periploc aseae	Gurmar	Shrub	Leaf, Root	Seed/Stem cutting	Swelling, Astringent,m Diabetes, Glycosuria, Snake bite
Ixora coccinea	Rubiace ae	jungle flame	Shrub	root,Flower. Fresh leaves	Seed	Dysentery,Diarrhea, Colic pain, Eczema, Wounds, Skin ulcer
Jasminum sambac	oleacea e	Moghra	Herb	Leaf, Flower	Stem cutting	Anthelmintic, Ulcer, Skin disease
Jatropha curcas	Euphorb iaceae	Safed arand	Shrub	Leaf Seed	Stem cutting	Scabies, Eczema, Ring worm, Antisweptic, Depurative, Cancer
Mentha arvensis	Lamiace ae	Pudina	Herb	Leaf	Stem cutting	Pheumatism, Antispasmodic, Antiseptic, Carminatice Diuretic
Vitex negundo	Verbena ceae	Nirgundi	Shrub	Root, Leaves, Stem	Stem cutting	Joints pain, Arthritis, Heardache, ulcer, Wound
Withania somnifera	Solanac eae	Ashwaga ndha	Shrub	Leaf, Root	Seed	Sedative, Nervine toni Insomnia, Carminative Anthelmintic Abdominal pain Constipation, Worms Blood disorder, Oeded
Tagetus erecta	Asterace ae	Genda	Herb	Leaf, Root	Stem cutting	Astringent, Antiseptic, Amenorrhoea, Wounds, injuries, Ear ache
Ocimum sanctum	Lamiace ae	Tulsi	Herb	Leaf, Flower	Seed	insecticidal, Oedema, Chronic ulcer, Earache, Abdominal Pain Helminthiasis, Pyorrhea, Blood purifier, Scabies, Eczema, Ring worm

DEPARTMENT OF BIOTECHNOLOGY

The Department of Biotechnology was established from the session 2005–2006 by the order no. 914/2005, dated 20/4/05 of Directorate of Higher Education, Govt. of Chhattisgarh, with both Undergraduate and Postgraduate programme and the programme was affiliated by Pt. Ravishankar Shukla University, Raipur by order no. 914/Ace./Affl./2007, dated 17/5/2007. Pt. Ravishankar Shukla University, Raipur has recognized our department as Research Centre for Ph.D. Programme in 2011 by order no. 4371/Ace/Res/2011, dated 30/07/2011. Now biotechnology department is affiliated with Hemchand Yadav University Durg since 2016. Later in 2012, the Department of Biotechnology, Govt. of India has granted us STAR College Programme. The aim and objective of the department is to nurture youth of the state for scientific exploitation of natural resources in sustainable manner, to explore health problem of the state and to protect environment and Biodiversity of the state by the help of tools and techniques of Biotechnology. To fulfill the mission of exploration of natural resource, existing health cause and environmental protection, the department has initiated skill development among youngsters of the state by UG, PG and Ph.D. programme. With the aim of above mission and vision the department is organizing UG, PG, Ph.D programme in close collaboration of various international, national institutions and industrial houses, so that we may provide skilled human resource to the academic and industrial houses for overall growth of Chhattisgarh state and finally Nation.

Faculty

Name - Dr. Anil Kumar

Designation - Professor of Zoology & HOD, Biotechnology

Name - Dr. Shweta Pandey

Designation – Assistant Professor, Biotechnology

NA Isolation from Plant

rinciple

Good quality DNA is a prerequisite for all experiments of DNA manipulation. All lant DNA extraction protocols comprise of the basic steps of disruption of the cell wall, ell membrane and nuclear membrane to release the DNA into solution followed by recipitation of DNA while ensuring removal of the contaminating biomolecules such as he proteins, polysaccharides, lipids, phenols and other secondary metabolites.

eagents Required

- Extraction(CTAB) Buffer
  1.4 M Na Cl
  100 mM Tris (pH 8.0)
  20 mM EDTA (pH 8.0)
  2% Mercaptoethanol
  2% CTAB
  Adjust all to pH 5.0 with HCL and make up to 100 ml with H2O.
- Chloroform : Isoamyl alcohol (24:1)
- RNase A (10mg / ml)
- 70% Ethanol
- 1X TE Buffer

rotocol

- Take 1 gm of fresh leaves and keep in deep freezer for 1 hours.
- Crush in mortar pestle by applying CTAB.
- Centrifuge at 14,000 rpm for 15 min.
- Transfer supernatant to fresh eppendorf tubes and add 700µl Chloroform : Isoamyl alcohol (24:1).
- Again centrifuge at 14,000 rpm for 15 min.
- Three layers forms, transfer first layer to fresh eppendorf tubes.
- Add chilled ethanol, cloudy appearance seen.

- DNA precipitates, remove alcohol and dry the pellet.
- Dissolve in TE buffer and preserve at 4°C.

Plant Tissue Culture (Surface Sterilization, Media Preparation and Micropropagation)

Surface Sterilization

Explants surface sterilization:

- Explants washed with sterile water.
- Explants washed with 70% alcohol for 30 seconds.
- Washed with sterile distilled water for 2 or 3 minutes.
- The explants washed with 0.01% mercuric chloride + Tween 20 (1 or 2 days) for 10 minutes .
- Then washed with sterile distilled water four times.

First time	-	4 minutes
Second Time	-	4 minutes
Third Time	-	4 minutes
Fourth Time	-	12 minutes

Explants surface sterilization is over. Then the explants were inoculated in the appropriate media.

Media Preparation

The basal medium is formulated so that it provides all of the compounds needed for plan growth and development, including certain compounds that can be made by an intac plant.

MS NUTRIENTS STOCKS

Nutrient salts and vitamins are prepared as stock solutions (20X or 200X concentrat required in the medium) as specified. The stocks are stored at 4° C. The desired concentrated stocks is mixed to prepare 1 liter of medium.

Murashige T & Skoog F (1962) A revised medium for rapid growth and bioas tobacco tissue cultures. Physiol. Plant 15: 473-497

MS major salts	mg/1 L medium	500 ml stock (20X)
1. NH_4NO_3	1650 mg	16.5 gm
2. KNO_3	1900 mg	19 gm
3. $Cacl_2.2H_2O$	440 mg	4.4 gm
4. $MgSO_4.7H_2O$	370 mg	3.7 gm
5. KH_2PO_4	170 mg	1.7 gm

MS minor salts	mg/1 L medium	500 ml stock (200X)
1. H_3BO_3	6.2 mg	620 mg
2. $MnSO_4.4H_2O$	22.3 mg	2230 mg
3. $ZnSO_4.4H_2O$	8.6 mg	860 mg
4. KI	0.83 mg	83 mg
5. $Na_2MoO_4.2H_2O$	0.25 mg	25 mg
6. $CoCl_2.6H_2O$	0.025 mg	2.5 mg
7. $CuSO_4.5H_2O$	0.025 mg	2.5 mg

MS Vitamins	mg/1 L medium	500 ml stock (200X)
1. Thiamine (HCl)	0.1 mg	10 mg
2. Niacine	0.5 mg	50 mg
3. Glycine	2.0 mg	200 mg
4. Pyrodoxine (HCl)	0.5 mg	50 mg

Iron, 500ml Stock (200X)
Dissolve 3.725gm of Na_2EDTA (Ethylenediaminetetra acetic acid, disodium salt) in 250ml dH_2O. Dissolve 2.785gm of $FeSO_4.7H_2O$ in 250 ml dH_2O Boil Na_2EDTA solution and add to it, $FeSO_4$ solution gently by stirring.

PLANT GROWTH REGULATOR STOCK

The heat-labile plant growth regulators are filtered through a bacteria-proof membrane (0.22 µm) filter and added to the autoclaved medium after it has cooled enough (less than 60^0 C). The stocks of plant growth regulators are prepared as mentioned below.

Plant Growth Regulator	Nature	Mol. Wt.	Stock (1 mM)	Soluble in
Benzyl aminopurine	Autoclavable	225.2	mg/ ml	1N NaOH
Naphtalene acetic acid	Heat labile	186.2	mg/ ml	Ethanol

The desired amount of plant growth regulators is dissolved as above and the volume is raised with double distilled water. The solutions are passed through disposable syringe filter (0.22 µm). The stocks are stored at -20^0 C.

Micropropagation

The totipotency of plant cells and tissues form the basis for *in vitro* cloning i.e. generatio or multiplication of genetically identical plants in *in vitro* culture. This rapi multiplication allow breeders and growers to introduce new cultivars much earlier tha they could by using conventional propagation techniques. Micropropagation can also b used to establish and maintain virus free plant stock.

Explant ⟶ Surface Sterilization ⟶ Inoculation ⟶ Subculture ⟶ Plan Development ⟶ Hardening

Phytocompounds Detection

Principle

Plants are commonly used source of natural products. Medicinal plants contain organi compounds producing definite physiological action on the human body and thes bioactive substances include tannins, alkaloids, carbohydrates, terpenoids, steroids an flavonoids Phytochemicals are natural compounds in the medicinal plants having defens mechanism.

Protocol

1. Test for Cardiac Glycosides

0.5 ml of each extract was treated with 0.2 ml glacial acetic acid then 1drop o 3.5% ferric chloride ($FeCl_3$) was added to the solution. This was layered with 1 ml o concentrated $H_2 SO_4$. A reddish brown ring was occurred at the interface indicates the presence of cardiac glycosides.

2. Test for Terpenoids

0.5 ml of plant extract was added to the test tube then 2 ml of chloroform was mixed to the solution. 3 ml of concentrated H_2SO_4 was added carefully from the wall o the test tube, to form a lower layer. Occurrence of reddish-brown colour at the interface indicates the presence of terpenoids.

3. Test for Steroid

0.5 ml of extract was dissolved in 3 ml of chloroform. The solution was filtered, 2ml of concentrated H_2SO_4 was added to the filtrate to form a lower layer. A reddish-brown colour ring at the interface indicates the presence of steroid.

4. Test for Flavonoid

0.5 ml c extract and 5 ml distilled water was added to test tube then it was filtered.5ml of diluted ammonia solution was added to the filtrate then concentrated H_2SO_4 was added. A yellow coloration indicated the presence of flavonoid. The yellow colour disappeared on standing.

Mitotic Index

Principle

Mitotic index is the measure for proliferation status of a cell population. It is defined as the ratio between number of cells in mitosis and total number of cells. This will help to identify the region of most mitotic activities. Mitotic index helps us to quantify the cell division. Mitotic index decreases with increasing distance from root tip, that means gradual decrease in cell division as move from the zone of cell division to zone of cell elongation. The meristematic region in the root tip is the actively growing region and thus the mitotic index is high.

Protocol

- Allow the roots of onion to grow and when it is grown up to 3cm length, the roots are cut.
- After cutting, roots were transferred into fixative (carnoy's fixative 10ml of glacial acetic acid + 60ml absolute ethyl alcohol+ 30ml chloroform).
- Root tips were then washed in distilled water for 1-2 minutes. After washing, the root are transferred into 1N HCl for 20minutes.
- After that the root tips were stained with aceto-carmine stain (2gm carmine + 45ml glacial acetic acid, make up it with 100ml distilled water) for 30min.

- 1drop of 1% glacial acetic acid (1ml glacial acetic acid + 99ml distilled water) wa applied and covered with cover slip and observed under microscope at 40 magnification.
- Mitotic index is calculated using formula given below –

$$\frac{\text{No. of cells in mitosis}}{\text{Total no. of cells}} \times 100$$

DEPARTMENT OF CHEMISTRY

The Department of Chemistry was established in 1958 and PG programme was introduced in 1965. Since its inception, the department has crossed several mile stones. The department offers undergraduate courses- B.Sc. with Chemistry, Industrial chemistry and Biochemistry and postgraduate course- M.Sc. Chemistry with Organic, Inorganic and Physical Chemistry as elective. The department also has facilities for Ph.D. programme in Chemistry. All courses offered by the department are designed according to the needs and demands of the current Industrial sectors and to make the students competent at local and global level.

With 15 faculty, the department in the current session caters 2250 UG and 50 PG students and 22 research scholars. Each faculty has specialized knowledge in different branches of Chemistry. Faculty members are active in educational sphere across the state and contribute to academic and research fields in various capacities like resource persons, reviewers, authors etc. both nationally and internationally.

Equipped with a state of the art instrumentation facility, research laboratories, departmental library and ICT tool, we are counted amongst the best department for education in Chemistry across the State of Chhattisgarh which provides a comprehensive teaching and research environment in chemical sciences.

The journey from a small department teaching undergraduate students in 1958 to DST-FIST supported department actively engaged in research activity is a result of coordinated effort of dedicated faculty. The department has contributed immensely to the college being accredited A+ grade by NAAC and achieving CPE- Phase III status by UGC. The department strives to achieve its prime objective- to produce and train technical and scientific personnel of the highest order of excellence having scientific attitude.

Faculty

Dr. Anupama Asthana (Head of the Department)

Dr. Alka Tiwari

Dr. Sukumar Chatterjee

Dr. Anil Kashyap

Dr. Manju Kaushal

Dr. Ajaya K. Singh

Dr. Nutan Rathod

Mrs. Upma Shrivastava

Dr. Ajay Pillai

Dr. V.S.Geete

Dr Sunitha B. Mathew

Dr. Anupama Kashyap

Dr. Prena Kathane

Dr. Soma Sen (Guest Faculty)

VISIT PLAN

- Demonstration of advanced experiments
- Glass Apparatus Exhibit
- Virtual Tour of Instrumentation Lab

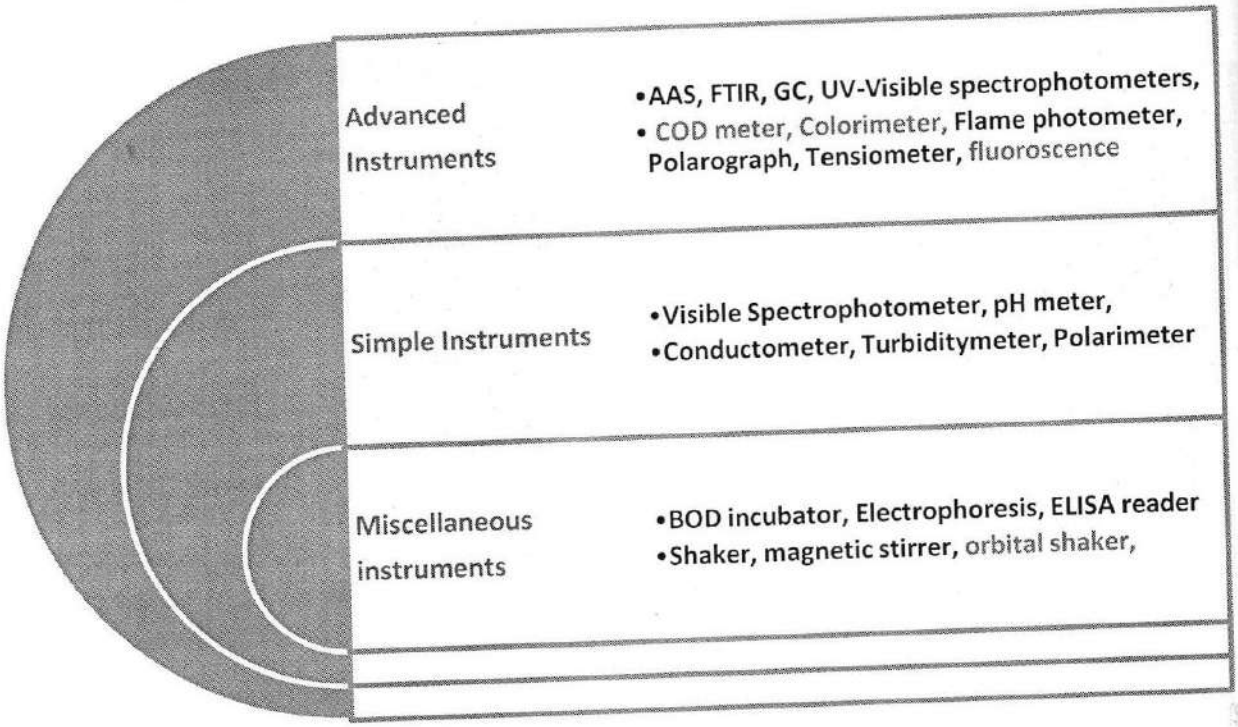
DEMONSTRATION OF ADVANCED EXPERIMENTS

Analytical Chemistry	•Food Adulteration detection and pH determination
Nano & Polymer Chemistry	•Synthesis of nanoparticles, polymer beads and its application, Quantum dots and its application
Electro & Thermochemistry	•Silver tree and Chemical volcano exhibit, Blue bottle experiment
Biochemistry	•Isolation of casein from milk

GLASS APPARATUS EXHIBIT

Display of glasswares	• Various types of tubes- ignition, test, boiling, graduated •Various types of pipettes, burettes, flasks, beaker •Miscellaneous - desiccator, thieles tube, centrifuge tubes
Display of assemblies	•Various types of distillation assemblies, condensors •Kjeldahl assembly, soxhlet extractor
Display of glass apparatus	•Landsberger, Man Singh Survismeter •Ostwald Viscometer, Stalagmometer, Pyknometer

VIRTUAL TOUR OF INSTRUMENTATION LAB



Expt. 1: Blue bottle reaction (reversible reaction).

