AGENDA

for the

TWENTY NINTH MEETING

Of the

ACADEMIC COUNCIL

to be held on

20th September 2007
(1130 Hours)

at

SRI SUKHMANI INSTITUTE OF ENGINEERING & TECHNOLOGY, DERA BASSI

PUNJAB TECHNICAL UNIVERSITY
JALANDHAR

PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

AGENDA ITEMS FOR 29TH MEETING OF THE ACADEMIC COUNCIL TO BE HELD ON 20TH SEPTEMBER, 2007 AT SRI SUKHMANI INSTITUTE OF TECHNOLOGY, DERA BASSI

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PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

AGENDA ITEMS FOR 29TH MEETING OF THE ACADEMIC COUNCIL TO BE HELD ON 20TH SEPTEMBER, 2007 AT SRI SUKHMANI INSTITUTE OF TECHNOLOGY, DERA BSSSI

Item No. 29.1   **To confirm the minutes of the 28th meeting of the Academic Council held on 18th May, 2007 at CIET, Rajpura**

Minutes of the 28th meeting of Academic Council held on 18th May, 2007 at 'Chitkara Institute of Engineering & Technology, Jansla is placed at **Appendix -I**. As there are no written comments received, the minutes may be confirmed.

Item No. 29.2   **Action taken report on the minutes of the 28th meeting of the Academic Council.**

The action taken report on the 28th meeting of the Academic Council is placed at **Appendix - II**

Item No. 29.3   **To brief about the admissions made through counselling in the session 2007 – 08**

A total number of 20306 applications were received for appearing in CET – 2007. The admission to B. Tech. / B. Pharm / B. Arch. courses were made for the various Universities in the State of Punjab through Centralized Council conducted by PTU, Jalandhar from 25.06.2007 to 02.08.2007. Total admission made through Counselling in the PTU affiliated colleges in the session 2007 -08 was 8766. Likewise, admissions were also made to 2nd year / 3rd semester of B. Tech. and B. Pharm through lateral entry through Centralized Counselling is 1532. The breakup of seats is as follows:

	2006 - 07	2007 - 08	% age Increase
B. Tech. 1st Year	7142	8229	15.21
B. Tech. 2nd Year	835	1375	39.27
B. Pharmacy 1st Year	407	508	24.81
B. Pharmacy 2nd Year	65	157	141.53
B. Architecture	7	29	314.28

A Total number of 270 students were admitted through Counselling to M. Tech. in PTU Regional Centres during the session 2007 – 08.

The matter is placed before the Council.

Item No. 29.4   **To brief about major decisions taken in meetings of BOS.**

The following major decisions have been taken by the various BOS

(a)   Six months Training to B.Sc. (MLT) students.

In view of large number of representation received by th University, the matter was placed in front of BOS – MLT whicl was discussed in detail and following was decided

"The candidates who have successfully completed their thre year teaching programme may be allowed to get six month jo training as part time training. They may be allowed to continu with their higher education such as PG Programmes. This w be implemented for students of session started from 2004, 20(and 2006 batches.

So far as the current batches are concerned, the job traini shall be given in 6th semester only, so that the degree awarded exactly after three years duration"

If the above is approved, the scheme for B.Sc.(MLT) shall revised.

1. The performance of newly recruited faculty may be monitored for first six months and thereafter be categorised . They should be given the appropriate pay scale including Basic Pay and other allowances as admissible to them.

2. The teacher : Student raio of 1:15 must be maintained.

3. For the time being the PTU will not insist on maintenance of the ratio 1:2:6 till the faculty available position improves.

   The current status of the action taken by the colleges may be intimated to the University.

The matter is placed before the Academic Council.

Item No. 29.7

To discuss about the affiliation fees and other related fee to be charged from the institutions affiliated to PTU.

In the 28th Council meeting the issue of pending dues with the various colleges was discussed at length. It was decided that the colleges shall clear the dues by June 20, 2007. This was followed up by a meeting with the PUTIA and the University wherein, it was decided that all outstanding dues shall be cleared immediately after the admission for the session 2007 – 08 is over. College are, now, requested to get the due cleared for which the University has drawn a schedule for all the colleges giving a specific date to depute their official alongwith the necessary record and receipts etc. to settle the accounts.

The matter is placed before the Academic Council.

Item No. 29.8

To inform about the schedule for checking of eligibility date and last date of admission.

The eligibility of all the students admitted through Centralized Counselling as well as under Management quota is to be checked by the University. All the colleges are requested to depute their officials to come along with original certificates of the students admitted directly / under management quota and list of the students admitted through

Counselling. The schedule for the eligibility check is placed at **Appendix - IV**.

In pursuance of Punjab Government Notification 13/2/2007-1TE2/2156 dated 14.08.2007, the last date for admission is 31st October, 2007. No admission shall be made after this the cut-off date.

Item No. 29.9   **To allow student a gap in study.**

A student who wants to have a gap in study of his / her own and accord, and gives it in writing also to the concerned colleges stating the reason to loose the year(s), is allowed to do so, subject to the condition that he / she will not be allowed any increase in the maximum permissible period allowed for successful completing the Course.

The matter is placed before the Council for consideration.

Item No. 29.10   **To establish the common eligibility criteria in respect of PTU courses common to regular mode and distance education mode of education**

Technical education is conducted in regular mode as well as distance education mode in various programmes of PTU. Some of these courses are common to the two streams and the university awards same degrees for courses. It has been endeavour that the syllabi, evaluation and eligibility criteria in these courses may be identical. It is only then that the degrees awarded in two modes can be regarding as equivalent. In this context, admission criteria for some of the courses in two modes of education are not identical.

Also the Common eligibility criteria for Lateral Entry Admission should also be followed in both the modes i.e. distance education & regular courses. Currently there is no Lateral Entry in the regular courses. This may be introduced in regular mode, to be at par with common courses with Distance Mode of Education.

The matter is placed before the Council for discussion.

Item No. 29.11   er reduction in duration of B. Tech. – Industrial
                      ɟ & Management (Specialization in TQM) from 4 years

In the meeting of Board of studies for B. Tech. – Industrial Engineering & Management (Specialization in TQM) held on 24th August, 2007, it has been suggested that the normal duration of B. Tech. – Industrial Engineering & Management (Specialization in TQM) may be reduced from 4 years to 3 years as was conceived earlier in Nov., 2004 and the scheme &contents of syllabus be adjusted accordingly. The detailed minutes of the meeting are placed at **Appendix -V**

The matter is placed before the Academic Council for consideration.

Item No. 29.12   **To consider the increase in intake of courses at PTU Caparo School of Manufacturing and Material Technology**

PTU Caparo School of Manufacturing & Material Technology has started functioning w.e.f session 2007 – 08. As many as 90 students have been admitted in the following three programmes through CET Counselling 2007 organized by the University:

(i)   B. Tech. (Electronics) with specialization in Manufacturing Electronics
(ii)   B. Tech. (Mechanical) with specialization in Manufacturing Technology
(iii)   B. Tech. (Information Technology) with specialization in Process Planning.

As per the guidelines approved by the Board of Governors, PTU, 50% of the seats were to be filled from amongst the Punjab Residents and the remaining 50% seats were to be offered to the candidates on All India Basis including the residents of State of Punjab.

The necessary infrastructure in terms of Laboratories, Faculty and classrooms is already in position. The school has proposed to increase the intake from the present 30 to 60 in each discipline from the session 2008 -09. The increase in intake shall be considered only

after getting the inspection done of the infrastructure and other requirements by the committee.

The matter is placed before the Council.

Item No. 29.13   **To brief about the Examinations**

The examinations for even semester were conducted from 29th May to 29th June, 2007. The date-wise declaration of different results is given at **Appendix - VI**

The matter is placed before the Academic Council for information.

Item No. 29.14   **To brief about the establishment of new college / increase in intake of course**

The University had advertised for establishment of new colleges / continuation of existing courses and increase in intake.

Further, colleges were invited to make presentation which was followed up by visit of inspection of the expert teams to the colleges. As an outcome of this exercise the following new colleges have been approved from the session 2007 -08:

Management Colleges

1	Cordia Institute of Business Management & Technology, VPO Sanghol, Tehsil Khamano Distt. Fatehgarh Sahib
2.	CIIS- Institute of Science & Technology, Mohali
3	Aryans Business School Village Nepra, Chandigarh - Rajpura Road, Tehsil Rajpura, Distt. Patiala
4	M.K. Institute of Management Studies, Village Shahpur, PO Udhopur, Partappura Road, Distt. Jalandhar
5	Dr. IT Business School, Village Jalalpur, PO Jansla, Near Banur, Tehsil Rajpura, Distt. Patiala
6	Swami Vivekanand Business School village Ramnagar, PO Jansla, Near Banur, Tehsil Rajpura, Distt. Patiala
7	Lord Krishna College of Management & Technology, Khokhar, Sangrur
8	Mata Sahib Kaur Khalsa College for Girls, Jagpal Pur, Distt. Kapurthala

Item No. 29.18   **To consider conduct of reappear examination for the students of last semester.**

The reappear examinations for the students failing in last semester are generally held in the month of December / January of that particular year. This results in causing hardship to the students who loose their job for not having passed that examination.

To alleviate their hardship, it is suggested that the reappear examination for the 8th semester may be held sometimes in the month of September / October of that particular calendar year.

The matter is placed before the Academic Council for consideration.

Item No. 29.19   **To brief about Construction of PTU Campus**

Punjab Technical University is developing its new campus on Jalandhar – Kapurthala Highway. A sum of Rs. 40 crores has been budgeted for utilization in the first phase. Current status of construction of various components of the project is as under

(a) Administrative Building is structurally completed. Flooring and other work is under progress and shall be completed by end of December, 2007

(b) The rear block shall be completed by 30th June, 2008.