Requriments: 1.6g sodium hydroxideNaOH, 10g glucose,$C_6H_{12}O_6$, 300 cm^3 distilled water, 0.2 percent methylene blue indicator solution, One-liter conical flask, rubber stopper for flask.

Procedure: Take water in the flask, add sodium hydroxide pellet and dissolved it. Add glucose when the sodium hydroxide gets dissolved. When all the glucose has dissolved, add five drops of the indicator solution and swirl. Allow the content to stand, the blue colour in the flask slowly disappears forming a colourless solution. If the flask is shaken a few times, then the blue colourrestores. This cycle of colour change can be repeated many times over a period of 45 minutes.

Expt 2: Preparation of Zinc sulphide Quantum dot (Qd) and adsorptive removal of dye

Requirements: Zinc sulphide, Nicotinic acid, Sodium sulphide, Sodium hydroxide, Solochrome dark blue (SDB) dye.

Preparation: For Qd synthesis, 50ml of 0.5 M Zinc acetate solution is added to 50 ml of nicotinic acid solution having 1.0% concentration. The pH is adjusted to 11 with 1M NaOH and an appropriate amount of 0.1 M Na_2S solution is quickly added into the mixture under vigorous stirring. Then the mixture is heated at 70°C for 120 min. The Qd was obtained by centrifuging, washing with ethanol and dryin in vacuum.

Dye Removal: Prepare 100 mg/l aqueous solution of SDB dye solution. Take a known aliquot of dye and dilute it to 10 ml with distilled water. Add known amount of Qd (0.04 g) into it and shake vigorously or keep in shaker. Take small aliquot of the content at equal time interval and measure the absorbance using spectrophotometer. Thus dyes and other toxicants can be removed using Qd.

Expt 3: Detection of adulterants in given food samples

The deliberate contamination of food material with low quality, cheap and toxic substance is known as food adulteration and thesubstance which lowers or degrades the quality of food material is called an adulterant. Traders do it for their economic benefit but it effects the health of the population.Hence effort must be made to check the food items to save people from it had effects.

Detection of adulteration in following food items will be demonstrated – Vanaspati in ghee, Argimone oil in edible oil, Metalin yellow in pulses, Turmeric powder and chilli powder.

Expt. 4: Determination of pH of products used in our daily life using pH meter

Requirements: pH meter, buffer solutions, different sample solutions

The pH scale is a measure of the strength of an acid or base. pH is equal to the negative logarithm of hydrogen ion concentration. Acid has pH ranging from 0 – 7, base 7-14 and pH 7.0 indicates neutral. Most life processes can occur within narrow range of pH. For eg. pH of blood is 7.2-7.4, food crops grow best at pH 7-7.8, saliva is slightly alkaline while stomach has highly acidic pH. Acids and bases come into play in everyday life in everything from digestion of foods we eat to the medicines we take and even cleaning products we use.

Calibrate pH meter with buffer solutions (pH – 4.0, 7.0 and 9.2). Dip the electrode in the sample provided and note down the pH. The pH of 7.0, below 7.0 and above 7.0 indicates that the sample is neutral, acidic and basic respectively.

Expt. 5: Green synthesis of silver nanoparticle from leaf extract of neem and its characterization

Requirements: 0.01 MSilver nitrate, neem leaf extract

Prepare 0.01M $AgNO_3$ and leaf extract. Collect the leaves and wash them with doubl distilled water and rinse off the extra water. Cut the leaves in small pieces and boil with doubl distilled water at 50-70°C for 30 min. Filter the extract using Whatmann filter paper, an collect them in clean and dried conical flask.

Mix the leaf extract and $AgNO_3$ solution in 1:1 ratio Stir it for 30 sec. The colour c solution turns green to yellowish brown, which indicate the formation of silver nanoparticle Nanoparticle synthesis was confirmed by taking UV-visible spectra. The characteristics peak obtained around 400-480 nm, which conform the formation of silver nanoparticle.

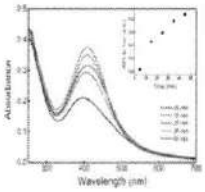


Fig. 2: Ag nanoparticle solution Fig.3 : UV-Visible spectra of Ag nanoparticle

Preparation of calcium alginate beads and adsorption of dye onto the polymer

Requirements: Sodium alginate, calcium chloride, methylene blue (MB) dye

Prepare 100 cm^3 of 3% solution of sodium alginate by dissolving 3 g of sodium alginate in distilled water and make up the volume to 100 cm^3 with distilled water. Slowly drip the viscous alginate solution through a needle of syringe into a beaker containing 200 cm^3 0.2 M $CaCl_2$. Beads are then washed 5-8 times with distilled water and stored in distilled water.

Prepare 50 mg/l aqueous solution of MB dye solution. Take a known aliquot of dye, dilute it to 10 ml with distilled water and add known amount of beads (0.1 g) into it with mechanical stirring at 250 rpm. Take small aliquot of the content at equal time interval and measure the absorbance using spectrophotometer. Thus dyes and other toxicants can be removed by adsorption method.

Sodium alginate solution (1.5%) was prepared by dissolving 1gm of sodium alginate in 100 ml of hot distilled water with stirring until the solution become homogenous. For preparation of beads, the prepared viscous solution was injected in the encapsulator, where it has the ability to charge the surface of the beads. The voltage applied lies in therange of 400-1700 V. This surface charge transforms the one-dimensional droplet chain in a funnel-like multiline stream. This prevents beads from hitting each other in flight, and from hitting each other as they enter the hardening solution. The process has been described in Figure 1.Sodium alginate solution (1.5%) was prepared by dissolving 1gm of sodium alginate in 100 ml of hot distilled water with stirring until

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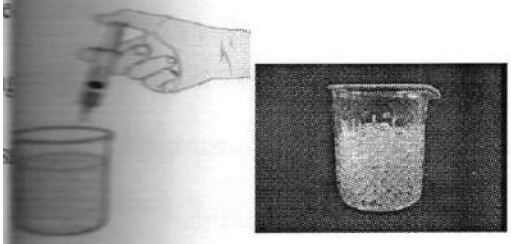


Fig. 4: Preparation of beads Fig. 5: Polymer beads

Expt. 7: Study of displacement of metals based on electrochemical series

Requirements: Copper wire, silver nitrate, jar

The potential of an electrode at a given temperature depends upon the concentration of the ions in the solution in which the electrode is dipping The term standard electrode potential is used to designate that potential which is obtained when the concentration or the activity of the ions in the solution in which electrode is dipped is unity and the temperature is 25°C. It is denoted by symbol E°.

The standard electrode potential of the electrode can be determined by coupling the electrode with standard hydrogen electrode as reference electrode whose potential has been arbitrarily taken as zero. The standard electrode potential of various electrodes have been seen determined and arranged in a tabular form in the increasing order of their values, known as electrochemical series. There are several applications of electrochemical series. With the help of electrochemical series we can study the displacement of metal having small negative or positive reduction potential from solution. Deposition of silver on copper results in silver tree formation is based on the following half reactions:

$Cu \rightarrow Cu^{++} + 2e^{-}$ $E^{\circ} = +0.34$

$Ag + 2e^{-} \rightarrow 2Ag^{+}$ $E^{\circ} = +0.80$

$Cu + Ag^{+} \rightarrow Cu^{++} + 2Ag$ $E^{\circ} = +0.56$

Expt. 8: Study of thermo-chemical reaction through chemical volcano

Requirements: Ammonium dichromate, match box

In a chemical reaction, two or more chemicals react to give one or more products alon with absorption and evolution of heat energy. A reaction in which energy is absorbed is calle endothermic reaction and in which energy is evolved is called exothermic reaction.

The decomposition of ammonium dichromate is an interesting exothermic chemica reaction. The ammonium dichromate glows and emit spark as it decomposes and produc green chromium oxide ash. It looks like eruption of volcano (Lava).

$$(NH_4)_2 Cr_2O_7 \rightarrow Cr_2O_3 + 4H_2O + N_2$$

Expt. 9: Isolation of Casein from milk by isoelectric precipitation

Requirements: Skimmed milk, Acetic acid, Sodium acetate, Solvent (Ethanol, diethy alcohol)

Casein, the phosphor protein of milk is separated from other protein by isoelectri precipitation i.e, by adjusting the pH of milk to its isoelectric pH (4.8).

Gently warm 20 ml of skimmed milk in a 100 ml beaker. While stirring with a glas rod add 2 ml acetic acid solution along with 2 ml sodium acetate solution. Stir the suspensio and centrifuge for about 45 seconds. Decant the supernatant carefully and filter the suspensio using a filtration unit connected to a suction pump (Buchner funnel fitted with Whatmann No filter paper disc). The moist precipitate is washed thrice with 20-25 ml of distilled water remove the salts. This is followed by two washes each with 20 ml of ethanol and diethyl ethe Transfer the cake to a clean watch glass and spread the material uniformly and allow it to d at room temperature over night.

DEPARTMENT OF GEOLOGY

Department of Geology was established in the year 1982 and the PG course (MSc. Geology) started in this department in the year 1987. Since then, the department has crossed many milestones of achievement in its journey towards excellence. Alumni of this department are serving the country with their knowledge of Geology in the capacity of Professor, Geologist entrepreneur, School teacher, consultant etc. Geology department is a recognized research centre for Doctoral Degree of Pt. Ravishankar Shukla University Raipur and at present two research scholars are pursuing their Doctoral Degree.

Faculty

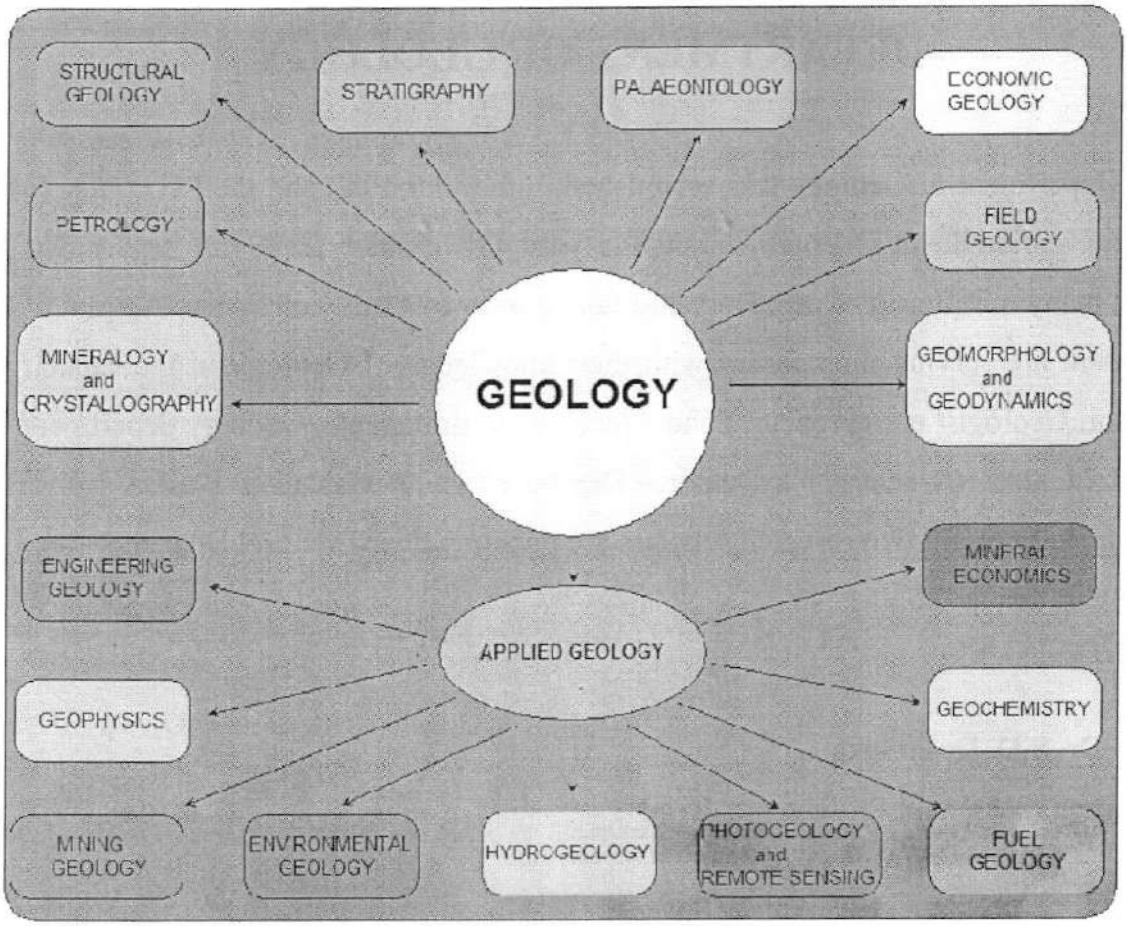
Name - Dr. S.D. Deshmukh
Designation - Assistant Professor & Head

Name - Dr. Prashant Kumar Shrivastava
Designation - Assistant Professor

Name – Dr. Vikas Swarnkar (Guest Faculty)

THE STUDY OF THE EARTH

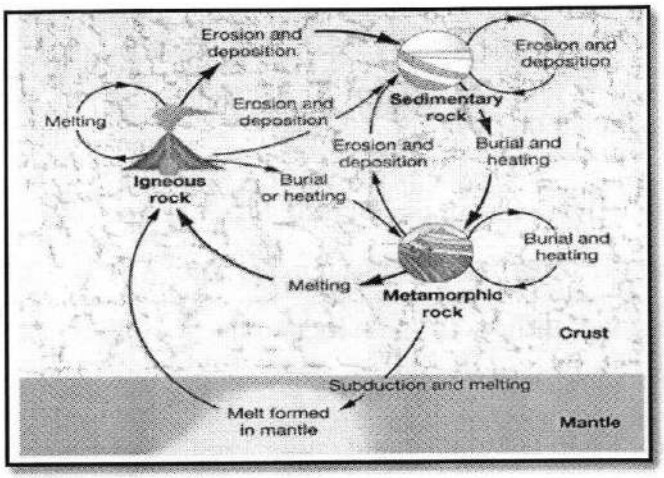
The subject of Geology is to trace the structural progress of our planet from the earliest beginnings of its separate existence, through its various stages of growth, down to its present condition. It seeks to determine the manner in which the evolution of the earth's great surface features has been affected. It unravels the complicated processes by which each continent has been built up. Man's inquisitiveness about, and his dependence on, environment and the processes contributing to its change form the basis of studies in Geology. The domain of Geology being very vast in its subject matter and scope, only the core branches are mentioned below.