(c) The work is in full swing in the areas of air-conditioning, water supply, sewerage, drainage and underground water tank, electrical, boundary wall, roads, footpath and parking area etc.

University is expected to shift in front block by first week of January, 2008.

The matter is placed before the Academic Council for information.

Item No. 29.20   **Any other item with the permission of the Chair.**

Item :- 29.20 (a)   Any Other Item

Proposed Fee Structure for B.Sc. (BT) / B.Sc. (HMCT) / M.Sc. (MLT) Course

Sl. No.	Head	Fee (in Rs.)		
		Annual	Odd Semester	Even Semester
1.	Tuition Fee	23,000/-	11,500/-	11,500/-
2	Development Charges	3,500/-	1,750	1,750
3.	Securities (Refundable) :		--	--
	College Security*	1000/-*		
	Library Security*	1000/-*		
4.	Other Charges:			
	Admission Fee	500/-	250/-	250/-
	Library Fee	200/-	100/-	100/-
	Computer Development Fund & Internet Services	1,000/-	500/-	~00/-
	Sports & Recreation Admission Fee	50/-	25/-	25/-
	Club Admission Fee	50/-	25/-	25/-
	Magazine & Library activities	200/-	100/-	100/-
	Medical & Health Care Fee	100/-	50/-	50/-
	Souvenir Fee	100/-	50/-	50/-
	Student Welfare Fund and Aid fund	50/-	25/-	25/-
	Periodical Test Fee	200/-	100/-	100/-
	Library Book replacement Fee	50/-	25/-	25/-
	A V Aids	150/-	75/-	75/-
	Identity Card	50/-	25/-	25/-
	Sports Fee	100/-	50/-	50/-
	Club Fee	100/-	50/-	50/-
	Student Amenities Fee	200/-	100/-	100/-
	Alumni Association & house charges	100/-	50/-	50/-
	Placement Charges	500/-	250/-	250/-
	Industrial Visits	250/-	125/-	125/-
	Lab Charges	2500/-	1250/-	1250/-
5.	University Related Fee (To be remitted to the University)	575/-	575/-**	--
6.	Hostel Charges:			
	ii. Room Rent	1200/- Per Annum		
		(d) Single Seater 1200/- P.A. per student (e) Two Seater 900/- per student (f) Three seater 600/- per student Room with more more than 3 seats 400/- P.A. per student		
	v. Other charges (Water supply, fan rent, electricity charges and security charges)	600/- P.A.		
	vi. Hostel maintenance Fund (Hostel & Mess Establishment charges)	600/- P.A.		
	vii. Mess equipment & Utensil Fees	100/- P.A.		

* To be paid at the time of admission only
**Rs. 575/-for first year and Rs. 275/- for subsequent years.
Note: Fee is to be charged semester-wise.

Any other item with the permission of the Chair

(a) To Approve fee structure for B.Sc. (FT) / B.Sc. (BT) / B.Sc. (HMCT) / M.Sc. (MLT) courses

Proposed Fee Structure for B.Sc. (FT) Courses

Sl. No.	Head	Fee (in Rs.)		
		Annual	Odd Semester	Even Semester
1.	Tuition Fee	14,000/-	7,000/-	7,000/-
2.	Development Charges	2,500/	1,250	1,250
3.	Securities (Refundable)		--	--
	College Security*	500/-*		
	Library Security*	500/-*		
4.	Other Charges:			
	Admission Fee	500/-	250/-	250/-
	Library Fee	200/-	100/-	100/-
	Computer Development Fund & Internet Services	1,000/-	500/-	500/-
	Sports & Recreation Admission Fee	50/-	25/-	25/-
	Club Admission Fee	50/-	25/-	25/-
	Magazine & Library activities	200/-	100/-	100/-
	Medical & Health Care Fee	100/-	50/-	50/-
	Souvenir Fee	100/-	50/-	50/-
	Student Welfare Fund and Aid fund	50/-	25/-	25/-
	Periodical Test Fee	200/-	100/-	100/-
	Library Book replacement Fee	50/-	25/-	25/-
	A V Aids	150/-	75/-	75/-
	Identity Card	50/-	25/-	25/-
	Sports Fee	100/-	50/-	50/-
	Club Fee	100/-	50/-	50/-
	Student Amenities Fee	200/-	100/-	100/-
	Alumni Association & house charges	100/-	50/-	50/-
	Placement Charges	500/-	250/-	250/-
	Industrial Visits	250/-	125/-	125/-
	Case Study Material	500/-	250/-	250/-
5.	University Related Fee (To be remitted to the University)	575/-**	575/-**	
6.	Hostel Charges: i. Room Rent	1200/- Per Annum (a) Single Seater 1200/- P.A. per student (b) Two Seater 900/- per student (c) Three Seater 600/- per student Room with more than 3 seats 400/- P.A. per student		
	ii. Other charges (Water supply, fan rent, electricity charges and security charges)	600/- P.A.		
	iii. Hostel maintenance Fund (Hostel & Mess Establishment charges)	600/- P.A.		
	iv. Mess equipment & Utensil Fees	100/- P.A.		

* To be paid at the time of admission only.
**Rs. 575/-for first year and Rs. 275/- for subsequent years.
Note : Fee is to be charged semester-wise .

PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

Minutes of the 28th meeting of the Academic Council held on the 18th of May, 2007 at Chitkara Institute of Engineering and Technology , Jansla (Rajpura).

28th meeting of the Academic Council was held on the 18th of May, 2007 at 11:30 hrs at Chitkara Institute of Engineering and Technology, Jansla (Rajpura) , under the chairmanship of the Vice Chancellor, Dr. S .K. Salwan.

1.1   List of the participants is enclosed at Annexure-1.

1.2   Dr. (Mrs.) Madhu Chitkara, Director, Chitkara Institute of Engineering and Technology welcomed the Vice Chancellor, all members of the Academic Council and other authorities of the Punjab Technical University

1.3   The Vice- Chancellor welcomed all the members of the Academic Council. The following new members were introduced:-

1.	Dr. S.L. Bhardwaj	PIMT, Mandi Gobindgarh
2.	Dr. D.S. Hira	SUSCET, Tangori
3.	Dr. A. P. Jain	MIMT
4.	Dr. Baljeet Kapur	Doaba Institute of Engg. & Technology Ghataur, Ropar
5.	Prof. M.L. Gambhir	Sri Sail College of Engg. & Technology, Badhani
6.	Mr. T. P. Singh	BBSBEC, Fatehgarh Sahib

Vice-Chancellor requested the Registrar to take up the Agenda items

1. The performance of newly recruited faculty may be monitored for first six months and thereafter be categorized. They should be given the appropriate pay scale including Basic Pay and other allowances as admissible to them.
2. The teacher : Student raio of 1:15 must be maintained.
3. For the time being the PTU will not insist on maintenance of the ratio 1:2:6 till the faculty available position improves.

It was further emphasized that confirmation on acceptance and implementation of decisions of 1 and 2 above must reach the PTU at least seven days before the commencement of counseling failing which the name of the concerned Institute shall be taken off the counseling list.
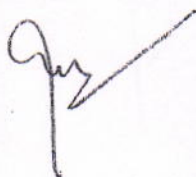
With regard to the difficulty in availability of Guides for M.Tech (part-time) students' thesis; etc. It was decided that for this purpose the Guide need not be from the same Institute - rather he/she can be from any institute within the PTU system. He advised necessary amendments to be issued to this effect. It was also clarified by the Chairman that the Teacher : Student ratio required for BBA/BCA is not 1:15 but it is 1:20

The Chairman insisted that all the institutes must implement all the points listed at agenda item 28.4 and send confirmation to PTU to this effect.

It was further brought out that maintaining computer : student ratio of 1:4 may not be insisted for Pharmacy /MBA institutes because it does not seem to be desirable a feasible. The Chairman advised that this point may be submitted to PTU along with justification.

Item No. 28.5   **To discuss about the affiliation fees and other related fee to be charged from the institutions affiliated to PTU.**

The Chairman expressed his concern over the non payment of statutory affiliation fees and other charges by a large number of institutes affiliated to the PTU. He added that the

amount outstanding as on date is Rs. 32 crores. He insisted on all the institutes to clear their dues forthwith so that the financial health of the PTU is taken care of. It was also decided that if dues outstanding from any institute for more than one year; the institute will not be allowed to participate in the counseling process and de-affiliation proceeding will be initiated. All dues must be cleared by 20 June 2007.

At this stage a point was raised regarding Distance Education Institutes under PTU and members brought out very poor standards being maintained by these institutes. The chairman mentioned that the point raised by the members will be referred to the Distance Education Council and their views will be obtained and passed on to all the members of the Academic Council. He, however, added that the Distance Education programmes of PTU are very popular and the number of enrolled students has grown from 3,000 to 70,000 within a period of three years and this is a very healthy growth rate, next only to IGNOU.

Responding to the queries of whether Govt. Institutes are exempted from payment of affiliation fees, the Chairman said that this matter was being looked into.
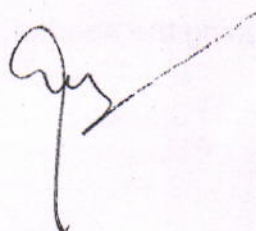
Item No. 28.6 **To deliberate on levy of penalties against certain institutions during the academic session 2006-07.**

Academic Council authorized PTU to recover all the dues and inform the institutions of their liabilities. If the dues are not cleared by 20 June 2007, these institutions should not be allowed for counselling and de-affiliation proceeding to be initiated.

Item No. 28.7 **To take note of change of status of SLIET.**

After detailed deliberation on this item; the following decision was taken with regard to proposed course of action at (i), (ii) and (iii).

Proposal at (i) and (ii)   Approved

Proposal at (iii)   :   Not feasible. In this regard the Chairman informed that SLIET had two options before them as under :-

(a)   PTU will continue holding examination for SLIET students and awarding degrees.