Physical Geology (Geomorphology) aims at the proper understanding of the processes which mould the surface of the globe through their ceaseless action through ages. A number of websites dedicated to learn about these processes and resultant landforms with beautiful images and illustrations can be visited on the web.

The scope of **Structural Geology** covers the study and interpretation of structures in rock masses, it also deals with the underlying principles and mechanism of formation of various structures and their relation to the tectonic processes.

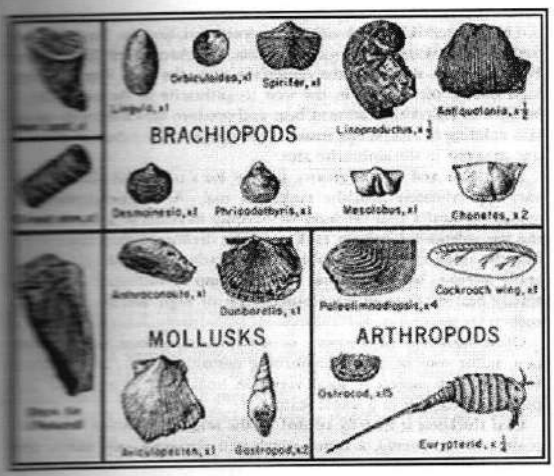
Mineralogy is the branch of Geology that deals with the study of physical, chemical and optical properties of minerals. Minerals serve as the building blocks for rocks.

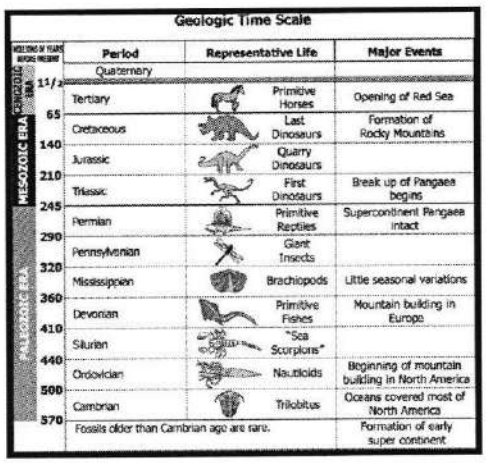


Petrology deals with the composition, forms, structures, textures and genesis of all the rocks divisible into three main classes i.e. igneous, sedimentary and metamorphic rocks.

Stratigraphy is the branch of Geology which deals with the study of rocks in four dimensions (the fourth being the time dimension). It arranges the rocks of the earth's crust in the order of their appearance, and interprets the sequence of events of which they form the records.

Each successive period in the earth's history, since the introduction of living things, has been marked by characteristic types of the animal and vegetable kingdoms, however imperfectly the remains of these organisms have been preserved or may be deciphered, materials exist for a history of life upon the planet. **Palaeontology**, the science of fossils (the remains of plants and animals) has revealed a number of facts concerning the evolution and migration of life forms through ages.





The study of mode of occurrence, geographic distribution and origin of various mineral and rocks of economic importance is the subject matter of **Economic Geology** .I comprises the study of ore minerals.

The study of geology is important for three main reasons: it reveals the deep histor of the Earth, informs other sciences, and it is useful for economic purposes. Almos everything we utilize in our lives has something to do with Earth. Homes, streets computers, toys, tools, and so on are likely made of materials obtained from the Earth Although the sun is the ultimate energy source of Earth, we rely on "Earth" energy source for our daily energy requirements (oil, carbon, nuclear energy obtained from uranium etc). Geology science is of paramount importance to locate those Earth energy sources how to extract them from Earth more efficiently and at a lower cost, and with the smalles impact on the environment. Water, an important natural resource, is scarce in many part of the world. The study of geology can help us find water resources underground to reduc the impact of water scarcity of people and civilization.

The study of geology also encompasses Earth processes which may affect overal civilization. An earthquake can destroy thousands of lives in a few minutes. Alsc tsunamis, floods, landslides, droughts, and volcanic activity can have an enormou influence on civilization. Geologists study those processes and can recommend actio plans to minimize damage in case such events will occur. For example, by studying floo patterns of rivers, geologists can recommend areas to avoid when building new cities towns, and residential neighborhoods in order to prevent future damage. Earthquak science, although a very difficult area of study, can help minimize damage to life an civilization by estimating where earthquakes are most likely to occur (known as fau lines) and to recommend the type of technology to be used in the construction of building in these vulnerable areas.

LEARNING MODULES AT GEOLOGY LABORATORY

A . Identification of rocks and minerals: The rocks and minerals possess unique physica properties. Study of these physical properties of various rocks and minerals shall be don during the lab visit.

B. Study of optical properties of minerals using petrological microscope shall be carrie out.

C. Study of geological features using aerial photographs with stereoscope shall be done.

DEPARTMENT OF MATHEMATICS

- Department of Mathematics (Established in 1968) is a Star Performance Department declared By UGC under CPE Scheme.
- The month of August 1958 visualized the advent of the Department of Mathematics. With the modest start it gradually ascended to a fully fledged department and on the marvelous 54 years tenure the department has been recognized as an important one of the grand center of teaching and research in Mathematics.
- Post graduate classes came into existence in the year 1968.
- The department has been receiving acclaim as a research center under Pt. Ravishankar Shukla University, Raipur since last 18 years.
- The department has developed well equipped computational lab and research center with mathematical softwares.
- The Department is actively engaged in activities like Regional Mathematical Olympiad (RMO) which is the first phase of International Mathematical Olympiad (IMO). RMO is organized by HBCSE and NBHM.
- Every year workshops and examination of RMO are being conducted by Dr. Rakesh Tiwari.
- In January, 2012, a four days State level workshop for district coordinators and qualified students for Indian National Mathematical Olympiad INMO has been organized.
- The department has developed expertise in the fields of Approximation Theory, Fuzzy Topology, Fixed Point Theory, Wavelets etc.
- It is general trend of the department to stimulate and honour laborious and meritorious student to encourage them and in this connection every year a "Silver Medal" is being conferred to the student who secures highest marks in M. Sc Mathematics Examination.
- The Department brings out selected seminar papers of worth in the form of Magazine "Ganit Suman".

- It is noteworthy that one of the Libraries named "Dr. Radha Krishnan" is being ru by the PG students with their own contribution. The library caters books of variou streams like General knowledge, General Awareness, Health Personalit Development, NET, GATE etc.
- Educational tour for PG students is also being organized by department every yea This types of tour aware the students with new and advanced academi development running in various institutes.

Faculty

Name - Dr. M. A. Siddiqui
Designation - Professor

Name - Dr. Padmavati
Designation - Professor

Name - Dr. Prachi Singh
Designation - Assistant Professor

Name - Dr. Rakesh Tiwari
Designation - Assistant Professor

Name – Smt. Nidhi Sharma (Guest Faculty)

Name – Smt. Shobha Rani (Guest Faculty)

Name – Ku. Jyoti Singh (Guest Faculty)

Name – Ravi Kumar (Guest Faculty)

Lab Visit –

1. Study of Mathematical models
2. Basic Geometry concepts
3. Discussion on Vedic mathematics
4. Visit to Dr. Radha Krishan Library
5. Brief introduction of Mathematical Olympiad
6. Latex programming

DEPARTMENT OF MICROBIOLOGY

The Department is running under self financing scheme since 2001 for UG classes and since 2005 for PG classes. The department maintains its mission for academic programme, involvement of students in day to day management for specific duties and adequate freedom to students. It has good infrastructure for teaching and research. There are two M.Sc. laboratories, one central instrument rooms, two PG classrooms and one UG laboratory etc.; Department is equipped with E classroom and has two up-to date configured computers with internet facility. Department houses, apart from regular and routine bacteriological equipments, variety of advanced instruments like column chromatography, electrophoresis facilities, Fermenters, high speed refrigerated centrifuge, shaking incubator, laminar air flow stations, deep fridge and BOD incubators. The department have its own departmental library with Text books, Reference books, Xerox copies of out of print books, Soft copies of reference books etc. Apart from that, the department subscribes some research journals with high Impact factor. The souvenir and proceedings of Seminar and Conferences are also available to students to inculcate research aptitude among them.

The theory and practical syllabus for PG classes are annually reviewed and revised by the experts of board of studies members. In the first semester, the students study core microbiology including bacteriology, mycology, virology and Immunology etc. The second semester curricula covers basic concepts including biomolecules and metabolism, cell and molecular biology and techniques in microbiology and Biostatistics subsequently study of applied and modern microbiology including environmental, food, agriculture, aquatic microbiology, microbial genomics and metagenomics included in third and fourth semesters. A unique feature of the curricula includes both theory and practical course for each papers and dissertation work in the fourth semester. Laboratory manual all the UG and PG Semester classes have been prepared in the department for the benefit of students. Class seminars and assignment work is regular practice of the department. Students are assigned to prepare day wise flow charts for practical exercises so as the experiments can be performed parallel to the theory course. Group discussions and Quiz is included in the teaching methods during the semester. Students of Sem. III go to various reputed research institutions to undertake project work for partial fulfillment of their course. The

department has signed an MOU with Dept. of Microbiology, Govt. ERR college o Science, Bilaspur to undertake Project work at PG leve

Students are directed for R&D activities related to their courses. Extension camp an social awareness campaigns are regularly arranged in the department. VA Mycorrhiza Rhizobium and Cyanobacteria based bio fertilizer formulations are being in progress i the department. The faculty members of the department participated in National an International seminars organized by different local and outstation institutions an published papers in peer reviewed journals.

Faculty

Name - Dr. Pragya Kulkarni
Designation - Asstt. Prof. Botany & HOD Microbiology

Name - Mrs. Rekha Gupta
Designation - Asstt. Prof.

Name - Mrs. Neetu Das
Designation - Asstt. Prof.

Name – Ku. Anamika Sharma (Guest Faculty)

"The science of microorganisms, including the study Protozoans, Algae, Fungi, Bacteria, Cyanobacteria, Liche Viruses, and Prions"

Study of Microorganisms includes their **growth** in laboratory conditio **observations, record preparation, final identification** and **further related studie**

Growth in laboratory includes –

- **Cleaning**

  The removal of visible soil and organic contamination from a device or surface, using either the physical action of scrubbing with a surfactant or detergent and water, or an energy-based process (for example, ultrasonic cleaners) with appropriate chemical agents

- **Sterilization**

  The use of physical or chemical methods to destroy all microbial life, including large numbers of highly-resistant bacterial Endospores

- **Decontamination**

  The physical or chemical processes by which an object or area, contaminated with a harmful or potentially harmful microorganism, is made safe for handling or use. Such processes include physical removal of most contaminants, thermal destruction of biological activity (sterilization), chemical inactivation (biocidal process), or a combination of these methods

- **Disinfection**

  A generally less lethal process of microbial inactivation (compared to sterilization) that eliminates virtually all recognized pathogenic microorganisms but not necessarily all microbial forms (for example, bacterial spores)

- **Inoculation**

  Transfer of microorganisms either from their source or actively growing culture stored in laboratory

- **Culture**

  Actively growing, visible growth of microorganisms growing under laboratory condition

Scope of Microbiology

Food, Dairy and Agriculture Microbiology: Production of compost, management of diseases Study of role of microorganisms in food.

Fermentation and Industrial Microbiology: Production of Alcoholic and Non alcoholic beverages, Organic acids, antibiotics and Enzymes.

Medical Microbiology: Study of causes and consequences of infectious diseases and their prevention.

Microbial Biotechnology: "Use of microorganisms for welfare of mankind". Microbes as Tools for molecular biology studies, for synthesis of novel bio molecules and neutraceuticals, for

production of monoclonal antibodies and study of immune disorders, as biosensors an intermediate for drug delivery

Glass wares used in microbiological laboratory

- Petri plates, Conical flask, Beaker, Measuring cylinder, Culture tube and Test tub Pipette, Volumetric flask, Funnel, Watch glass, Microscope slide and cover slip

Tools of microbiological laboratory

- Inoculation needle and loop, Spreader, Spirit lamp or Bunsen burner, Forceps, Cotto Aluminum foil, Immersion oil

Study of different types of Instruments and microscopes

- Chemical balance, Autoclave, Hot air oven, Laminar air flow, Incubator, Colony counte pH meter, Centrifuge, Colorimeter, High resolution Compound Microscope

Primary Isolation using culture media

Microorganisms can be isolated from their natural sources as soil, water and air or an contaminated surface. They are allowed to grow on suitable growth media for revealing of the visible growth (culture) through pour plate or spread plate method. Individual colonies are the made pure by repeated sub culturing.

Culture Media

Synthetic, Semi synthetic or Natural medium prepared aseptically for growth of microorganisms

Study the macroscopic features of microbial cultures

Cultural characteristics and distinguishing features of individual culture are compared wi literature

- Bacteria – Colour, margin, elevation size of colony
- Cyanobacteria – Colour, pattern of growth
- Fungi – Colour, appearance, reverse colour, pattern of growth
- Lichens – Type of thallus, colour, sexual stage

Microscopic identification of microorganisms

- Bacteria: Gram staining and observation under microscope and biochemical tests
- Fungi: Simple staining and observation under microscope
- Cyanobacteria: Observation under microscope

Immunological studies

- Blood grouping test
- Serological test to study of antigen-antibody interaction

DEPARTMENT OF PHYSICS

The Department was established in 1958, PG course was started in 1965. Very distinguished and learned professors were among the faculty. Originally the faculty was 01 prof.+ 09 asst. prof. But now the setup has been changed to 01 prof. + 06 Asst. prof. At present two posts of Asst. Prof. are vacant. These posts are filled on contract basis from time to time. The adequacy is satisfied up to 80% only due to vacant positions; but due to the quality and competency of the faculty and available high level learning resources, and the healthy practices in knowledge transfer process, this deficiency is overcome.

Faculty

Name - Dr. P. Bose
Designation – Professor

Name – Dr. J.K. Saluja
Designation – Professor

Name – Dr. R.S. Singh
Designation – Professor

Name - Smt. Anita Shukla
Designation - Assistant Professor

Name - Smt. Siteshwari Chandraker
Designation - Assistant Professor

Name – Dr. Abhishek Kumar Misra
Designation - Assistant Professor

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Experiment Number 1

Variation of magnetic field at axis of circular coil

Object: To study the variation of magnetic field with the distance along the axis of curre carrying circular coil using Stewart and Gee's apparatus.

Apparatus required: Stewart and Gee's type tangent galvanometer, a battery, a rheostat, a ammeter, a one way key, a reversing key (commutator) , connecting wires.

Formula:

If a current carrying coil is place in y-z plane then its axis will be x-axis. The magnetic field alon the axis of coil is given by,

$$B = \frac{\mu_0 NI}{2} \frac{a^2}{(a^2 + x^2)^{3/2}} \qquad = (1)$$

Where, $\mu 0$ ($= 4\pi \times 10{-}7$) is the vacuum permeability, N is the number of turns of the field coil, is the current in the wire, in amperes, a is the radius of the coil in meters, and x is the axi distance in meters from the center of the coil.

If θ is the deflection produced in magnetometer at a certain position on the axis of coil then magnetic field at that point will be,

$B = H \tan\theta$ (2)

The equations (1) and (2) implies that the graph between x and $\tan\theta$ will give the variation magnetic field at the axis of circular coil.

Figure and Circuit Diagram

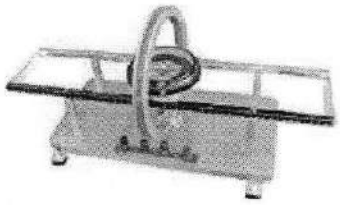


Fig 1. Tangent Galvanometer

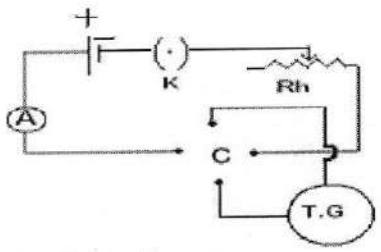


Fig 2. Circuit diagramme

Procedure:

1. Place the instrument in such a way that the arms of the magnetometer lie roughly east and wes and the magnetic needle lies at the centre of the vertical coil. Place the eye a little above the coil and rotate the instrument in the horizontal plane till the coil, the needle and its image in the mirr provided at the base of the compass box, all lie in same vertical plane. The coil is thus set roughl in the magnetic meridian. Rotate the compass box so that the pointer lies on the 0-0 line.

2. Connect all the components as shown in circuit diagram.

3. Adjust the value of the current so that the magnetometer at central position gives a deflection the order of 70°-75°. Note this magnetometer reading for the both directions of currents. This wil give you θ value at x=0.

4. Now slide the magnetometer along the +axis of coil with an increment of 2cm and note the deflection of needle in magnetometer (both ends of needle position) for the both directions of current in coil. Record a number of observations. (x=0,2,4, 6, 8, 10, 12cm)
5. After this, repeat the point 4 for the magnetometer position along –axis of coil. i.e. repeat the observation by shifting the magnetometer in the opposite direction and keeping the current constant at the same value.

Observations

1. Least count of the magnetometer =
2. Current I =
3. Deflection in needle at x=0, (θ_0)=
4. $\tan\theta_0$ =

5. ***Table A: Deflection in magnetometer along +axis of coil.***

Sr. No	Distance of needle from centre of centre, *x (cm)*	Deflection on East arm					*tan θ*
		Current in one direction		Current in reverse direction		Mean θ in deg.	
		θ_1	θ_2	θ_3	θ_4		
1.	2						
2.	4						
3.	6						
4.	8						
5.	10						
6.	12						
7.	14						
8.	16						

6. ***Table B: Deflection in magnetometer along -axis of coil.***

Sr. No	Distance of needle from centre of centre, *x (cm)*	Deflection on East arm					*tan θ*
		Current in one direction		Current in reverse direction		Mean θ in deg.	
		θ_1	θ_2	θ_3	θ_4		
1.	2						
2.	4						
3.	6						
4.	8						
5.	10						
6.	12						
7.	14						
8.	16						

Plot in *x and tanθ: The plot of tanθ vs x will be found as shown in Fig 3.*

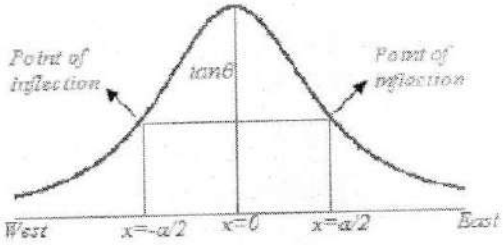


Fig. 3

Result: With help of the graph between tan θ and x, following points can be concluded.

1. The intensity of magnetic field is maximum at the centre and goes on decreasing as we move away from the centre of the coil towards right or left.

2. The point on the both side of graph where curve becomes convex to concave (i.e. the curve changes its nature) are called the point of inflection. The distance between the two points of inflexion is equal to the radius of the circular coil.

3. The radius of coil= distance between points of inflection=.....cm

Precautions:

1. There should be no magnet, magnetic substances and current carrying conductor near the apparatus.

2. The plane of the coil should be set in the magnetic medium.

3. The current should remain constant and should be reversed for each observation.

Experiment Number 2

Introduction

Galileo was the first person to show that at any given place, all bodies – big or small – fall [illegible] when dropped, with the same (uniform) **acceleration**, if the resistance due to air is negligible. The gravitational attraction of a body towards the center of the earth results in the same acceleration for all bodies at a particular location, irrespective of their mass, shape or material, and this acceleration is called the **acceleration due to gravity**, g. The value of g varies from place to place, being greatest at the poles and the least at the equator. Because this value is large, bodies fall quickly to the surface of the earth when dropped, and so it is very difficult to measure their acceleration directly with considerable accuracy.

Therefore, the acceleration due to gravity is often determined by indirect methods – for example, using a **simple pendulum** or a **compound pendulum**. If we determine g using a simple pendulum, the result is not very accurate because an ideal simple pendulum cannot be realized under laboratory conditions. Hence, you will use two different compound pendulums to determine the acceleration due to gravity in the laboratory, namely the Bar pendulum and the Kater's pendulum.

Apparatus

Bar Pendulum

Small metal wedge

Spirit level

Stopwatch

Meter scale

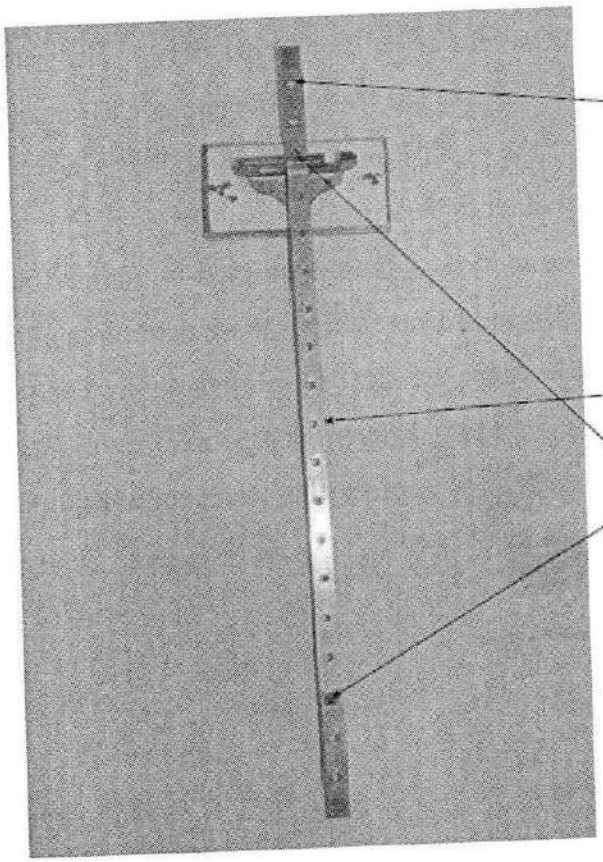
Theory

A bar pendulum is the simplest form of compound pendulum. It is in the form of a rectangular bar (with its length much larger than the breadth and the thickness) with holes (for fixing the knife edges) drilled along its length at equal separation.

If a bar pendulum of mass M oscillates with a very small amplitude θ about a horizontal axis passing through it, then its angular acceleration ($d2\theta/dt2$) is proportional to the angular displacement θ. The motion is **simple harmonic** and the **time period** T is given by

$$T = 2\pi\sqrt{\frac{I}{Mgl}}, \qquad (1)$$

where I denotes the **moment of inertia** of the pendulum about the horizontal axis through its **center of suspension** and l is the distance between the center of suspension and **center of gravity** (C.G.) of the pendulum.



- *Bar pendulum*
- A uniform rectangular metallic bar (~1m long), with holes drilled along its length (~5 cm apart)
- CG in the middle of the bar
- 2 knife edges symmetrically placed on either side of CG to suspend it at various distances from CG

Photograph of a typical bar pendulum

According to the theorem of parallel axes, if I_G is the moment of inertia of the pendulum about an axis through C.G., then the moment of inertia I about a parallel axis at a distance l from center of gravity (C.G.) is given by

$$\begin{aligned} I &= I_G + Ml^2 \\ &= Mk^2 + Ml^2 \end{aligned} \tag{2}$$

where k is the **radius of gyration** of the pendulum about the axis through C.G. Using Equation (2) in Equation (1), we get

$$\begin{aligned} T &= 2\pi\sqrt{\frac{Mk^2 + Ml^2}{Mgl}} \\ &= 2\pi\sqrt{\frac{k^2 + l^2}{gl}} \\ &= 2\pi\sqrt{\frac{k^2/l + l}{g}} \\ &= 2\pi\sqrt{\frac{L}{g}}, \end{aligned} \tag{3}$$

where L is the length of the equivalent simple pendulum, given by

$$L = \left(k^2/l + l\right) \tag{4}$$

Therefore,

$$g = 4\pi^2 \frac{L}{T^2}. \tag{5}$$

The point at a distance L from the centre of suspension along a line passing through the centre of suspension and C.G. is known as the **centre of oscillation.**

Time period T will have minimum value when $l = k$ (using Equation (3)). Hence PQ = $2k$ (refer to figure).

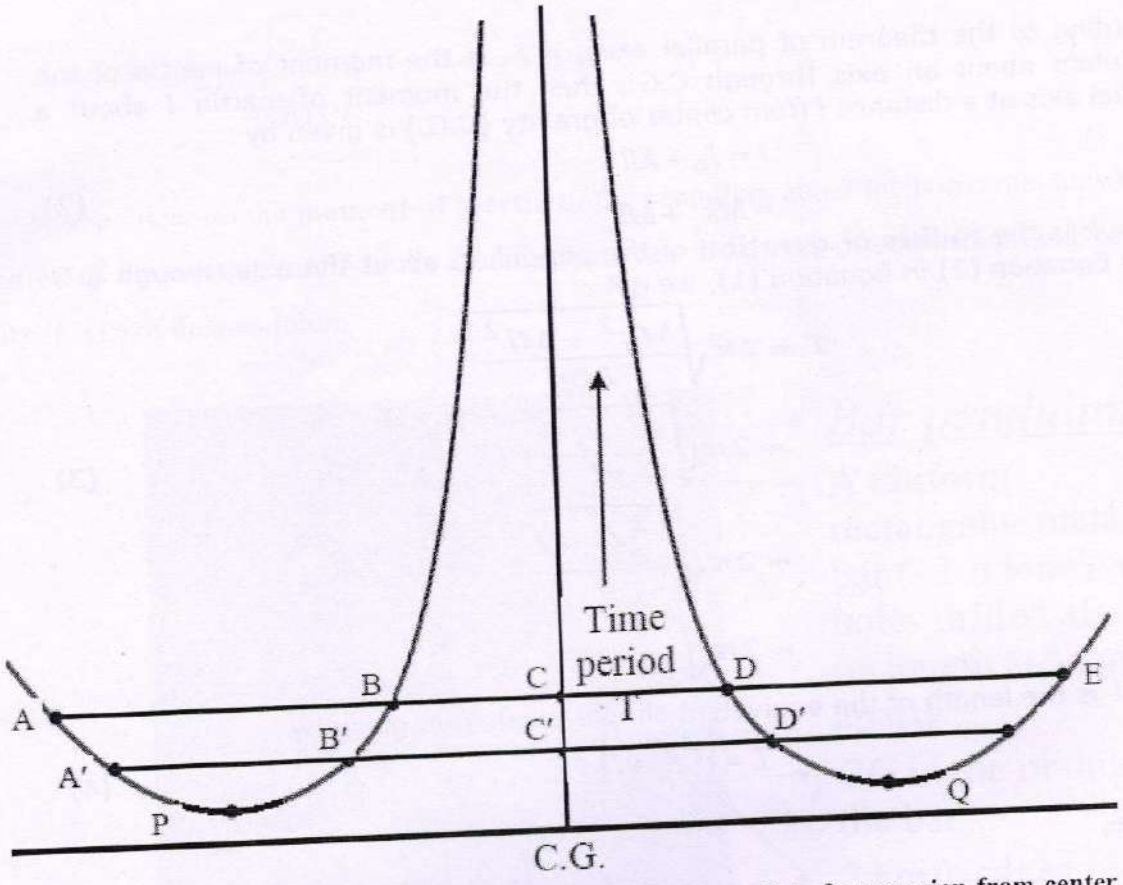


Figure 1: Expected variation of time period with distance of the point of suspension from center of gravity (C.G.)

Simplifying Equation (4), we get

$$l^2 - lL + k^2 = 0. \tag{6}$$

Equation (6) is a quadratic equation in l having two roots. If l_1 and l_2 are the two values of l, then by the theory of quadratic equations

$$l_1 + l_2 = L, \tag{7}$$

and

$$l_1 l_2 = k^2 \tag{8}$$

So we can write the solutions as

$$l = l_1, \qquad l = l_2 = \frac{k^2}{l_1} \tag{9}$$

Since both the sum and the product of the two roots are positive, for any particular value of l there is a second point on the same side of C.G. and at a distance k^2/l from it, about which the pendulum will have the same time period. If a graph is plotted with the time period as ordinate and the distance of the point of suspension from C.G. as abscissa, it is expected to have the shape shown in Figure 1, with two curves which are symmetrical about the C.G. of the bar.

To find the length L of a simple pendulum with the same period, a horizontal line ABCDE can be drawn which cuts the graph at points A, B, D and E, all of which read the same time period. For

the center of suspension, D is the center of oscillation (D is at distance $l_1+l_2=L$ of from the center of suspension A). Similarly, for B as the center of suspension, E is the center of oscillation. The measurements can also be used to determine g using Ferguson's method as explained below.

Ferguson's method for determination of g

Using Equations (5) and (6) we get

$$l^2 = \frac{g}{4\pi^2} lT^2 - k^2.$$

A graph between l^2 and lT^2 should therefore be a straight line with slope $\frac{g}{4\pi^2}$, as shown in Figure 2. The intercept on the y-axis is $-k^2$.

Acceleration due to gravity, $g = 4\pi^2 \times$ slope

Radius of gyration, $k = \sqrt{\text{(intercept)}}$

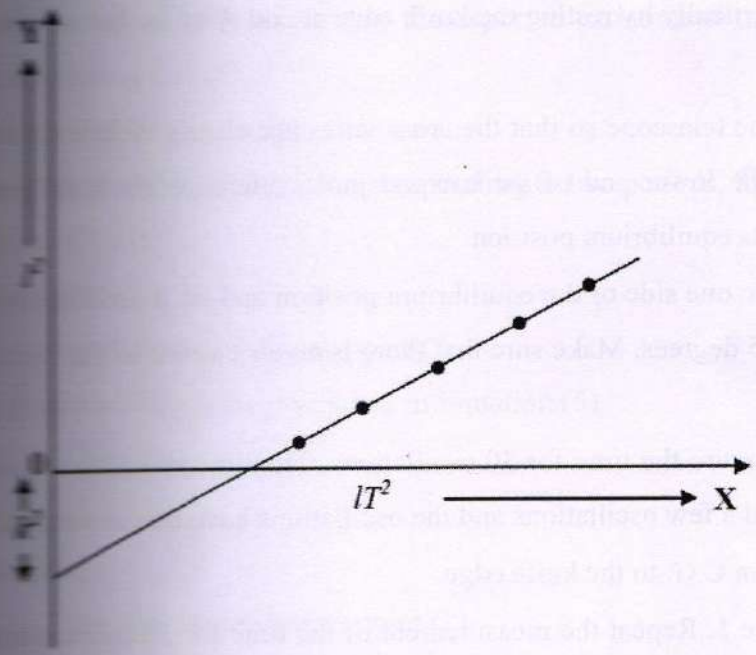


Figure 2: Expected form of the graph between l_2 and lT^2.