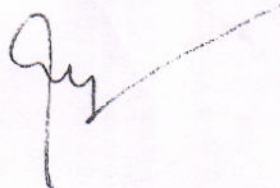(b)   SLIET may conduct their own examination and also award degrees.

The member from SLIET requested that the option at (b) above may be allowed to be exercised by them with effect from the next semester.

Item No. 28.8   To brief on the construction of PTU campus.

It was brought out by the Chairman that phase-I of the construction of PTU campus; a front block comprising of G+3 storeys, is expected to be completed by Sept/Oct. 2007. He added that this coincides with completion of a decade for the University. He invited suggestions from various institutions as to how the occasion should be celebrated. These suggestions will be discussed in the next meeting of the Academic Council.

Item No. 28.9   To brief about the conduct of CET-2007

It was informed that Dr. R.P. Singh, Dean (Academics) has been appointed as Chief Coordinator for the conduct of the above examination. The Chairman apprised all present that it was gratifying to note that this year the response for CET has been very encouraging – a record number of 30,000 brochures have already been sold against nearly 14,000 seats in all. As far as MBA admission test is concerned. The Chairman informed that the responsibility has been entrusted to GNDU, Amritsar. Some of the members enquired about 'on-line admission', to which the Chairman responded that a panel has been constituted to study the feasibility of 'on-line' admissions and the matter is being pursued. Regarding supply of complementary copies of the CET brochure to the institute, it was confirmed that PTU was already doing the needful.

Item No. 28.10   **To consider case for continuance of affiliation of ITFT.**

This point was deliberated at length and the Chairman expressed his concern at ITFT not having shifted to its own premises though they were expected to do so with in one year of the provisional affiliation granted to them by PTU in 2004. Even their latest commitment to shift to the permanent site before the start of academic session 2007-08 has not been maintained. The member from ITFT brought out the difficulties encountered in commencing the construction of its permanent building. After detailed deliberations, the Academic Council agreed to recommend an extension for three months with effect from the start of the session 2007-08, i.e. 2.8.2007. It was made very clear that NO FURTHER EXTENSION WILL BE GRANTED. The chairman stated that the above recommendation of the Academic Council will be considered by BOG.

Item No. 28.11   **To brief about the application received for establishment of new Colleges/courses.**

Progress on this point, as mentioned against this item in the agenda, was explained to all present. The exercise of short listing of colleges bases upon their presentation, inspection and outcome of inspection will be placed in the next meeting of the council.

Item No. 28.12   **To brief about sports and cultural activities of the University.**

All present were appraised about the progress on above activities as listed at (a), (b) and (c) of the agenda item 28.12. it was appreciated that Ms. Mandeep Kaur (a student from LIT) represented PTU for the RANGOLI event in the North-Zone Inter University Youth Festival held at GNDU Amritsar from 17.12.2006 to 21.12.2006 and the University got second prize in this event, thus making it eligible for competing in National Youth Festival held at the University of Madras from 22.01.2007 to 25.01.2007 , in which the above participant got the third prize and brought laurels to the University.

PUNJAB TECHN   RSITY, JALANDHAR
SCHEME OF TEACHING FOR M.SC (MLT) BIOCHEMISTRY

1st Semester

COURSE NO.	SUBJECT	L	T	P	INT.	EXT.	TOTAL MARKS	DURATION OF EXAM. HRS.
MLT-101	Principles of Biochemistry	5	1	-	40	60	100	3
MLT-103	Enzymes & Metabolism	5	1	-	40	60	100	3
MLT-105	Vitamins, Hormones, General physiology and Nutrition	5	1	-	40	60	100	3
MLT-107	Principles of Biochemistry Lab	-	-	4	40	60	100	
MLT-109	Enzymes & Metabolism Lab	-	-	4	40	60	100	
MLT-111	Vitamins, Hormones, General physiology and Nutrition Lab	-	-	4	40	60	100	
Total		**15**	**3**	**12**	**240**	**360**	**600**	

2nd Semester

COURSE NO.	SUBJECT	L	T	P	INT.	EXT.	TOTAL MARKS	DURATION OF EXAM. HRS.
MLT-102	Principles of Biochemistry	3	1	-	40	60	100	3
MLT-104	Biological oxidation & Metabolism	3	1	-	40	60	100	3
MLT-106	Nutrition & General Physiology	3	1	-	40	60	100	3
MLT-108	Molecular Biology	3	1	-	40	60	100	3
MLT-110	Statistics & Laboratory Management	3	1	-	40	60	100	3
MLT-112	Principals of Biochemistry Lab	-	-	5	40	60	100	
MLT-114	Nutrition & General Physiology Lab	-	-	3	40	60	100	
MLT-116	Statistics & Laboratory Management Lab	-	-	3	40	60	100	
Total		**15**	**5**	**11**	**320**	**480**	**800**	

3rd Semester

COURSE NO.	SUBJECT	L	T	P	INT.	EXT.	TOTAL MARKS	DURATION OF EXAM. HRS.
MLT-201	Inborn errors of Metabolism	3	1	-	40	60	100	3
MLT-203	Diagnostic Biochemistry	3	1	-	40	60	100	3
MLT-205	Organ Function Tests	3	1	-	40	60	100	3
MLT-207	Clinical Biochemistry	3	1		40	60	100	3
MLT-209	Diagnostic Biochemistry Lab	-	-	5	40	60	100	
MLT-211	Organ Function Tests Lab	-	-	5	40	60	100	
MLT-213	Clinical Biochemistry Lab	-	-	5	40	60	100	
Total		15	3	12	280	420	700	

4th Semester

COURSE NO.	SUBJECT	L	T	P	PRESENTATION	EXT. VIVA	TOTAL MARKS	DURATION OF EXAM. HRS.
MLT-202	Dissertation				100	100	200	

Punjab Technical University, Jalandhar.
B.Sc Biotechnology
Study Scheme

3rd Semester

S. No.	Course No.	Course Title	L	T	P	Internal Marks	External Marks	Total Marks
1.	BSBT- 201	Organic Chemistry	4	1		40	60	100
2.	BSBT-203	Biophysics	4	1		40	60	100
3.	BSBT-205	Immunology-I	4	1		40	60	100
4.	BSBT-207	Techniques in Biotechnology- I	4	1		40	60	100
5.	BSBT-209	Biochemistry -II	4	-		40	60	100
7.	BSBT-211	Organic Chemistry lab.			3	40	60	100
8.	BSBT-213	Biochemistry-II lab.			3	40	60	100
9.	BSBT-215	Immunology-I lab			3	40	60	100
	Total		20	4	9	320	480	800

Punjab Technical University, Jalandhar

B.Tech. Automobile Engg

Study scheme

5th Semester

Code	Title of the course	L	T	P	Maximum Marks		Total Marks	Duration of Theory Examination (in Hours)
					Internal	External		
AE-301	Automotive Design-I	3	1	-	40	60	100	3
AE-303	Automotive Transmissions	3	1	-	40	60	100	3
AE-305	Automotive Electricals & Systems	3	-	-	40	60	100	3
AE-307	Heat Exchangers & Air Conditioning	4	1	-	40	60	100	3
AE-309	Numerical Methods & Simulation in Engg.	3	-	-	40	60	100	3
CE-216	Environmental Science	3	-	-	40	60	100	3
AE-311	Computer Aided Design Lab	-	-	2	30	20	50	
AE-313	Automotive Transmissions Lab	-	-	2	30	20	50	
AE-315	Automotive Electricals & Systems Lab	-	-	2	30	20	50	
AE-317	Heat Exchangers & Air Conditioning Lab	-	-	2	30	20	50	
AE-319	Numerical Methods & Simulation in Engg. Lab	-	-	2	40	60	100	
	Institutional Training**	-	-	-	60	40	100	
	Advisory meeting			1				
	Total				460	540	1000	

** Industrial Training in reputed industries will be arranged for 6 weeks duration at the end of fourth semester.

1

Punjab Technical University, Jalandhar
M. Pharm (Pharmaceutics)
Study Scheme

1st Semester

Sr. No.	Course Code	Subject	Exam Hours	Maximum Marks	
				Int.	Ext.
1	PHCEU 511	Advanced Pharmacokinetics and Biopharmaceutics	3	20	80
2	PHCEU-513	Dosage - forms Design, Development and Process Validation	3	20	80
3	PHCEU-515	Novel Drug Delivery Systems	3	20	80
4	PHCEU-517	Pharmaceutics Laboratory-I	12	20	80
Total				80	320

2nd Semester

Sr. No.	Course Code	Subject	Exam Hours	Maximum Marks	
				Int.	Ext.
1	PHCEU 512	Pharmaceutical Technology	3	20	80
2	PHCEU-514	Drug Regulatory Affairs and IPR	3	20	80
3	PHCEU-516	Molecular Biology and Pharmaceutical Biotechnology	3	20	80
4	PHCEU-518	Pharmaceutics Laboratory – II	12	20	80
Total				80	320

M. Pharm (3rd & 4th Semester) (Research work for one year)

The thesis shall be presented by the candidate at the end of record academic year. The thesis shall be evaluated as under:

Evaluation of written thesis   :   Maximum Marks: 200
Presentation of Seminar on thesis   :   Maximum Marks: 100
& Viva Vice

Total Marks: 300

Punjab Technical University, Jalandhar
M. Pharm (Pharmaceutical Chemistry)
Study Scheme

1st Semester

Sr. No.	Course Code	Subject	Exam Hours	Maximum Marks	
				Int.	Ext.
1	PHCHM 511	Organic Chemistry & Selected aspects of Drug Research.	3	20	80
2	PHCHM-513	Spectral Analysis.	3	20	80
3	PHCHM-515	Advanced organic Chemistry & Spectrometry	3	20	80
4	PHCHM-517	Pharmaceutical Chemistry Laboratory -I	12	20	80
Total				80	320