Learning Outcomes

This experiment will enable you

1. To determine the acceleration due to gravity (g) using a bar pendulum.
2. To verify that there are two pivot points on either side of the centre of gravity (C.G.) about which the time period is the same.

3 To determine the radius of gyration of a bar pendulum by plotting a graph of time period of **oscillation** against the distance of the point of suspension from C.G.

4 To determine the length of the equivalent simple pendulum.

Procedure

1 Balance the bar on a sharp wedge and mark the position of its C.G.

2 Fix the knife edges in the outermost holes at either end of the bar pendulum. The knife edges should be horizontal and lie symmetrically with respect to centre of gravity of the bar.

3 Check with spirit level that the glass plates fixed on the suspension wall bracket are horizontal. The support should be rigid.

4 Suspend the pendulum vertically by resting the knife edge at end A of the bar on the glass plate.

5 Adjust the eye piece of the telescope so that the cross wires are clearly visible through it. Focus the telescope on the lower end of the bar and put a reference mark on the wall behind the bar to denote its equilibrium position.

6 Displace the bar slightly to one side of the equilibrium position and let it oscillate with the amplitude not exceeding 5 degrees. Make sure that there is no air current in the vicinity of the pendulum.

7 Use the stop watch to measure the time for 30 oscillations. The time should be measured after the pendulum has had a few oscillations and the oscillations have become regular.

8 Measure the distance l from C.G. to the knife edge.

9 Record the results in Table 1. Repeat the measurement of the time for 30 oscillations and take the mean.

10 Suspend the pendulum on the knife edge of side B and repeat the measurements in steps -9 above.

11 Fix the knife edges successively in various holes on each side of C.G. and in each case measure the time for 30 oscillations and the distance of the knife edges from C.G.

Observations

Table 1: Measurement of T and l

Least count of stop-watch = ...sec.

Sl. No.	Side A up				Side B up				
	Time for 30 oscillations (t) 1	2	t (mean)	$T=t/30$ (sec)	l (cm)	Time for 30 oscillations (t) 1	2	t (mean)	$T=t/30$ (sec)	l (cm)
1										
2										
3										
4										
5										
6										
7										
8										
9										

Calculations

Plot a graph showing how the time period T depends on the distance from the center of suspension to C.G. (l). Figure 1 shows the expected variation of time period with distance of the point of suspension from C.G.

Acceleration due to gravity (g)

Draw horizontal lines on the graph corresponding to two periods, T_1 and T_2, as shown in Fig1.

For the line ABCDE

$l_C=(BD+BE)/2=$ ..... cm.

$T_C=$ _____sec.(corresponding to point C)

Hence, using the formula for g as given in Equation (5),

$g=$ _____cm/sec^2.

For the line A'B'C'D'E'

$l_{C'}=(B'D'+B'E')/2=$ ..... cm.

$T_{C'}=$ _____ sec. (corresponding to point C')

Hence, $g=$ .....cm/sec^2.

Radius of gyration (k)

Let l_1 = ½ (AC + CE) = ½ AE,

and l_2 = ½ (BC + CD) = ½ BD.

Calculate the radius of gyration using the expression

$k = \sqrt{l_1 l_2}$ = ...cm.

Calculate another value for k from the line A'B'C'D'E':

k' = ...cm.

Hence, the mean value for radius of gyration about C.G. is

k_{mean} = ½(k + k') = ...cm.

Also, the mean length corresponding to minimum time period is $PQ = 2k$.

If M is the mass of the bar pendulum, the moment of inertia of the bar pendulum is obtained using the equation

$$I = Mk^2$$

Make the following table for calculated values of l^2 and lT^2 corresponding to all the measurements recorded in Table 1.

Table 2: Calculated values of l^2 and lT^2

S. No.	Side A up		Side B up		Mean values	
	l^2 (cm^2)	lT^2 (cm sec^2)	l^2 (cm^2)	lT^2 (cm sec^2)	l^2 (cm^2)	lT^2 (cm sec^2)
1						
2						
3						
4						
5						
6						
7						
8						
9						

Plot a graph of l^2 against lT^2 (as shown in Figure2) and determine the values of the slope and the intercept on the l^2 axis.

Slope of the graph = ... cm/sec^2.
Intercept = ... cm^2.
Acceleration due to gravity $g = 4\pi^2$ x slope = ... cm/sec^2.
Radius of gyration, $k = \sqrt{\text{(intercept)}}$ ..... cm^2.

Estimation of error

Maximum log error

Using Equation (5)

$$g = 4\pi^2 \frac{L}{T^2}$$

Taking logarithm on both sides and differentiating, we have

$$\frac{\Delta g}{g} = \frac{\Delta L}{L} + \frac{2\Delta T}{T}$$

$$\Rightarrow \Delta g = g\left(\frac{\Delta L}{L} + \frac{2\Delta T}{T}\right),$$

where ΔL and ΔT are the least counts of distance and period axes of the graph

Results

The acceleration due to gravity, g = -------- cm/s^2

Actual value = -------- cm/s^2

Percentage error = -------- %

Maximum log error = --------- cm/s^2

The radius of gyration about the axis of rotation = ------- cm.

The MOI of the pendulum about the axis of rotation = ---- gcm^2.

Experiment Number 3

MEASUREMENT OF VISCOSITY BY THE STOKES METHOD

OBJECT

To measure coefficient of the dynamic viscosity of the glycerine and ri oil with a Stokes viscometer. Evaluate the error of measurements.

Compare your results to the accepted value.

THEORY

Viscosity is a measure of the resistance of a fluid which is being deforme either shear stress or tensile stress. Viscosity describes a fluid's internal resistanc flow and may be thought of as a measure of fluid friction. For example, h viscosity felsic magma will create a tall, steep stratovolcano, because it cannot far before it cools, while low-viscosity magic lava will create a wide, shal sloped shield volcano. All real fluids (except superfluids) have some resistanc stress and therefore are viscous, but a fluid which has no resistance to shear stre known as an ideal fluid or inviscid fluid. Viscosity coefficients can be define two ways:

Dynamic viscosity, also absolute viscosity, the more usual one. Th physical unit of dynamic viscosity is the pascal-second (Pa·s), (equivaler N·s/m2, or kg/(m·s)). The usual symbol for dynamic viscosity used by mecha and chemical engineers — as well as fluid dynamicists — is the Greek lette (μ).

Kinematic viscosity is the dynamic viscosity divided by the density (m^2/s).

values of the dynamic viscosity of some selected liquids and gases for temperature of 20°C and pressure 1.10^5 Pa.

Liquid	mPa.s	Gas	μPa.s
Glycerine	1480	Neon	32.1
Engine oil	989	oxygen	20.8
Mercury	1.554	air	18.6
Water	1.002	hydrogen	9.0

Free fall in a viscous liquid

Determination of dynamic viscosity in a Stokes viscometer is based on a study of free fall of an iron ball in examined fluid. There are three forces acting on the ball: F_g – gravitational force, F_r – force of resistance and F_b – buoyant force.

Gravitational force can be evaluated by $F_g = mg$,

Where m is mass of the ball and g is a vector of acceleration due to gravity.

Buoyant force can be evaluated form the Archimedes' principle like mass of particular volume of water displaced by the ball.

$$F_b = -m_{fluid} \cdot g = -4/3\ \pi r^3 \rho g,$$

Where r is radius of the ball and ρ is density of it.

Force of resistance is evaluated by the Stokes law $F_r = -6\pi\mu\rho v$, where v is velocity of the ball.

Equation of motion of the ball can be written as

$$m\ dv/dt = F_g + F_b + F_r = (m - 4/3\ \pi r^3 \rho)g - 6\pi\mu\rho v$$

Simplifying the vector equation into the vertical direction and assuming the initial velocity to be zero we obtain

$$m\ dv/dt = (m - 4/3\ \pi r^3 \rho)g - 6\pi\mu\rho v$$

Now we can apply two substitutions $\alpha = g(1 - \rho/\rho_{ball})$ and $\beta = 9\mu/(2r^2\rho_{ball})$

obtaining

$$\frac{dv}{dt} = \alpha - \beta v \quad \Rightarrow \quad \frac{dv}{\alpha - \beta v} = dt \quad \Rightarrow \quad \int_0^v \frac{dx}{\alpha - \beta x} = \int_0^t dy$$

By integrating we have

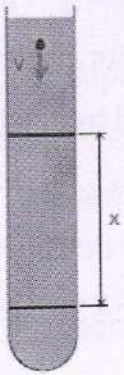
$$t = \left[-\frac{1}{\beta}\ln|\alpha - \beta x|\right]_0^v = \frac{1}{\beta}\ln\left|\frac{\alpha}{\alpha - \beta v}\right| \quad \Rightarrow \quad v = \frac{\alpha}{\beta}\left(1 - e^{-\beta t}\right) = v_\infty\left(1 - e^{-\beta t}\right)$$

The last formula tells us that the ball velocity exponentially raises to the value

$$v_\infty = \frac{2gr^2(\rho_k - \rho)}{9\eta}. \qquad [1]$$

Stokes viscometer.

Viscosity is measured with various types of viscometers. The theory of the Stok viscometer is based on the study of the free fall of the ball in investigated liquid.



The Stokes viscometer is usually a transparent cylinder filled with the investigated which we measure the time of the free fall of the ball Δt between two marks at a $x = \Delta L$. The ball is made from the suitable material, e.g. iron or steel. Taking into simple formula for the final velocity $v_\infty = \Delta L/\Delta t$ and considering the equation [1] obtain formula for the dynamic viscosity:

$$\mu = \frac{2}{9}gr^2(\rho_{ball} - \rho)\frac{\Delta t}{\Delta L},$$

Where g is acceleration due to the gravity, r is the radius of the ball, ρ_{ball} is density of the material of the ball, ρ is the density of the investigated liquid, Δ the time of the free fall of the ball between the two rings placed at the distance ΔL (Density of the glycerine ρ = 1261 kg/m3, density of the ricine oil ρ = 960 kg/m3, density of the balls ρb_{all} = 7860 kg/m3).

PROCEDURE

The method of measurement is the same for both glycerine as well as for ricine oil.

1. Place 12 balls into the Petri dish. Measure the diameter of each ball.
2. Determine the probable mass of the Petri dish together with the balls, using the balance weight.
3. Determine the mass of the balls using the analytical weigh in such a way that first of all you will weigh the mass of the Petri dish with the balls and then the mass of the dish without the balls.
4. On the walls of the measuring cylinders are placed two rubber rings between you will measure the time of the fall of the balls in the liquid. Adjust the distance between these rubber rings in such way that the upper ring will be placed at least 5 cm below the surface of the liquid.
5. Using the stopwatch measure the time of the fall of each ball between the upper and lower rubber rings. Eliminate the smallest and the biggest values.
6. Using the densitometer measure the density of each liquid.
7. Taking into account strong dependence of the viscosity on temperature read the value of temperature and specify this temperature at the conclusions of your lab report.
8. Compare your results of the measurement of the viscosity with the accepted values.

Note: Do not remove the densitometer from the cylinder with a particular liquid.

Experiment Number 4

P-N JUNCTION DIODE CHARACTERISTICS

Objective:

1. To plot Volt-Ampere Characteristics of Silicon P-N Junction Diode.
2. To find cut-in Voltage for Silicon P-N Junction diode.

3. To find static and dynamic resistances in both forward and reverse biased conditions for P-
Junction diode.

Hardware Required:

S. No	Apparatus	Type	Range	Quantity
01	PN Junction Diode	IN4001		1
02	Resistance		1k ohm	1
03	Regulated power supply		(0 – 30V)	1
04	Ammeter	mC	(0-30)mA, (0-500)μA	1
05	Voltmeter	mC	(0 – 1)V, (0 – 30)V	1
06	Bread board and connecting wires			

Introduction:

Donor impurities (pentavalent) are introduced into one-side and acceptor impurities in the other side of a single crystal of an intrinsic semiconductor to form a p-n diode with a junctio called depletion region (this region is depleted off the charge carriers). This region gives rise to potential barrier Vγ called **Cut- in Voltage**. This is the voltage across the diode at which it sta conducting. The P-N junction can conduct beyond this Potential. The P-N junction supports un directional current flow. If +ve terminal of the input supply is connected to anode (P-side) and ve terminal of the input supply is connected to cathode (N- side), then diode is said to be forwa biased. In this condition the height of the potential barrier at the junction is lowered by an amou equal to given forward biasing voltage. Both the holes from p-side and electrons from n-side cross the junction simultaneously and constitute a forward current (**injected minor current** – due to holes crossing the junction and entering N-side of the diode, due to electro crossing the junction and entering P-side of the diode). Assuming current flowing through t diode to be very large, the diode can be approximated as short-circuited switch. If –ve terminal the input supply is connected to anode (p-side) and +ve terminal of the input supply is connec to cathode (n-side) then the diode is said to be reverse biased. In this condition an amount equal reverse biasing voltage increases the height of the potential barrier at the junction. Both the ho on p-side and electrons on n-side tend to move away from the junction thereby increasing depleted region. However the process cannot continue indefinitely, thus a small current cal **reverse saturation current** continues to flow in the diode. This small current is due to therma generated carriers. Assuming current flowing through the diode to be negligible, the diode can

[illegible] as an open circuited switch. The volt-ampere characteristics of a diode explained by [illegible] equation: $I = I_o(Exp(V/\eta V_T)-1)$

[illegible] flowing in the diode

[illegible] saturation current

[illegible] applied to the diode

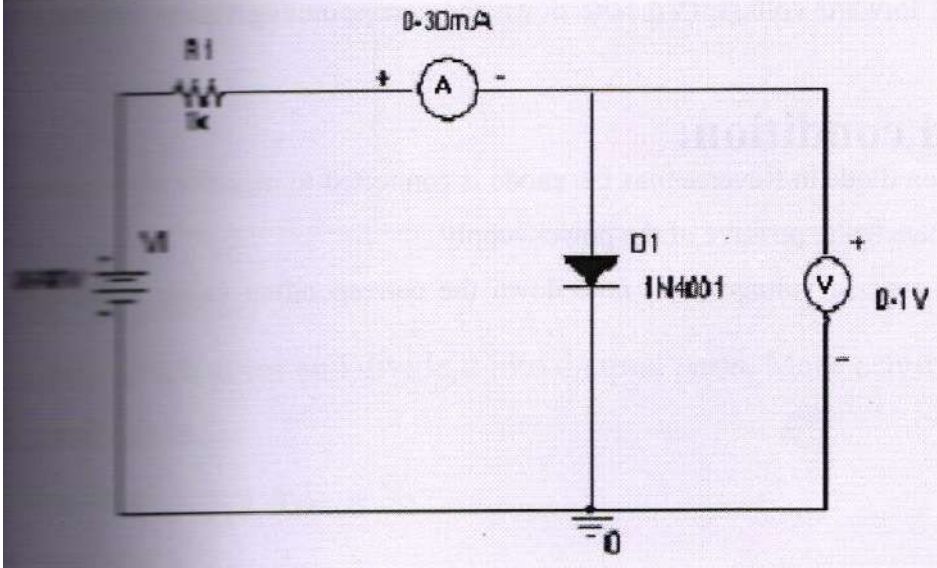
[illegible] equivalent of temperature=kT/q=T/11,600=26mV(@ room temp).

[illegible] and 2 (for Si)

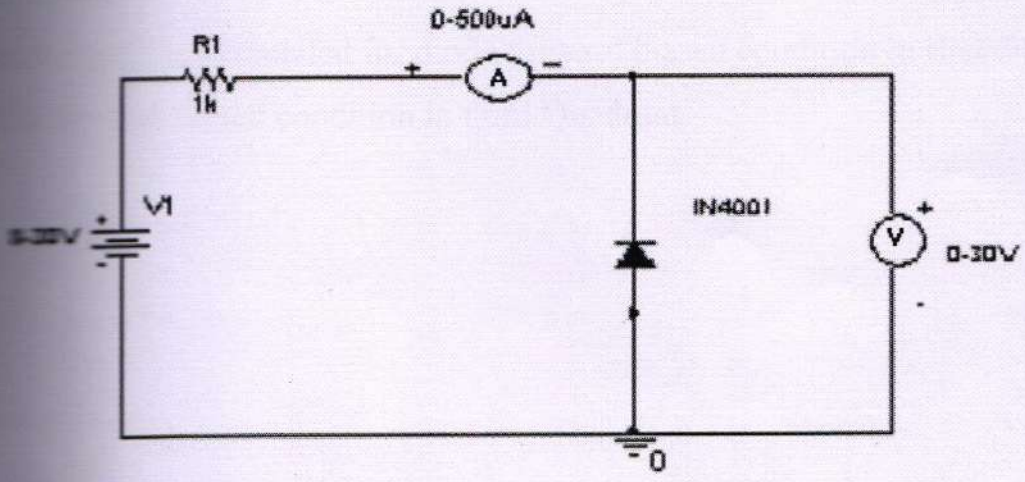
[illegible] that Ge diode has smaller cut-in-voltage when compared to Si diode. The reverse [illegible] current in Ge diode is larger in magnitude when compared to silicon diode.

Circuit diagram:

Forward Bias



Reverse Bias



Precautions:

1. While doing the experiment do not exceed the ratings of the diode. This may lead to damage o the diode.
2. Connect voltmeter and Ammeter in correct polarities as shown in the circuit diagram.
3. Do not switch **ON** the power supply unless you have checked the circuit connections as per th circuit diagram.

Experiment:

Forward Biased Condition:

1. Connect the PN Junction diode in forward bias i.e. Anode is connected to positive of the powe supply and cathode is connected to negative of the power supply.
2. Use a Regulated power supply of range (0-30) V and a series resistance of 1kΩ.
3. For various values of forward voltage (V_f) note down the corresponding values of forwar current(I_f) .

Reverse biased condition:

1. Connect the PN Junction diode in Reverse bias i.e. anode is connected to negative of the powe supply and cathode is connected to positive of the power supply.
2. For various values of reverse voltage (V_r) note down the corresponding values of revers current (I_r).

Tabular column:

Forward Bias:

S. No	V_f (volts)	I_f (mA)

Reverse Bias:

S. No	Vr (volts)	Ir (μA)

Graph (instructions)

1. Take a graph sheet and divide it into 4 equal parts. Mark origin at the center of the graph sheet.
2. Now mark +ve x-axis as V_f

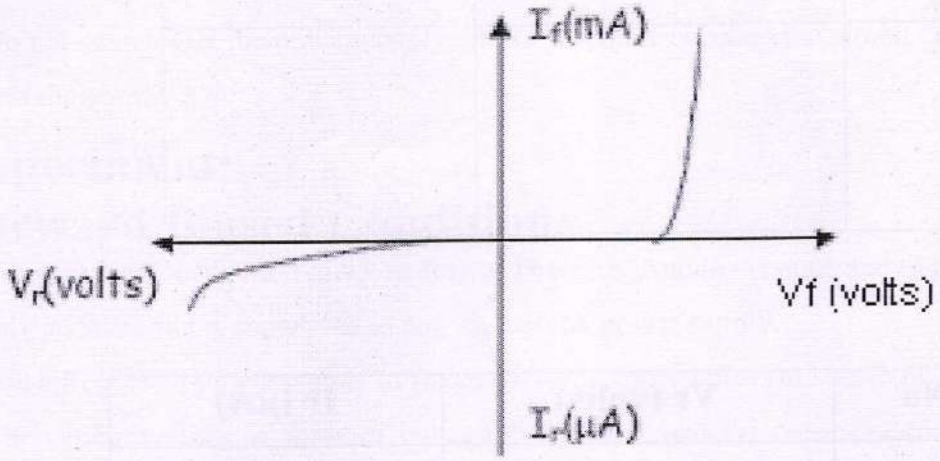
-ve x-axis as V_r

+ve y-axis as I_f

-ve y-axis as I_r.

3. Mark the readings tabulated for diode forward biased condition in first Quadrant and diode reverse biased condition in third Quadrant.

Graph:



Calculations from Graph:

Static forward Resistance $R_{dc} = V_f/I_f\ \Omega$

Dynamic forward Resistance $r_{ac} = \Delta V_f/\Delta I_f\ \Omega$

Static Reverse Resistance $R_{dc} = V_r/I_r\ \Omega$

Dynamic Reverse Resistance $r_{ac} = \Delta V_r/\Delta I_r\ \Omega$

Result:

Thus the VI characteristic of PN junction diode is verified.

1. Cut in voltage = ... V
2. Static forward resistance = ... Ω
3. Dynamic forward resistance = ... Ω

DEPARTMENT OF ZOOLOGY

The Department of Zoology is one of the oldest Department of Govt. [illegible] P.G.Auto. College Durg started from the inception of the college in 1958. It has [illegible] a landmark of excellence since P.G course was started in the year 1965. The [illegible] offers Under Graduate programme in Zoology with various combination of [illegible] like Chemistry, Botany, Biotechnology, Anthropology, Geology & Biochemistry. [illegible] programmme is offered in the area of biodiversity, toxicity, Environmental Biology, [illegible] Toxicity, Histopathology and Reproductive Biology, Endocrinology, Ichthyology [illegible] Genetic has been carried out since 1970. [illegible] Doctorate degrees have been awarded so for. Besides providing workspace for [illegible] the department houses a well – equipped lab and library with around 700 [illegible] Research journals are available in the central library of the college. The department [illegible] taken minor and major research project's supported by funding agencies such as [illegible] & CGCOST. It has organized two national conferences funded by UGC & [illegible]. Several research papers have been published in various national and [illegible] journals by the faculty.

Faculty

[illegible] - Dr Kanti Choubey

[illegible] - Professor and Head

[illegible] - Dr Anil Kumar

[illegible] - Professor & I/C of Biotechnology

[illegible] – Dr. Usha Sahu

[illegible] - Assistant Professor

[illegible] – Dr. Divya K. Minj

[illegible] - Assistant Professor

[illegible] - Dr. Neeru Agrawal

Designation - Assistant Professor

Name - Dr. Mousmi Dey

Designation - Assistant Professor

Name - Dr. Sanju Sinha

Designation - Assistant Professor

Name - Dr. Alka Mishra

Designation - Assistant Professor

Name – Shri Evraj Janghel (Guest Faculty)

Experiment 1. Live demonstration of Protozoa

Requirements: Slide,coverslip,compound microscope, ceedarwood oil, water sample form pond or ditches and vital stain.

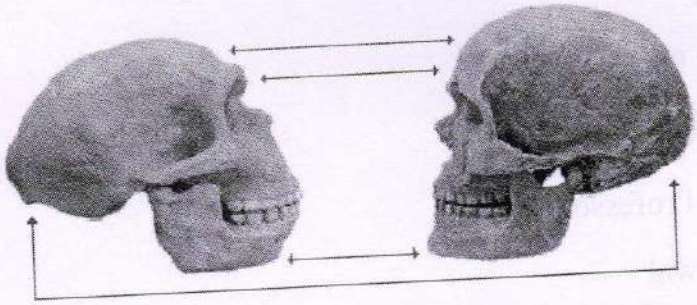
Procedure: Take one drop of water sample to be observe on a slide. ,cover it with cover glass. Observe under lowpower microscope, select the organism and then focus it under high power . For observing further details take a small drop of cedar wood oil on coverglass and observe organisms under 100X resolution. For detail organelle study some vital stains may also be used.

Along with the live demonstration some video clips of a moving protozoa will be displayed on the scree

Experment 2: Study of evoloution of man through skull of different time zones and models.

All people today are classified as ***Homo sapiens***. Our species of humans first began to evol nearly 200,000 years ago in association with technologies not unlike those of the early Neandertals. It now clear that early *Homo sapiens*, or **modern humans**, did not come after the Neandertals but were the contemporaries. However, it is likely that both modern humans and Neandertals descended from *Hom heidelbergensis*.

Compared to the Neandertals and other late archaic humans, modern humans generally have more delica skeletons. Their skulls are more rounded and their brow ridges generallyprotrude much less. They rare have the occipital buns found on the back of Neandertal skulls. They also have relatively high forehead smaller faces, and pointed chins.



Neandertal modern *Homo sapiens*

The first fossils of early modern humans to be identified were found in 1868 at the 27,000-23,000 year old Cro-Magnon rock shelter site near the village of Les Eyzies in southwestern France. They were subsequently named the **Cro-Magnon** people. They were very similar in appearance to modern Europeans. Males were 5 feet 4 inches to 6 feet tall (1.6-1.8 m.) That was 4-12 inches (10-31 cm.) taller than Neandertals. Their skeletons and musculature generally were less massive than the Neandertals. The Cro-Magnon had broad, small faces with pointed chins and high foreheads. Their cranial capacities were over 1590 cm^3, which is relatively large even for people today.

There are three models regarding evolution of man

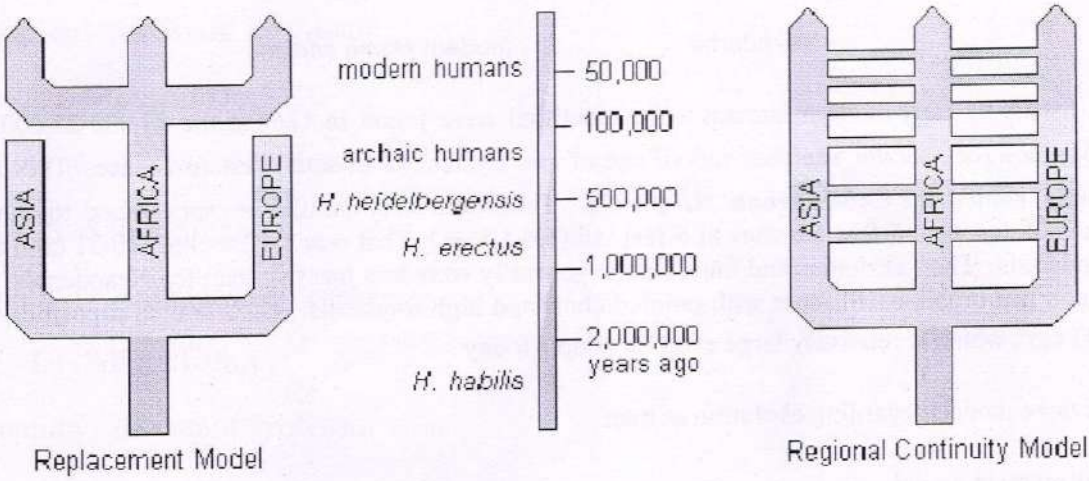
The Replacement model

Regional continual model

Assimilation Model

The replacement model of Christopher Stringer and Peter Andrews proposes that modern humans evolved from archaic humans 200,000-150,000 years ago only in Africa and then some of them migrated into the rest of the Old World replacing all of the Neandertals and other late archaic humans beginning around 60,000-40,000 years ago or somewhat earlier. If this interpretation of the fossil record is correct, all people today share a relatively modern African ancestry. All other lines of humans that had descended from *Homo erectus*presumably became extinct. From this view, the regional anatomical differences that we now see among humans are recent developments--evolving mostly in the last 40,000 years. This hypothesis is also referred to as the "out of Africa", "Noah's ark", and "African replacement" model.

The regional continuity model (or multiregional evolution model) advocated by Milford Wolpoff proposes that modern humans evolved more or less simultaneously in all major regions of the Old World from local archaic humans. For example, modern Chinese are seen as having evolved from Chinese archaic humans and ultimately from Chinese *Homo erectus*. This would mean that the Chinese and some other peoples in the Old World have great antiquity in place. Supporters of this model believe that the ultimate common ancestor of all modern people was an early *Homo erectus* in Africa who lived at least 1.8 million years ago. It is further suggested that since then there was sufficient gene flow between Europe, Africa, and Asia to prevent long-term reproductive isolation and the subsequent evolution of distinct regional species. It is argued that intermittent contact between people of these distant areas would have kept the human line a single species at any one time. However, regional varieties, or subspecies, of humans are expected to have existed.



Replacement Model Arguments

There are two sources of evidence supporting the replacement model--the fossil record and DNA. So fa the earliest finds of modern *Homo sapiens* skeletons come from Africa. They date to nearly 200,000 yea ago on that continent. They appear in Southwest Asia around 100,000 years ago and elsewhere in the O World by 60,000-40,000 years ago. Unless modern human remains dating to 200,000 years ago earlier are found in Europe or East Asia, it would seem that the replacement model better explai the fossil data for those regions. However, the DNA data supporting a replacement are mo problematical.

3.**Assimilation Model**

It is apparent that both the complete replacement and the regional continuity models have difficul accounting for all of the fossil and genetic data. What has emerged is a new hypothesis known the **assimilation** (or partial replacement) **model**. It takes a middle ground and incorporates both of t old models. Gunter Brauer, of the University of Hamburg in Germany, proposes that the first mode humans did evolve in Africa, but when they migrated into other regions they did not simply repla existing human populations. Rather, they interbred to a limited degree with late archaic humans resulti in hybrid populations. In Europe, for instance, the first modern humans appear in the archaeologic record rather suddenly around 45-40,000 years ago. The abruptness of the appearance of these Cr Magnon people could be explained by their migrating into the region from Africa via an easte Mediterranean coastal route. They apparently shared Europe with Neandertals for another 12,000 years more. During this long time period, it is argued that interbreeding occurred and that the partial hybridized predominantly Cro-Magnon population ultimately became modern Europeans. In 2003, discovery was made in a Romanian cave named Peştera cu Oase that supports this hypothesis. It was partial skeleton of a 15-16 year old male *Homo sapiens* who lived about 30,000 years ago or a earlier. He had a mix of old and new anatomical features. The skull had characteristics of both mode and archaic humans. This could be explained as the result of interbreeding with Neandertals according Erik Trinkaus of Washington University in St. Louis. Alan Templeton, also of Washington Universit reported that a computer-based analysis of 10 different human DNA sequences indicates that there h been interbreeding between people living in Asia, Europe, and Africa for at least 600,000 years. This consistent with the hypothesis that humans expanded again and again out of Africa and that the emigrants interbred with existing populations in Asia and Europe. It is also possible that migrations we not only in one direction--people could have migrated into Africa as well. If interbreeding occurred, may have been a rare event. This is supported by the fact that most skeletons of Neandertals and Cr Magnon people do not show hybrid characteristics.

genetically different from our *Homo sapiens* ancestors who lived 10-20,000 years ago? The answer is almost certainly yes. In fact, it is very likely that the rate of evolution for our species has continually accelerated since the end of the last ice age, roughly 10,000 years ago. This is mostly due to the fact that our human population has explosively grown and moved into new kinds of environments, including cities, where we have been subject to new natural selection pressures. For instance, our larger and denser populations have made it far easier for contagious diseases, such as tuberculosis, small pox, the plague, and influenza to rapidly spread through communities and wreak havoc. This has exerted strong selection for individuals who were fortunate to have immune systems that allowed them to survive. There also has been a marked change in diet for most people since the end of the last ice age. It is now less varied and predominantly vegetarian around the globe with a heavy dependence on foods made from cereal grains. It is likely that the human species has been able to adapt to these and other new environmental pressures because it has acquired a steadily greater genetic diversity. A larger population naturally has more mutations adding variation to its gene pool simply because there are more people. This happens even if the mutation rate per person remains the same. However, the mutation rate may have actually increased because we have been exposed to new kinds of man-made environmental pollution that can cause additional mutations.