2nd Semester

Sr. No.	Course Code	Subject	Exam Hours	Maximum Marks	
				Int.	Ext.
1	PHCHM 512	Medicinal Chemistry	3	20	80
2	PHCHM-514	Chemistry of Natural Products	3	20	80
3	PHCHM-516	Bio-Organic Chemistry	3	20	80
4	PHCHM-518	Pharmaceutical Chemistry laboratory-II	12	20	80
Total				80	320

3rd & 4th Semester

(Research work for one year)

The thesis shall be presented by the candidate at the end of record academic year. The thesis shall be evaluated as under:

Evaluation of written thesis	:	MM: 200
Presentation of Seminar on thesis & Viva Vice	:	MM: 100
Total	:	300 Marks

1

Punjab Technical University, Jalandhar
M.Pharm Pharmacognosy
Scheme of syllabi

Semester I

Course code	Subject	Examination hours	Maximum marks	
			Int.	Ext.
PHCOG 511	Cultivation of Medicinal Plants	3	20	80
PHCOG 513	Modern Analytical Techniques	3	20	80
PHCOG 515	Plant Drug Standardisation	3	20	80
PHCOG 517	Pharmacognosy Laboratory- I	12	20	80
Total			80	32

Semester II

Course code	Subject	Examination hours	Maximum marks	
			Int.	Ext.
PHCOG 512	Phytochemistry and Biogenesis	3	20	80
PHCOG 514	Plant Biotechnology	3	20	80
PHCOG 516	Advances in Pharmacognosy	3	20	80
PHCOG 518	Pharmacognosy Laboratory -II	12	20	80
Total			80	320

3rd and 4th Semester

(Research work for one year)

The thesis shall be presented by the candidate at the end of second academic year. The thesis shall be evaluated as follows.

Evaluation of written thesis   Maximum Marks: 200
Presentation of seminar on thesis work   Maximum Marks: 100
And viva vocel examination

Total Marks: 300

PUNJAB TECHNICAL UNIVERSITY
STUDY SCHEME OF B.Tech (CSE)

THIRD SEMESTER

Sr. No.	COURSE CODE	COURSE TITLE	HOURS/WEEK			MARKS		
			L	T	P	INT	EXT	TOTAL
1.	CS-201	Computer Architecture	3	1	-	40	60	100
2.	CS-203	Discrete Structures	3	1	-	40	60	100
3.	CS-205	Digital Circuits & Logic Design	3	1	-	40	60	100
4.	CS-207	Data Structures & Programming Methodology	3	1	-	40	60	100
5.	CS-209	Written & Oral Technical Communication	2	1	-	40	60	100
6.	CS-252*	Object Oriented Programming Using C++	3	1	-	40	60	100
7.	CS-213	Software Lab- I (DSPM)	-	-	3	30	20	50
8.	CS-215	Institutional Practical Training	-	-	-	60	40	100
9.	CS-217	Hardware Lab -I (DCLD)	-	-	2	30	20	50
10.	CS-254*	Software Lab-II(OOPS)	-	-	3	30	20	50
		Total (31 Hours)	17	6	8	390	460	850

* Course has been replaced with CS – 211 (Programming Language)

SIXTH SEMESTER

Sr. No.	COURSE CODE	COURSE TITLE	HOURS/WEEK			MARKS		
			L	T	P	INT	EXT	TOTAL
1.	CS-302	Relational Database Management System-II	3	1	-	40	60	100
2.	CS-304	Introduction to Business System	3	1	-	40	60	100
3.	CS-306	Asynchronous Transfer Mode	3	1	-	40	60	100
4.	CS-308&	Software Engineering	3	1	-	40	60	100
5.		Elective –I	3	1	-	40	60	100
6.	CS-312	Open Elective	3	1	-	40	60	100
7.	CS-314	H/W Lab-V(ATM)	-	-	4	30	20	50
8.	CS-316	S/W Lab-VIII(RDBMS-II)	-	-	4	30	20	50
9.	CS-318	S/W Lab-IX(S/W Engg.)	-	-	2	30	20	50
10.	CS-320	S/W Lab-X(Business System)	-	-	2	30	20	50
		General Fitness				100		100
		Total (36 Hours)	18	6	12	460	440	900

& Course Contents has been changed

Open Elective
CS - 312 COMPUTERS AND SOCIETY   (For other branches only)

SEVENTH / EIGHTH SEMESTER

Sr. No.	COURSE CODE	COURSE TITLE	HOURS/WEEK			MARKS		
			L	T	P	INT	EXT	TOTAL
1.	CS-424@	Expert System	3	1	-	40	60	100
2.	CS-404	Formal Language & Automata Theory	3	1	-	40	60	100
3.	CS-406	Project	-	-	8	100	100	200
4.	CS-408	Principles of Engineering Ecomonics & Management Techniques	3	1	-	40	60	100
5.	CE-216	Environmental Sciences	3	-	-	40	60	100
6.		Department elective –II	3	1	-	40	60	100
7.		Department Elective-III	3	1	-	40	60	100
8.		Department Elective-III Lab	-	-	2	30	20	50
9.	CS-416	Software Lab –XIII(SI&LP)	-	-	2	30	20	50
		General fitness				100		100
		Total (35 Hours)	18	5	12	500	500	1000

@ *Course has been shifted from elective to compulsory course*

List of Electives -II

  I.   CS-410 Organisational Structure
  II. CS-416 Overview of IT Materials
  III. CS-418 System Simulation and Modelling
  IV. CS-420 Emerging Technologies and Current IT- Trends

List of Electives-III

  I.   CS-412 Graphical User Interface
  II. CS-422 Advanced Microprocessor
  III. CS-402$ Symbolic Logic & Logic Processing
  III. CS-426 Image Processing & Pattern recognition

Labs of Elective-III

  I.   CS-414 Graphical User Interface
  II. CS-428 Advanced Microprocessor
  III. CS-430 Expert System.
  IV. CS-432 Image Processing & Pattern recognition

$ *Course has been shifted from compulsory to elective course*

CS -252 OBJECT ORIENTED PROGRAMMING USING C++

Internal Marks: 40 L T P
External Marks: 60 3 1 0
Total Marks: 100

SECTION-A [33%,11 Hrs,20-Marks]

1. Basics of C & C++
Introduction, Basics, Data Type, Bit Field integer, Operations, Control Structures, Storage
Classes, User Defined Data Type, Reserved Words and Standard 110 Statements in C &
C++ .

2. Object Orient Programming With C++
Introduction ,Object Oriented Programming Concept, Objective of OPP, Programming
Structure in C++, Data Abstraction

3. Overloading and Information Hiding
Introduction, Function Overloading, Information Hiding

SECTION-B [34%,14 Hrs,21-Marks]

4. Memory Management in C++ :
Introduction ,Constructor-Automatic Initialization of Objects, Dynamic Memory
Management ,
Default Constructor, Copy Constructor, Constructor and Information Hiding, Destructor-
Automatic Clear up of an Object

5. Inheritance
Introduction, Inheritance-Data and Code Sharing , Class Derivation ,Ambiguity in Class
Member Access ,Virtual Base Class-A Remedy , Class Initialization in Inheritance
,Arguments for the Base Class

SECTION-C [33%,11 Hrs,19-Marks]

6. Bindings and Polymorphism
Introduction , Bindings in C++, Polymorphism

7. Generic Facility
Introduction ,Concept of Generic Facility, Generic Function ,Overloading a Generic
Function,
Generic Classes

8. File Handling in C++
Introduction , Concept of Stream in C++, File Positioning Functions , Error Handling
During
File Operation

CS -254 Lab III (Object   ed Programming)
Internal Marks: 30 L T P
External Marks: 20 0 0 2
Total Marks: 50

List of experiments:
To write following programs in C / C++ :
1. Using basic statements like control statements , looping statements, various I/O statements and
various data structures.
2. Creating classes in C++ for understanding of basic OOPS features.
3. Representing concepts of data hiding, function overloading and operator overloading.
4. Using memory management features and various constructors and destructors.
5. Representing Inheritance, virtual classes and polymorphism.
6. Writing generic functions.
7. File handling programs.

CS-308 SOFTWARE ENGINEERING

L-3, T-1 , P-0

SECTION-A [35%,12 Hrs,20-Marks]

1. Introduction: The Software Engineering Discipline-Evolution and Impact. Why study Software Engineering? Emergence of Software Engineering.

2. Software Life Cycle Models: Why use a life cycle Model? Classical waterfall Model, Iterative, Prototype, Evolutionary, Spiral Models and their Comparison.

3. Software Project Management: Project Planning, Metrics for Project Size estimation-LOC and Function-Point, Project estimation Techniques, COCOMO, Team Structure, Software Configuration Management.

SECTION-B [40%, 14 Hrs, 24-Marks]

4. Requirements Analysis and Specification: Software Requirement Specification(SRS), Formal System Development Techniques.

5. Software Design: Issues in Software Design, Function Oriented Design, Object Oriented Design, Object Modelling Using UML. and User Interface Design.

6. Coding and Testing: Code Standard and guidelines, Code Review, Verification and Validation, Unit testing, Black Box Testing, White Box Testing. Integration and system Testing.

SECTION-C [25%, 10 Hrs,16-Marks]

7. Software Reliability and Quality Management.

8. Software Maintenance: characteristics of Software maintenance, Software Reverse Engineering, Software Maintenance Process Models.

9. Software Reuse: Issues in Software Reuse, Domain Analysis, Component Classification, Searching, Repository Maintenance.

TEXT-BOOKS

1) Pressman R. S., Software Engineering: A practitioner's Approach, Third Edition McGraw Hill, New York, 1987.
2) Jalota.Software Engineering.
3) Sommerville I., Software Engineering, Fourth Edition, Addison - Wesley Pub. Co.. 1992.