It is not clear what all of the consequences of the environmental and behavioral changes for humans have been. However, it does appear that the average human body size has become somewhat shorter over the last 10,000 years, and we have acquired widespread immunity to the more severe effects of some diseases such as measles and influenza.

Experiment 3:- Osteology

Aim: To study the bones of rabbit.

Requirement: Articulated and disarticulated bones of rabbit

The endoskeleton of rabbit is chiefly formed of bone and cartilaginous part is very little.

Broadly like those of other vertebrates, the skeleton of rabbit can also be divided into two parts:

(i) The axial skeleton is present along the longitudinal axis of the body and consists of the bones of skull, the vertebral column, the ribs and the sternum;

(ii) The appendicular skeleton lies at right angle to the longitudinal axis of the body and consists of the bones of limbs and the girdles.

Axial Skeleton:

Characteristics of Skull:

Some important characteristic points in the mammalian skull are as follows:

1. Since there is a general tendency to increase in the size of the brain, the skull has a short posterior cranial part for lodging the brain and the long anterior facial part comprising mainly the jaws. In higher mammals the facial part lies below the cranial part.
2. The number of bones in the skull is much reduced, many of them are fused intimately so that their separating boundaries are marked only by the sutures.
3. Skull is dicondylic, i.e., 2 occipital condyles. Each exoccipital bears an occipital condyle.
4. Diaphragmatic skull-a vertical interorbital septum is present in between two orbits. Cranium does not extend in orbital region.
5. The food passage is well separated from the nasal passage due to the development of palate which is formed of premaxillae, maxillae and palatines.
6. Zygomatic arch on either side of the skull is formed by squamosal, jugal and maxillary bones.

7. The auditory capsules are formed by the union of periotic and tympanic forming a swollen tympanic bulla.
8. The articular and quadrate of the jaws become separated and free, and form malleus and incus respectively (two ear-ossicles of the three). Stapes forms the columella.
9. Otic bones, prootic, epiotic and opisthotic, are fused to form a single periotic.
10. Turbinal bones are much folded and, thus, increases the olfactory surface of nasal chambers.
11. Only a single bone, the dentary, forms one half of the lower jaw.
12. Jaws suspensorium is craniostylic, i.e., dentary, articulates with the cranium (skull) by squamosal.
13. Prefrontal, postfrontal, parasphenoid and quadratojugal are lacking. Pterygoids scale-like.
14. Premaxillae, maxillae and dentaries bear the thecondont teeth (teeth embedded in sockets). Teeth a diphyodont (milk and permanent) and heterodont (different types). Canines are absent leaving a space, called diastema.

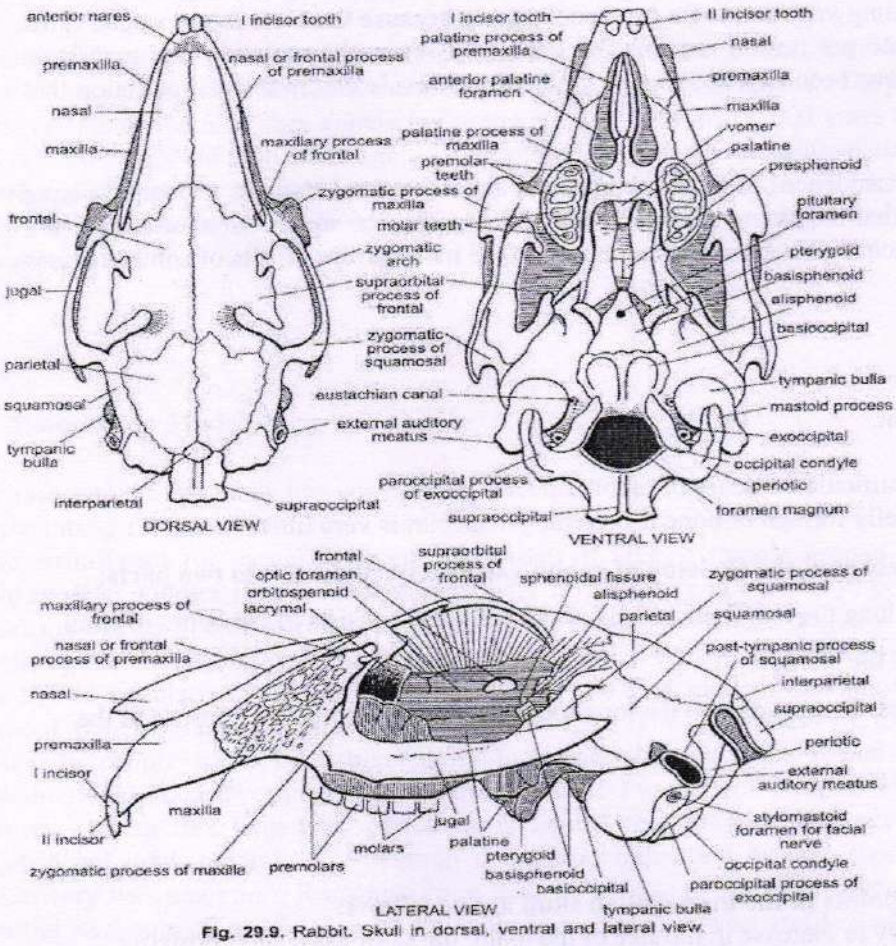


Fig. 29.9. Rabbit. Skull in dorsal, ventral and lateral view.

Vertebral Column

The vertebral column of rabbit, like that of birds and lizards, is differentiated into the following five regions. The total number of vertebrae in rabbit is about 45-47.

1. Cervical
2. Thoracic
3. Lumbar
4. Sacral
5. Coccygeal or caudal

Vertebral formula of rabbit: C_7, T_{12-13}, L_{6-7}, S_4, Cd_{15} where C, T, L, S, Cd stand for cervical, thoracic, lumbar, sacral and caudal respectively.

column of mammals is distinguished from other vertebrates in the following respects.

Characteristics of Mammalian Vertebrae:

are more a less flattened on both the surfaces, i.e., amphiplatyan type. The centra on either
provided with small bony plate, epiphysis.
epiphysial cartilage separates the centrum and epiphysis in the embryonic condition, which later
fused with the centrum. Thus, in adults no epiphysial cartilage is found.
between the adjacent centra are present intervertebral discs of central portion of the intervertebral disc
nucleus pulpous, which represents the remnant notochord. The discs are shock-absorbing
and probably represent the hypocentrum.

Vertebrae:

seven cervical vertebrae, first and the second are highly modified, known as atlas and axis
Remaining 3rd to 7th are more or less alike and can be called typical cervicals.

Vertebra:

without any solid centrum and zygapophyses. It consists of a large neural arch but a reduced
(The centrum is, however, present in the embryonic condition which later fuses with the axis
known as odontoid process). The neural canal is large and divided into two parts in living

part is the neural canal for the passage of spinal cord and lower part is occupied by the odontoid
of the axis. Two large concave occipital facets are present in the anterior face of the altas for
with the occipital condyles of the skull.

-occipital joint allows movements of the head in sagittal plain, as in nodding the head. The
processes arising from the sides are broad, long and wing like for the attachment of muscles that
rotate the head and neck.

not transverse processes but are enlarged flattened cervical ribs, perforated basally by the
canals. A pair of lateral and a mid-ventral articular facet is present on the posterior face of
for the odontoid process of axis.

Vertebra:

cervical vertebra. Its neural spine is high, ridge-like, laterally compressed and elongated
-posteriorly. Its centrum bears a peg-like odontoid process in the anterior face which is
ally the centrum of atlas. This process forms the atlanto-axial joint, which allows the rotation
and atlas on the axis.

movement is facilitated by a pair of smooth articular surfaces on the anterior face of the axis one on
of the odontoid process. The transverse processes are short and perforated basally by
canals for vertebral artery. A pair of post-zygapophyses are found but pre-zygapophyses are

Cervical Vertebra:

vertebra is broad and has a small flattened centrum, a large neural arch and a small
Pre-and post-zygapophyses are well developed. Transverse processes are bifurcated into
ventral lamellae perforated basally by a foramen transversaria or vertebrarterial canal. The
are much reduced and more or less incorporated in the vertebra. The transverse processes and
provide surface for the attachment of neck muscles.

The cervical vertebrae from 3rd to 6th are similar in structure. But the 7th cervical differs from others in having a more elongated neural spine, in having its transverse processes simple and imperforate and in th presence of a small concave semilunar facet at the posterior edge of the centrum for the articulation of thoracic ribs.

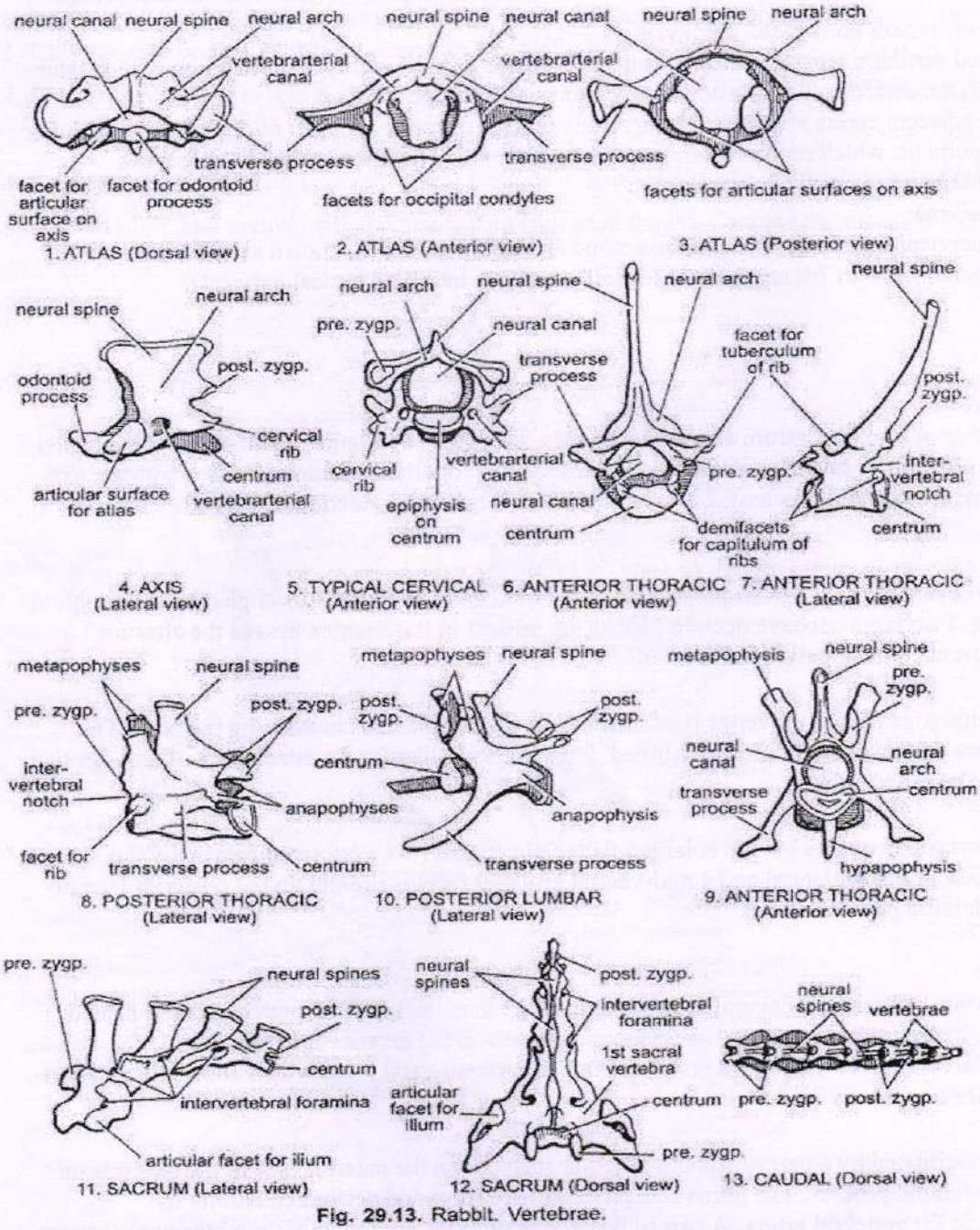


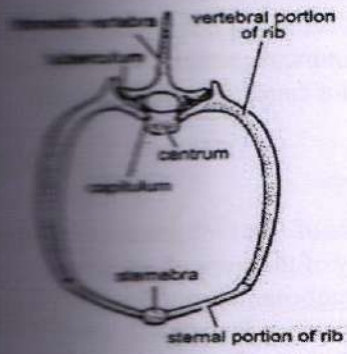
Fig. 29.13. Rabbit. Vertebrae.

B. Thoracic Vertebrae:

The thoracic vertebrae are 12-13 and each vertebra is provided with a well-developed centrum, a neural arch, long neural spine and pre- and post-zygapophyses. The transverse processes are short and stout. Ea bears near its extremity a small smooth articular surface or tubercular facet for the tubercle of a rib.

On the anterior and posterior borders of each vertebra is a little semilunar facet, the capitular facet, situat at the junction of the centrum and neural arch. The neural spines of the anterior thoracic vertebrae are m or less straight and directed backwards. Posterior 4 or 5 thoracic vertebrae are little different from the anterior thoracic vertebrae.

longer and stout centra, short neural spines, reduced transverse processes with no tubercular
, and zygapophyses are distinct. Capitular facets are present near the anterior of centrum. Neural
directed upward. Metapophyses and anapophyses are present on the anterior end of neural arch
end of neural arch below post-zygapophyses respectively.



Rabbit. A thoracic vertebra with its ribs.

ribs are 12 or 13 pairs and found articulating with the thoracic vertebrae. Each rib is a bony
divided into a dorsal longer bony vertebral rib and a ventral smaller cartilaginous sternal rib.
part is biramus (double headed), the heads are known as tuberculum and capitulum which
with the transverse process and with the demi-facets on the centra of two adjacent vertebra
respectively.

of the rib articulates with the sternum. The sternal parts of all the thoracic ribs, except the
meet the sternum below and are called true ribs. The last three or four ribs have no sternal parts
with one anterior to them are not connected with the sternum and, hence, known as floating

Vertebrae:

7 and out of which the first two are called anterior lumbars. Each anterior lumbar has a large,
built centrum, a neural arch enclosing a broad neural canal and well developed forwardly
neural spine. The transverse processes are large, distally expanded beside pre- and post-
and directed downwards and forwards.

two pairs of bony processes, called mammillary processes, i.e., metapophysis is present at the
of neural arch and it is sloping forward. Beneath it lies the median pre-zygapophysis;
is present at the posterior end of neural arch beneath the post-zygapophysis and it is a small
directed process. Each anterior lumbar also has a median ventral process beneath the centrum,
hypapophysis.