REFERENCES:

1) Ghezzi C. Jazayeri M. And Mandrioli D.: Fundamentals of Software Engineering, Prentice Hall, N. J. 1991
2) Pfleedger S. L., Software Engineering: The Production of Quality software, Second Edition, Macmillan Publishing Company. 1991.
3) Oehm B. W., A Spiral Model of Software Development and Enhancement, IEEE Computer, 21.pp 61-72, May 1988.
4) Fairley R., Software Engineering Concepts, McGraw Hill, New York, 1985.

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PUNJAB TECHNICAL UNIVERSITY
TEACHING SCHEME OF B.TECH (CIVIL ENGG.)

THIRD SEMESTER

Course	Name of Course	L	T	P	Contact Hrs.	Ext.	Int.	Marks
Theory								
CE-201	SURVEY-1	3	1	-	4	60	40	100
CE-203	FLUID MECHANICS-I	3	1	-	4	60	40	100
CE-205	BUILDING MATERIAL	3	-		3	60	40	100
CE-207	SOLID MECHANICS	3	2	-	5	60	40	100
HM-253	PRINCIPALS OF ECONOMICS & MANAGEMENT	3	1	-	4	60	40	100
CE-209	LAB-I (FLUID MECAHNICS-I)	-	-	2	2	20	30	50
CE-211	LAB-II (SOLID MECHANICS)	-	-	2	2	20	30	50
CE-213	WORSHOP TRAINING OF 4 WEEKS DURATION AFTER 2ND SEMESTER	-	-			40	60	100
CE-215	SURVEY-I LAB			3		20	30	50
TOTAL		15	5	7	27	400	350	750

Fourth Semester

Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int	Marks
Theory								
CE-202	Survey-II	3	1		4	60	40	100
CE-204	Fluid Mechanics-II	3	1		4	60	40	100
CE-206	Building Construction	3	1		4	60	40	100
CE-208	Structural Analysis-I	3	1		5	60	40	100
CE-210	Rock Mech. & Engg Geology	3	1		4	60	40	100
CE-216	Environmental Science	3	1		4	60	40	100
Practicals								
CE-212	Survey-II Lab			3	4	40	60	100
CE-214	StructuralAnalysisLab			2	2	20	30	50
CE-218	Fluid Mechanics-II Lab			2	2	20	30	50
	General Fitness						100	100
	Total	18	6	7	31	440	460	900

Survey Camp of 6 weeks duration at the end of 4th semester.

Scheme of B.Tech (Civil) Seventh/Eighth Semester

Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int.	Marks
CE-	Industrial Training					500	500	1000

Scheme of B.Tech (Civil) Seventh/ Eighth Semester

Course	Name of Course	L	T	P/D	Contact Hrs.	Ext.	Int.	Marks
Theory								
CE-402	Hydrology & Dams	3	1		4	60	40	100
CE-406	Environmental Engg-II	3	1		4	60	40	100
CE-408	Design of Steel Structures-II	3	1		4	60	40	100
CE-410	Irrigation Engg-II	3	1		4	60	40	100
CE-412	Foundation Engg.	3	1		4	60	40	100
Practicals								
CE-416	Design of Steel Structures-II Lab			2	2	20	30	50
CE-418	Irrigation Engg-II Lab			2	2	20	30	50
CE-414	Project			4	4	80	120	200
(Any one of the following specilisation								
Environment Engg.								
GeoTech. Engg.								
Transportation Engg								
Hydraulic Structures								
Structural Engg.								
General Fittness							100	100
	Total	18	6	8	28	420	480	900

2

CE-205   Building Materials

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 0 2

1. **Building Stones:** General, Qualities of a good building stone-Deterioration of stones-Preservation of stones, Common building stone of India & their Uses-Artificial stones. '

2. **Bricks:** General, Constituents of bricks, desirable and harmful ingredients in brick earth, qualities of good bricks, testing of bricks, strength, Absorption, weathering of bricks. Varieties of fire bricks, sand lime bricks, building tiles- roofing; flooring and wall tiles.

3. **Lime:** Cementing material, Characteristics of good quality lime, classifications & testing of Lime, Hydraulic test, acid test, setting & slaking of lime, uses of different varieties of lime

4. **Concrete:** Constituents of concrete, different types of cements used in concrete, brief introduction to ingredients and manufacture of cements. Hydration and compounds of hydration. Properties and testing of cement.

5. **Concrete Mixes:** Design of concrete mixes by ISI method and ACI method. Design of high strength concrete mixes. Design of concrete mix for flexural strength.

6. **Production of Concrete:** Introduction, Batching of materials, mixing of concrete materials, transportation and placing of concrete, compaction of concrete, curing of concrete.

7. **Properties of fresh and hardened concrete:** Introduction, workability, factors effecting workability, methods of determination of workability, strength of concrete, factors effecting strength of concrete, durability and permeability of concrete, factors effecting permeability of concrete, creep and shrinkage of concrete.

8. **Timber:** Advantages of timber construction, timber trees- exogenous and endogenous trees; soft and hard woods, structure of tree, felling of trees, defects in timber, characteristics of good timber, uses and testing of timber.

9. **Miscellaneous Materials :** Paints and varnishes; Distempering; white and color washing; glass and glass products; Asphalt and Bitumen. Commercial forms of iron & steel & their uses, use of plastics in civil Engg.

Recommended Book

1. Building Materials : Rangwala

CE-207   SOLID MECHANICS

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 2 0

1 **Simple Stresses and Strains:** Introduction, stress-strain curves for elastic materials, different types of stresses and strains, elastic limit, Hookes' Law, Young's modulus of elasticity, Bulk modulus, modulus of rigidity, Lateral strain, Elongation due to self weight bars of tapering sections, bars of varying sections, equivalent area of composite sections, temperature stresses, relation between elastic constants. Volumetric strain.

2. **Complex Stress:** Introduction, rectangular block subjected to normal stresses along and across two planes, combination of normal and tangential stresses, pure shear, principal stresses and Principal planes, Mohrs Circle, Principal strains, Computation of Principal stresses from Principal strains.

3. **Bending moment & shear force diagrams:** Introduction, Types of beams, supports and loading, sign conventions for bending moments and shear forces, Shear force and Bending moment diagrams for simply supported, cantilever and overhanging beams for different types of loading. Relationship between Bending moment, Shear Force and loading Graphical method of plotting Bending Moment & Shear Force Diagrams.

4. **Bending and Shear Stresses:** Introduction, Assumption made in theory of simple bending, derivation of basic equation, determination of stresses in simple sections, built up sections and composite sections. (flitched Beams), Introduction to theory of unsymmetrical bending beams of uniform strength, variation of shear stress across depth of various beam sections.

5. **Torsion:** Introduction, torsion of shafts and springs, derivation of basic torsion equation, Power transmitted, sections subjected to combined bending and torsion, Principal stresses, equivalent Bending Moment & Torque, Helical spring, analysis of closed Coil helical spring.

6. **Deflection of Beams:** Derivation of basic equation of elastic curve, deflection in beams with different end conditions and different loadings by double integration method, Macaulay's method.

7. **Columns and Struts:** Introduction, Euler's buckling loads for columns with different end conditions, limitations of Euler's formula, column carrying eccentric loads, laterally loaded columns, empirical formula.

8. **Strain Energy:** Introduction, Strain Energy due to axial Loads, Bending shear and Torsional stress, Impact load, strain energy due to Principal stress & strains, theories of failure. (5 lectures)

Books Recommended:

1. Strength of Materials : Sadhu Singh
2. Strength of Materials ; E. Popov.
3. Strength of Materials : S.M.A. Kazimi

CE-215   Survey-I Lab

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 4

1. Measurement of distance, ranging a line, plotting of details in chain survey.
2. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
3. Different methods of leveling, height of instrument, rise & fall methods.
4. Plane table survey, different methods of plotting two point & three point problem.

CE-212   Survey-II Lab

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 4

1. Setting up temporary and permanent adjustment of a theodolite. Measurement of horizontal angles by repetition and reiteration methods using a theodolite. Measurement of vertical angle by theodolite.
2. Determination of tocheometric constants. Determination of reduced levels by techeometric observations.
3. Determination of height of an inaccessible object with instrument axis in the same plane as the object and in different planes.
4. Setting out a transition curve. Setting out of circular curves in the field using different methods

CE-307 DESIGN OF CONCRETE STRUCTURE – I

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 2 0

Note : Use of relevant Indian Standards is allowed.
1. Introduction to earth quake resistant design, intensity & Magnitude, lateral force analysis and basic concepts of ceismic design as per IS-1893
2. Assumptions made in theory of RCC. Principle of design of flexural members by working stress and Limit State Methods.
Note: All design and analysis using Limit State Method for following topics.
3. Analysis of beams:
Moment of Resistance of singly, doubly and flanged beams, Design of continuous beams.
4. Analysis of shear, bond and torsion.
5. Analysis of one and two way slabs, Design of flat slabs, Design of continuous slabs
6. Calculation of cracking and deflection for Limit State of Serviceability.
7. Design of axially and eccentrically loaded columns.
8. Design of Stair case.

Books Recommended:
1. Design of Reinforced Concrete Structures P. Dayaratnam
2. Reinforced Concrete Fundamentals Fergnson
3. Design of Concrete Structures Nilson and Winter
4. Reinforced Concrete Structural Elements Purshothaman
Behavior, Analysis and Design
5. Reinforced Concrete Design Pillai & Menon
6. Limit State Design Ramachandra
7. Limit State Design A.K. Jain
8. Limit State Design of Reinforced Concrete P.C. Vergese
9. Earthquake Resistant design of structures by Pankaj Aggarwal & Manish Shikahande-PHI Publications.
10. Earthquake Design by CVR Murthy & Andrew Charleson published by Nicee-IIT Kanpur

CE - 315 ENVIRONMETAL ENGINEERING Lab

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

1. To measure the PH value of a sample
2. To determine optimum Alum dose for Coagulation
3. To determine residual chlorine and to optimize dose and chlorine by breakpoint chlorination.
4. To find MPN for the bacterio- logical examination of H_2O
5. To find the turbidity of a given sample
6. To find B.O.D. of a given sample
7. To measure D.O. of a given sample
8. Determination of Hardness of a given sample
9. Determination of total solids, dissolved solids, suspended solids of a given sample
10. To determine the concentration of sulphates in water/wastewater sample.
11. To find chlorides in a given sample
12. To find acidity/alkalinity of a given sample
13. To determine the COD of a wastewater sample.

BooksRecommended:-
1. Environment Engg. Chemistry by Sawyer & Macarty.
2. Standard Methods of examination of water & wastewater APHA, AWWA, WEF

CE – 304 GEOTECHNICAL ENGINEERING

		L T P
Internal Marks:	40	3 1 0
External Marks:	60	
Total Marks:	100	

1. **Basic Concepts:** Definition of soil and soil mechanics common soil problems in Civil Engineering field. Principal types of soils. Important properties of very fine soil i.e. adsorbed water, Base Exchange and soil structure. Characteristics of main Clay mineral groups i.e. montmorilonite, illite and kaollite, Basic definitions in soil mechanics. Weight volume relationship theory and determination of specific gravity from picnometer test. Field denesity from sand replacement method and other methods.

2. **Index Properties:** Grain size analysis. Stock's law and Hydrometer analysis. Consistency and sensitivity Clay as per I.S. Code Atterberge Limits Flow Index and Toughness Index. Underlying theory of shrinkage limit determination. Classification of coarse grained soils. Classification of fine-grained soils as per Indian standard classification system (IS-1498-1970).

3. **Compaction:** Definition and object of compaction and concept of O.M.C. and zero Air Void Line. Modified proctor Test. Factors affecting compaction Effect of compaction on soil properties and their discussion. Field compaction methods- their comparison of performance and relative suitability. Field compacative effor. Field control of compaction by proctor.

4. **Consolidation:** Definition and object of consolidation difference between compaction and consolidation. Concept of various consolidation characteristics i.e. a_v, m_v and c_v primary and secondary consolidation. Terzaghi's Differential equation and its derivation Boundary conditions for Terzaghi's solution for one dimensional consolidation concept of c_v, t_v & U. consolidation test determination of c_v from curve fitting methods, consolidation pressure determination. Normally consolidated and over consolidated clays. Causes of over-consolidation. Effect of disturbance on e-Log sigma curves of normally consolidated clays, importance of consolidation settlement in the design of structures.

5. **Permeability and Seepage:** Concept of effective stress principal, seepage pressure, critical hydraulic gradient and quick sand condition. Capillary phenomenon in soil. Darcy's Law and its validity, seepage velocity, co-efficient of permeability and its determination in the laboratory. Average permeability of startified soil mass, factors affecting 'K' and brief discussion.

6. **Shear Strength:** Stress analysis of a two dimensional stress system by Mohr circle. Concept of pole. Coulomb's law of shear strength coulomb - Mohr strength theory. Relation between principal stesses at failure. Direct, triaxial and unconfined shear strength tests. Triaxial shear tests based on drainage conditions typical strength envelopes for clay obtained from these tests. Derivation of skempton's pore pressure parameters. Stress strain and volume change characteristics of sands.

7. **Earth Pressure:** Terms and symbols used for a retaining wall. Movement of all and the lateral earth pressure. Earth pressure at rest. Rankine states of plastic equilibrium and derivations of expressions for K_a and K_p for horizontal backfills. Rankine's theory both for active and passive earth pressure for Cohesionless backfill with surcharge and fully submerged case. Cohesive backfill condition. Rankine's Earth pressure for a cohesionless backfill with sloping surface (with proof) concept of active and passive Earth pressure on the basis of stability of a sliding wedge. Coulomb's method for cohesion less backfill. Merits and demerits of Ranking and Coulomb's theories graphical construction and Rebhan's graphical construction (without surcharge load).

8. **Stability of Slopes:** Taylores stability numbers, different methods of checking the stability of finite slopes.

Books:-
1. Soil Mech. & Foundation Engg, by K.R.Arora
2. Geotechnical Engineering, by P. Purshotama Raj
3. Soil Mech. & Foundation Engg., by V.N.S.Murthy

CE-318 CONCRETE DRAWING (COMPUTER AIDED)

		L T P
Internal Marks:	30	0 0 2
External Marks:	20	
Total Marks:	50	

Detailed Working Drawings (Computer Aided):
1. Isolated Footing : Rectangular, Circular and Square footing.
2. Combined Footing : Rectangular, Trapezoidal, Strap and Raft Footing
3. Spherical and Conical Domes
4. Cantilever and Counterfort Retaining Walls
5. Intz Tank
6. Design & detailing of an RCC multistorey frame with the help of design and detailing software.

PUNJAB TECHNICAL UNIVERSITY
STUDY SCHEME OF B.Tech (IT)

SIXTH SEMESTER

Sr. No.	COURSE CODE	COURSE TITLE	HOURS/WEEK			MARKS		
			L	T	P	INT	EXT	TOTAL
1.	IT-302	Advanced Internet Technologies	3	1	-	40	60	100
2.	IT-304	Management Information Systems	3	1	-	40	60	100
3.	IT-306*	Web Administration	3	-	-	40	60	100
4.	IT-308*	Network operating System	3	1	-	40	60	100
5.	IT-310	Open Elective	3	1	-	40	60	100
6		Elective –I	3	1	-	40	60	100
7	IT-314	MIS Lab.	-	-	2	30	20	50
8.	IT-316	Web Administration Lab.	-	-	4	30	20	50
9.	IT-318	NOS Lab.	-	-	4	30	20	50
		General Fitness				100		100
		Total (33Hours)	18	5	10	430	420	850

* Contents of the courses has been changed

Elective-I

IT-312   Expert System
IT-320   Neural Networks
IT-322 Artificial Intelligence & Applications

SEVENTH/EIGHTH SEMESTER

Sr. No.	COURSE CODE	COURSE TITLE	HOURS/WEEK			MARKS		
			L	T	P	INT	EXT	TOTAL
1.	IT-402	Introduction to Java	3	1	-	40	60	100
2.	IT- 424#	DOT Net Frame Work	3	1	-	40	60	100
3.	CE-216	Environmental Sciences	3	1	-	40	60	100
4.		Elective-II	3	1	-	40	60	100
5.		Elective-III	3	1	-	40	60	100
6.	IT-410	Major Project	-	-	8	100	100	200
7.	IT-412	Introduction to Java Practical	-	-	4	30	20	50
8.	IT- 426#	DOT Net Frame Work Lab						
		General Fitness				100		100
		Total (32 Hours)	15	5	12	430	420	850

New Subjects replaced existing course IT – 404 e-services

Elective-II
IT-406 Multimedia and Applications
IT-414 Data ware Housing and Mining
IT-416 Modeling and Simulation

Elective-III

IT-408 Software Project Management
IT-420 Image Processing & Pattern Recognition&
IT-422 Programming In C#&

& New Subjects

IT-306 WEB ADMINISTRATION

L T P

3 - -

PREREQUISITES:-E-Commerce.

OBJECTIVES: - The course provides the knowledge in designing the web pages using different packages.

COURSE CONTENTS

Section-A [40%,Hrs-14,Marks-30]

HTML: - Formatting text, hyperlinks and color in web pages creating tables and frames. Working with images, maps and forms.

Scripting Languages: - JavaScript- Using Operators, statements, function, handling events and working with objects. Creating frames, Processing forms, using hidden fields and cookies. Working with links and images

Section-B [25%,Hrs-10,Marks-12]

Active Server Pages (ASP) :- ASP basic architecture, Request Object, response Object, application Object, Session Object, Server Object Database Access in ASP

Section-C [35%,Hrs-12,Marks-18]

PHP
Basics of Server-side scripting, Conventions in PHP, Passing information through a Form and Links, User Interaction: PHP with forms and Cookies, Files, Strings and Mail, Database Access in PHP.

RERFERNCES:-

Active Server pages 3 Developers Guide- Alberto Manuel Ricart, Stephen Asbury, DIG Books India.

HTML 4 By QUE

Teach Yourself HTML 4 With XML, DHTML and Java Script - Stephine Cottrell Bryant

Essential PHP for Web Professionals by Christopher Cosentino, Pearson Education , India.

IT-308 NETWORK OPERATING SYSTEM

Internal Marks: 40   **L T P**
External Marks: 60   **3 1 0**
Total Marks: 100
PREREQUISITES:-Computer Network-I.
OBJECTIVES:- The course provides the sufficient knowledge about the threortical and practical aspects of Networks and their applications.
COURSE CONTENTS

SECTION A [30%,Hrs-11,Marks-19]

Introduction

The GNU-Linux Connection, The Heritage Of Linux: UNIX, What Is So Good About Linux? ,Overview Of Linux ,Additional Features Of Linux,

The Linux Operating System

Getting Started ,Logging In ,Working With The Shell, Curbing Your Power: Superuser Access, Getting The Facts: Where To Find Documentation

SECTION B [30%,Hrs-11,Marks-19]

Command Line Utilities

Special Characters, Basic Utilities, Working With Files, | (Pipe): Communicates Between Processes, Compressing and Archiving Files, Locating Commands, Obtaining User And System Information ,Communicating With Other Users, Email

The Linux Filesystem

The Hierarchical Filesystem, Directory And Ordinary Files, Working With Directories, Access Permissions,

The Shell

Command Line, Standard Input And Standard Output, Running A Program In The Background, Filename Generation/Pathname Expansion

SECTION C [40%,Hrs-14,Marks-22]

The Editors

The Vim Editor: History, Creating And Editing A File With Vim, The Compatible Parameter, Vim Features, Command Mode: Moving The Cursor, Input Mode, Command Mode: Deleting And Changing Text, Searching And Substituting, Yank, Put, And Delete Commands, Reading And Writing Files, Setting Parameters, Advanced Editing Techniques, Units Of Measure

The Emacs Editor: History, Getting Started With Emacs, Basic Editing Commands, Advanced Editing, Language-Sensitive Editing, Customizing Emacs.