Lumbar:

seventh lumbars are called posterior lumbars. These resemble the anterior lumbars in all
but the hypapophysis is absent, only a small ridge is present in its place.

Vertebrae (Sacrum):

four vertebrae in the sacral region of rabbit which fuse together to form a compound bone, the
but only the first articulates with ilium of the pelvic girdle. It is believed that out of these four
constituting sacrum, only first vertebra is the sacral vertebra and the remaining three vertebrae
anterior caudals.

of the sacrum is provided with a long neural spine, tubercle-like projections on the upper
zygapophyses, and intervertebral foramina. The first vertebra is the largest and has large,
stout transverse processes, probably fused sacral ribs.

These articulate with the ilia of pelvic girdle. This joint is called sacro-iliac joint. Hypapophyses and anapophyses are absent and the metapophyses are relatively small. The sacro-iliac joint provides strengt to the pelvic girdle and the vertebral column at the time of throwing the body forward when the hindlimb are straightened.

E. Caudal Vertebrae:

The caudal vertebrae are sixteen in rabbit. Only the anterior caudal vertebrae are provided with well-developed neural spines, neural arches and zygapophyses. These processes being gradually reduced until the terminal vertebrae near the end of the tail is only left in the form of cylindrical centrum. The transver processes are absent in caudal vertebrae. The muscles attached to the anterior caudal vertebrae provide movements of the tail in many planes.

Sternum:

The thorax of rabbit is bounded mid-ventrally by the sternum which consists of five elongated bony piec known as sternebrae. Thus, the sternebrae together constitute the main body of the sternum, called mesosternum. The first anterior most sternebra is the longest and called manubrium or presternum. It is ventrally produced into a keel. The first pair of sternal ribs articulate with it in the middle. Sixth sternebra is the smallest of all and the last one is long and slender. Except first rib, all the sternal ribs called xiphisternum terminating into an expanded xiphoid cartilage are attached at the intersternebral junctions.

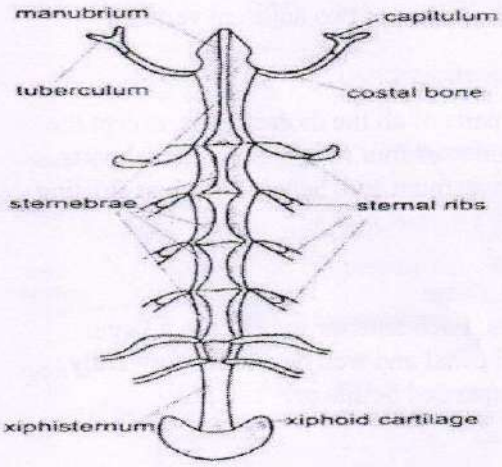
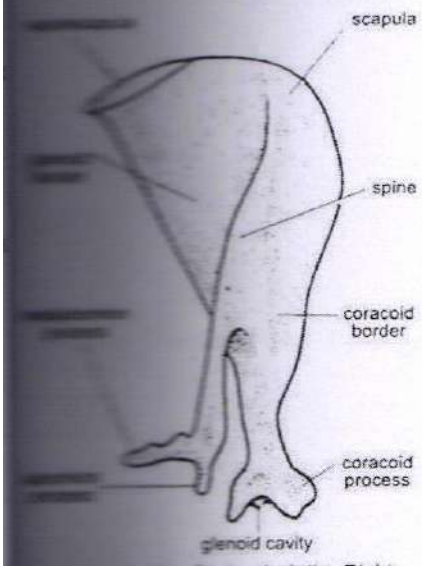


Fig. 29.15. Rabbit. Sternum.



Pectoral girdle. Right half in outer view.

Pectoral Girdle:

It consists of two separate halves placed dorsal to the anterior thoracic ribs in between the forelimbs, it supports forelimbs and protects the soft parts of the body from the ventral side. Each half of the pectoral girdle is known as innominate. Thus one half of the pectoral girdle is formed of a broad, more or less triangular bony plate, called scapulo-coracoid and a small clavicle bone.

Scapulo-Coracoid:

It is mainly formed of scapula which is a thin, flat, and more or less triangular bony structure. Its outer surface bears a prominent ridge, called the spine which divides its surface into antero-dorsal and postero-dorsal portions to which are attached muscles. The spine terminates ventrally into an expanded knob-like structure, the acromion process which posteriorly bears backwardly directed metacromion process.

The ventral part of scapulo-coracoid is directed downwards and forwards terminating below into a concave glenoid cavity for the head of humerus. Above this cavity is present a small hook-like coracoid process, a rudimentary coracoid. The suprascapula is in the form of a thin strip of cartilage situated along the posterior vertebral border of the scapula.

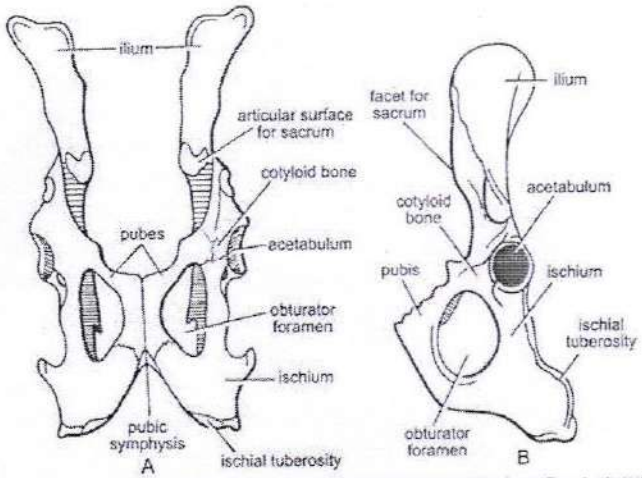


Fig. 29.17. Rabbit. Pelvic girdle. A – Complete girdle in ventral view; B – Left half.

Clavicle is a thin, slightly curved bone extending between the acromion processes and manubrium of th sternum.

2. Pelvic Girdle:

The pelvic girdle is also formed of two equal halves or os-innominate. Both the halves are joined togeth mid-ventrally by pubic symphysis to form a stout and strong girdle situated in the pelvic region betwee the two hindlimbs. Each half or os-innominatum is formed of three bones, the ilium, ischium, and pubis All these bones are fused together to form a single hip bone.

The ilium is the antero-dorsal longest bone, which bears a rough flat articular surface roughly at about t middle of its length for sacrum. The anterior and dorsal edge of the ilium is raised into iliac-crest. The ilium extends posteriorly up to the acetabulum. The postero-dorsal part of the os-innominate is formed b the ischium.

The posteriormost part of ischium is broad and projects outwards into a prominent ischial tuberosity. Th pubis is a narrow bone and forms the ventro- median portion of innominate. Both the pubes unite with each other on the mid-ventral line to form a pubic-symphysis.

The pubis does not take part directly in the formation of acetabulum, because a cotyloid bone is present between the acetabulum and pubis. A big obturator foramen is present between the ischium and pubis which is always covered by the obturator membrane and muscles in the lifetime. Acetabulum is only formed by the ilium and ischiam on both sides of the girdle and into it articulates the head of humerus.

3. Forelimbs Bones:

Humerus:

The bone of the upper-arm is the humerus, which is a long bone having a proximal large rounded head f the articulation in the glenoid cavity of scapula. The proximal end of the humerus near the head is provided with a bicipital groove in between the two tuberosities (greater and lesser) for the attachment o muscles.

The anterior surface of the humerus below the head has a projection called deltoid ridge for the attachm of muscles. The distal end of the humerus is provided with a pulley-like trochlea for articulation with ul Just above trochlea are present two fossae (depressions)-anterior smaller is coracoid fossa and posterior larger is olecranon fossa. Both the fossae communicate with each other through a supra-trochlear foram

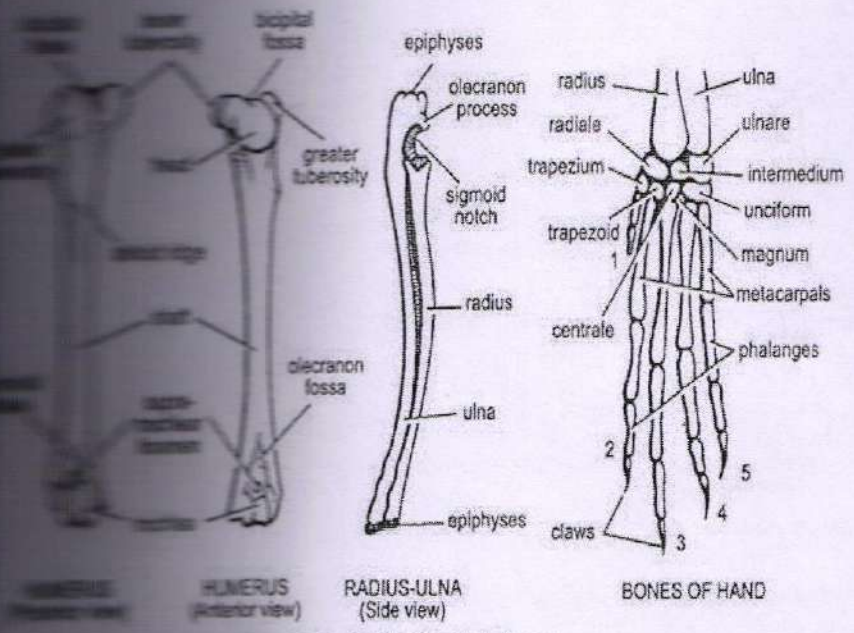


Fig. 29.18. Rabbit. Forelimb bones.

The bones of the forearm are radius and ulna which are closely held together at the two ends, so that they cannot move over each other. The ulna is the long bone and proximally bears a prominent projection called the olecranon process. It articulates with the olecranon fossa of humerus.

The olecranon process is basally notched called the sigmoid notch into which fits the trochlea of humerus. The radius is the smaller bone than ulna and situated towards the inner side. The radius and ulna are distally provided with epiphysis and articulate with the wrist bones.

The wrist bones or carpals are 9 small bones arranged in two rows. Proximal row has three carpals, called radiale, ulnare and intermedium. The radiale is situated below the radius, ulnare below the ulna, while the intermedium is situated between them.

The distal row consists of trapezium and trapezoid situated below the radiale, centrale and magnum situated below the intermedium and unciform situated below the ulnare. The unciform is actually fused two carpals. Besides these, a sesamoid pisciform is present on the ventral side of carpus.

The bones of the palm or manus are five long metacarpals, which support the five digits having 2, 3, 3, 3, 3 phalanges respectively. The terminal phalanx of each digit bears a horny claw.

The bone of the thigh is the femur which is a long bone with a flattened proximal end. Its flattened proximal end bears a rounded smooth head towards the inner side for the articulation with the acetabulum.

The proximal end of the femur also bears three trochanters for the attachment of muscles.

The first or greater trochanter is situated above the head, the second or lesser trochanter is situated below the head, while the third trochanter is situated below the greater trochanter. The deep groove below the third and greater trochanter is the digital fossa.

The main body of the femur or shaft terminates distally into a pair of expanded condyles enclosing the intercondylar groove for the articulation with tibio-fibula. On the anterior side of this groove is called the patellar groove into which moves the patella bone. These condyles are provided with articular facets for articulating with the tibia.

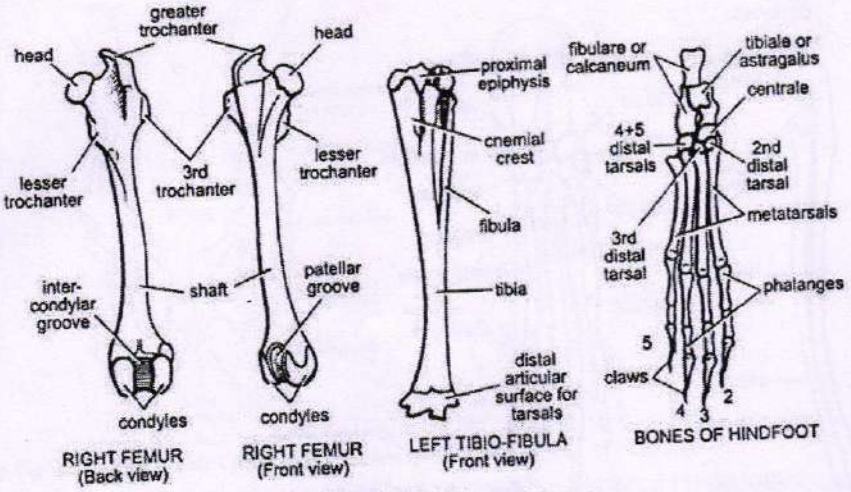


Fig. 29.19. Rabbit. Hindlimb bones.

Tibio-Fibula:

The shank of the hindlimb is provided with long stout and straight tibia and a small slender fibula bones. The fibula is a reduced slender bone which is fused with the tibia distally, while proximally it is free. Th proximal end of these bones is provided with proximal epiphysis which articulates with the condyles of femur. Tibio-fibula articulate distally with the bones of the ankle or tarsus. A cnemial crest is present on the proximal dorsal end of tibia whose two depressions articulate with two condyles of femur.

Bones of Foot:

The ankle is formed of six tarsus arranged in three rows. The first proximal row is formed of two tarsals tibiale and intermedium, both fused to form the astragalus located on the preaxial side.

The other largest is the calcaneum which is produced into a process behind its articulation with the tibio fibula. The astragalus bears a pulley-like surface for articulation with tibia. The middle row has a single bone, the centrale, just in front of astragalus. The distal row has three tarsals which are mesocuneiform, ectocuneiform and cuboid.

The bones of sole or foot are 4 long metatarsals (the first is absent). Four digits or toes are only present each formed of three phalanges. The last phalanx of each digit is provided with a claw. Hallux (first toe absent.

Experiment No 4:-Haemotology

Aim: Blood group detection test

Requirements: Slide, antiserum, needle, cotton.

The groups are based on whether or not you have two specific antigens -- A and B:

- Group A has the A antigen and b antibody.
- Group B has the B antigen and the a antibody.
- Group AB has A and B antigens but neither a nor b antibodies.
- Group O doesn't have A or B antigens but has both a and b antibodies.

There's also a third kind of antigen called the Rh factor. You either have this antigen (meaning your type is "Rh+" or "positive"), or you don't (meaning your blood type is "Rh-" or "negative"). So, from th blood groups, there are eight blood types:

- A positive or A negative
- B positive or B negative
- AB positive or AB negative
- O positive or O negative

Procedure: Take clean and sterilized slide. Prick the tip of the finger with disposable needle. Then p drops of blood in three slide . Now add anti serum A in one slide ,antiserum B in 2^{nd} slide and Ant third slide.Mix thoroughly with the blood . The agglutination reaction shows the blood type. If agglutinate with antiserum A then blood group is A if with antiserum B then B type and if with antiserum then AB type and If with none then O type. If blood agglutinate with Anti D then Rh^+ then Rh^- type.

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SMART CLASS ROOM

PG CLASS ROOM

SWAMI VIVEKANAND AUDITORIAL HALL

NEW BUILDING

COMPUTER LAB

GLIMPSES OF INAUGURAL SESSION OF LAST THREE DST INSPIRE INTERNSHIP SCIENCE CAMP