The Shells

The Bourne Shell: Background, Shell Basics, Parameters And Variables, Processes, History, Aliases, Functions, Controlling Bash Features And Options, Processing The Command Line.

The TC Shell: Shell Scripts, Entering And Leaving The TC Shell, Features Common To The Bourne Again And TC Shells, Redirecting Standard Error, Working With The Command Line, Variables, Control Structures

Programming Tools

Programming In C, Using Shared Libraries, Make: Keeps A Set Of Programs Current, Debugging C Programs, Threads, System Calls, Source Code Management, Control Structures, File Descriptors, Parameters And Variables, Expressions, Shell Programs

References:
1) **"A Practical Guide to Linux"** by Sobell, Pearson Publishers, India
2) **"Linux Programming by Example: The Fundamentals"** by Robbins, Pearson Publishers, India
3) **"Linux+ Certification Guide"** by Drew Bird and Mike Harwood, Tata Mc-Graw Hill Publishers, India

IT-404 DOT Net Frame Work

L T P
3 1 -

SECTION-A [40%, 14 Hrs,25-Marks]

1. Framework Fundamentals

Using Value Types:-Built-in Types, Declaring Value Types, Creating User-Defined Types, Creating Enumerations.

Using Common Reference Type: Reference Type, Comparing the behavior of Reference and Value Types, Built-in Reference Types, String and String Builders, Creating and Sorting Arrays, Using Streams, Throw and Catch Exceptions.

Constructing Classes: Inheritance, Interface, Partial Classes, Generics, Events, Attributes, Type Forwarding.

Converting Between Types: Boxing and Unboxing, Conversation in Custom Types.

2. Input/Output(I/0)

Navigating File system:-File System Classes, *FileSystemInfo* Class, *FileInfo* Class, Getting information about a File, Copying a File, *DirectoryInfo* Class, Enumerating Files in a Directory, *DriveInfo* Class, *DriveType* Enumeration, Enumerating Drives, *Path* Class, Changing a File Extension in a Path, *FileSystemWatcher* Class, Monitoring Directory for Changes.

Reading and Writing files:-Streams, *File* Class, *Directory* Class, *FileAccess* Enumeration, *FileMode* Enumeration, *FileStream* Class, *StreamReader* Class, Reading from a File, *StreamWriter* Class, Writing to a File, Readers and Writers, *MemoryStream* Class, Using a MemoryStream, *BufferedStream* Class, Using Buffered Stream

Compressing streams:-Compression Streams, *GZipStream* Class, *DeflateStream* Class, Compressing Data within a Compression Stream, Decompressing Data within a Compression Stream

Working with isolated storage:- Isolated Storage, *IsolatedStorageFile* Class, Creating a Store, *IsolatedStorageFileStream* Class, Reading and Writing Data to Isolated Storage, Using Directories in Isolated Storage, *IsolatedStorageFilePermission* Class, Permitting Isolated Storage.

SECTION-B [35%, 13 Hrs,22-Marks]

3. Searching, modifying and encoding Text

Forming regular expressions:-Using Regular Expressions for Pattern Matching, Extracting Matched Data, Replacing Substrings using Regular Expressions, Using Regular Expressions to constrain String Input.

Encoding and decoding:-Encoding Class, Examining Code pages, Specifying Encoding Types when reading a file.

4. Collections and Generics

Collecting Data items:-Types of Collections, Adding and removing items, Iterating over items, Consistent interfaces in collections, Sorting Items

Working with sequential lists:-Sequential Lists, *Queue* Class , *Stack* Class

Working with dictionaries:- Dictionary, Equality, IEqualtiyComparer Interface, *SortedList* Class, Specialized Dictionaries.

Using specialized collections:-Working with bits, collecting strings, the *NameValueCollection* class.

Generic collections:- Generics work, improving safety and performance, generic collection class structure

5.Graphics

Drawing graphics:- the System.Drawing namespace, location and size of controls, color of controls, draw lines and shapes, customize pens, fill shapes.

Working with images:- *Image* and *Bitmap* classes, display pictures, create and save pictures, use of icons.

Formatting text:- Add text to graphics, create a *Font* object, write text, controlling formatting of text.

SECTION-C [25%, 9 Hrs,13-Marks]

6.Threading

Creating threads:- Simple threads, passing data to threads, stopping threads, execution context
Sharing data: Avoiding collision, synchronizations locks
Asynchronous programming model:- understanding asynchronous programming, *ThreadPool*, timer objects

7.Application Domains and Services

Application domains:- *AppDomain* class, creating application domain, loading assemblies in application domain, unload an application domain.
Configuring application domains:- Using an application domain to launch assemblies with limited privileges, Configuring application domain properties.
Creating windows services:-Creating a service project, implementing a service, create and install a project for a service, manage and control a service

References:-

1. .NET Framework 2.0 Application Development Foundation by Tony Northup and Shawn Wildermuth, with Bill Ryan of GrandMasters, PHI

IT-422 Programming in C# Department Elective-III

SECTION-A [30%,10 Hrs,16-Marks]

Introducing C#: Evolution of C#, Characteristics of C#, Applications of C#, How does C# differ from C++, How C# differs from Java.

Overview of C#: A simple C# program, namespaces, adding comments, main returning a value, using aliases for namespace classes, passing string objects to *WriteLine* method, command line arguments, main with a class, providing interactive input, using mathematical functions, Multiple Main Methods, compile time errors, program structure, program coding style.

Literals, Variables and Data Types: Literals, variables, data types, value types, reference types, declaration of variables, initialization of variables, default values, constant variables, scope of variables, boxing and unboxing

Operators and Expressions: Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operator, bitwise operators. Special operators, arithmetic expressions, evaluation of expressions, precedence of arithmetic operators, type conversions, operator precedence and associativity, mathematical functions

Decision Making and Branching: Decision making with if statement, the if...else statement, nesting of if...else statements, the else if ladder, the switch statement, the ? : operator

SECTION-B [35%,13 Hrs,22-Marks]

Decision Making and Looping: The while statement, the do statement, the for statement, the for each statement, Jumps in loops

Methods in C# : Declaring methods, the main method, invoking methods, nesting of methods, method parameters, pass by value, pass by reference, the output parameters, variable argument lists, methods overloading

Handling Arrays: One-dimensional arrays, creating an array, two-dimensional arrays, variable-size arrays, the System.Array class, ArrayList class

Manipulating Strings: Creating strings, string methods, inserting strings using system, comparing strings, finding substrings, mutable strings, arrays of strings, regular expressions

Structure and Enumerations: Structures, structs with methods, nested structs, differences between classes and structs, enumerations, enumerator initialization, enumerator base types, enumerator type conversion

Classes and Objects: Basic principles of OOP, defining a class, adding variables, adding methods, member access modifiers, creating objects, accessing class members, constructors, overloaded constructors, static members, static constructors, private constructors, copy constructors, destructors, member initialization, the this reference, nesting of classes, constant members, read only members, properties, indexers

SECTION-C [35%,13 Hrs,22-Marks]

Inheritance and Polymorphism: Classical inheritance, containment inheritance, defining a subclass, visibility control, defining subclass constructors, multilevel inheritance, hierarchical inheritance, overriding methods, hiding methods, abstract classes, abstract methods, sealed classes, sealed methods, polymorphism.

Interfaces: Multiple Inheritance: Defining an interface, extending an interface, implementing interfaces, interfaces and inheritance, explicit interface implementation, abstract class and interfaces

Operator Overloading: Overloadable operators, need for operator overloading, defining operator overloading, overloading unary operators, overloading binary operators, overloading comparison operators

Delegates and Events: Delegates, delegate declaration, delegate methods, delegate instantiation, delegate invocation, using delegates, multicast delegates, events.

Managing Console I/O Operations: Console class, console input, console output, formatted output, numeric formatting, standard numeric format, custom numeric format.

Managing Errors and Exceptions: Types of errors, exceptions, syntax of exception handling code, multiple catch statements, the exception hierarchy, general catch handler, using finally statement, nested try blocks, throwing our own exceptions, checked and unchecked operators, using exceptions for debugging

References:

Programming in C#, E Balagurusamy Tata McGraw-Hill Publishing Company Ltd.

PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

SCHEDULE OF ELIGIBILITY CHECK
for admissions made upto 1st October, 2007

Date	Engineering Colleges	Management Colleges	Pharmacy Colleges	Other Colleges
08 Oct 2007	1. GZSCET, Bathinda 2. SBSCET, Ferozepur 3. BCET, Gurdaspur 4. MIMIT, Malout 5. BHSBCE, Lehragaga 6. GNDEC, Ludhiana 7. DAVIET, Jalandhar 8. BBSBEC, Fatehgarh Sahib 9. AIET, Faridkot 10. ACET, Amritsar 11. BKSJEC, Amritsar 12. BGIET, Sangrur 13. BMSCE, Muktsar 14. BCET, Bhutta	1. APJIM, Jalandhar 2. BISIT, Gagra 3. BGIMT, Sangrur 4. BNMCTE, Alamgir 5. CTIMIT, Jalandhar 6. CSHTM, Rajpura 7. CMTR, Mohali 8. DBIACS, Mandi Gobindgarh 9. DIMT, Doraha 10. GJIMT, Mohali 11. GNAIMT, Phagwara 12. GGNIMT, Ludhiana 13. SMDC, Lehragaga 14. SUCMIT, Tangori	1. ACPTE, Mastuana 2. ASBASJSMCP, Bela 3. BISCP, Kot-ise-Khan 4. CCP, Landran 5. CCP, Rajpura 6. DCP, Kharar 7. GHGKC, Gursar Sadhar 8. GPG, Patiala 9. GP, Amritsar 10. ISFCP, Moga 11. LCP, Phagwara	
09 Oct 2007	1. CTIEMT, Jalandhar 2. CEC, Landran 3. CIET, Jansla 4. CEM, Kapurthala 5. DBEC, Mandi Gobindgarh 6. GGSCMT, Kharar 7. GGSCET, Talwandi Saboo 8. GTBKIET, Chhapianwali 9. IITTCET, Pojewal 10. IGCE, Abhipur 11. IET, Bhaddal 12. KCEIT, Nawanshahr 13. LLRIET, Moga 14. LIT, Phagwara	1. GNIMT, Ludhiana 2. GSICST, Garhshankar 3. GTBIMT, Dakha 4. IMS, Ludhiana 5. ITFT, Chandigarh 6. KIMT, Ludhiana 7. MIM, Patiala 8. LLRMIMT, Dhudike 9. LIM, Phagwara 10. MRSKTC, Bathinda 11. NCIT, Muktsar 12. PCTE, Baddowal 13. PIMT, Mandi Gobindgarh 14. RIM, Railmajra	1. Pt. JRGP, Hoshiarpur 2. RIP, Railmajra 3. SDCP, Barnala 4. SBSPPC, Patti 5. SCP, Nangal 6. GCP, Khanpur Khui 7. SSCP, Badhani 8. CTIPS, Shahpur 9. VMSCP, Batala 10. SVCP, Ramnagar	
10 Oct 2007	1. LCET, Katni Kalan 2. PCET, Lalru Mandi 3. RIET, Phagwara 4. RBIEB, Ropar 5. RIEIT, Railmajra 6. RIMT, Mandi Gobindgarh 7. SBBSIET, Padhiana 8. SUSCET, Tangori 9. SSIET, Patti 10. SSCET, Badhani 11. SSIET, Dera Bassi 12. SPCET, Dera Bassi 13. SVIET, Ramnagar 14. DIET, Kharar	1. TEC, Handiaya 2. RIMTCT, Mandi Gobindgarh 3. SASIITR, Mohali 4. SDSIT, Barnala 5. SIICS, Badhani 6. SIMT, Jalandhar 7. JDIMT, Muktsar 8. SSMTI, Jalandhar 9. SSIMT, Dinanagar 10. TIM, Patran 11. GGSITR, Talwandi Saboo 12. BMSIMT, Moga 13. BFICIT, Barnala 14. BMSCITLS, Muktsar	1. RBIP, Kharar 2. SCP, Kharar 3. GNIPC, Hoshiarpur 4. MCP, Bathinda 5. PCTEIP, Jhandey 6. LLRCP, Moga 7. AIPBS, Bathinda	1. CCHMCT, Landran 2. KCIHMCT, Nawanshahr 3. DBIHMCT, Mandi Gobindgarh 4. CTIHMCT, Jlandhar 5. PCTEIHMCT, Jhandey 6. SSIHMCT, Jalandhar
11 Oct 2007	1. MAS - RIMT, Mandi Gobindgarh	1. SSSMT, Amritsar 2. CMT, Patiala 3. CIBMT, Sanghol 4. CIIS-IST, Mohali 5. ABS, Nepra 6. MKIMS, Shahpur, Jalandhar 7. Dr. ITBS, Ram Nagar, Banur 8. SVBS, Banur 9. LKCMT, Khokhar, Sangrur 10. MSKKCG, Jagpalpur, Kpt. 11. DIMT, Bulandpur, Jalandhar 12. BSCCM, Nurpur 13. SAVJCIMTS, Hussainpur, Ldh 14. CCT, Landran		
12 Oct 2007	**All Architecture Colleges / PTU Gian Jyoti School of TQM, Mohali / PTU Caparo School of Manufacturing and Material Technology, Jalandhar**			

Note : Eligibility for all courses (UG/PG- including MBA/MCA being offered by Engg. Colleges) will be checked simultaneously except Architecture if not specified otherwise. .

Minutes of the 1st Meeting of Board of Studies for
PTU's B.Tech. Industrial Engg. & Management (Specialisation in TQM) Programme

Date   :   24th August, 2007
Time   :   03:30 to 5.00 p.m.
Venue :   PTU's Gian Jyoti School of TQM & Entrepreneurship,
                B-102, Phase VIII, Industrial Area, Mohali.

PRESENT

Board of Studies:

1. Dr. O P Bajpai, Director, UIET, Kurukshetra University (Chairman of BOS)
2. Mr. R P Sehgal, Executive Director, Swaraj Mazda Ltd., Chandigarh
3. Dr. T P Singh, Principal, Baba Banda Singh Bahadur Engg. College, Fatehgarh Sahib

PTU:

- Dr. VK Arora, Dean Academics, PTU

School:

- Manish Trehan, CEO, PTU's Gian Jyoti School of TQM & Entrepreneurship

Leave of absence granted to:

1. Dr. DD Sharma, Prof. & Head, Entrepreneurship Dev. & Indl Coordn. Dept. NITTTR, Chandigarh

PROCEEDINGS

1. Dean Academics, PTU welcomed the members of the Board of Studies of B.Tech. Industrial Engg. & Management (Specialisation in TQM) Programme to the 1st meeting. He thanked them for accepting nomination to the BOS of the University's innovative and first B.Tech. programme for working professionals and sparing time to provide valuable guidance for this progamme. Chairman of the BOS then asked the CEO of the School to make a short presentation on the progress of the B.Tech. Programme. The presentation highlighted the following:

    a) Details of approval of Scheme and Syllabus.

    b) Innovative pedagogy of the programme, which has contributed to its success, with a healthy enrolment of over 100 students from various organisations, in each of the first four batches.

    c) Brief profile of the learners. The average age of the students is 31 years, with average work-experience of 9 years. They are from various industries and different functional areas.

    d) Feedback from students as well as from industry is very encouraging (summary of feedback collected from the students during the last three semesters was presented to the members; sample comments of students were also circulated to the members). Printed study material, Application-focused assignments and Personal Contact Sessions, which form the back-bone of delivery of this programme, have all received a very good rating. (Copies of printed study material and assignments were shown to the members, who appreciated the fine quality.)

AGENDA ITEMS

No.	Item	Minutes
1.1	Reduction of duration of B.Tech.-Industrial Engineering & Management (Spl. in TQM) programe and revision of Scheme & Syllabus	1) There was a detailed discussion on reduction of the duration of the programme from existing 4 years, keeping in view that the programme is for working Diploma Holders/ Science Graduates with 2 years experience. Members took note of the following: a) B.Tech.– Industrial Engineering & Management (Spl. in TQM) Programme was first conceived as a 3 year (6-semester) Programme. The Scheme & Syllabus was prepared based on this, which was duly approved in November, 2004 by the Committee constituted by PTU for approval of the Scheme & Syllabus. b) Subsequently, a Special Committee of PTU's Academic Council was constituted. The committee met in Feb. 2005 and recommended that the duration of the programme should be 4 years (8 semesters). Accordingly, the Scheme & Syllabus was revised to make it a 4 year (8 semester) programme, which was duly approved by PTU in March 2005. c) Recently, Thapar Institute of Engineering and Technology (TIET), Patiala has started B.Tech. Programme through Distance Education in April 2007. The normal duration of TIET's Programme is 3 years (6 semesters). The programme is approved by Distance Education Council (DEC). Like our B.Tech. programme, TIET's programme is also for Diploma holders with 2 years work experience. Details of their programme were reviewed by the members. d) AICTE's Lateral Entry Scheme as per which Diploma Holders are allowed to directly join the 2nd year (3rd semester) of 4 year Engineering degree programme. 2) In view of the above, members recommended that PTU should consider reducing the normal duration of B.Tech.– Industrial Engineering & Management (Spl. in TQM) Programme from 4 years to 3 years. Members requested the School to prepare a revised Scheme and put it up to the BOS. 3) Members also deliberated on reduction of the duration of the programme, for the batches that are enrolled currently, from 4 years (8 semesters) to 3.5 years (7 semesters). Members noted that, at present, the 4th semester of the B.Tech. Programme was in progress, upon successful completion of which students would be awarded Advanced Diploma by PTU. Members had no objection to this reduction (from 8 semesters to 7 semesters for existing batches) and requested Dean Academics to check out whether implementation of this was feasible. Thereafter, the courses could be reorganized.

2

1.2	To discuss the various academic issues relating to B.Tech.-Industrial Engineering & Management (Spl. in TQM).	1) Issues relating to conduct of the open-book End-Semester University exam. were then taken up. In this regard, minutes of the last meeting of the Special Committee for B.Tech.– Industrial Engineering & Management (Specialisation in TQM) Programme, held on 24th April 2006 were put up before the members (Minutes of this meeting are enclosed as Annexure 1). Members of the BOS endorsed the decisions that were taken in that meeting, which forms the basis for conduct of the open-book End-Semester University exams. Members were informed that subsequently, the University had taken a decision that hand-written notes and assignments would not be permitted in the open-book exams. 2) School has been advised to put up the panel of paper setters to the BOS for approval well before the next end-semester exams. to enable its timely finalization. 3) Keeping in view the complex nature of the task of paper-setting for open-book exams. and evaluation of answer-books, members requested the University to consider enhancement in the remuneration being paid to paper setters and evaluators, which, at present, is Rs. 500 per paper for paper setting (alongwith answer key) and Rs. 10 per answer book checked.
1.3	Any other item with the permission of chair.	
1.3.1	Recognition of B.Tech.-Industrial Engineering and Management (Spl. in TQM) by DEC.	Issue of recognition of B.Tech.– Industrial Engineering & Management (Specialisation in TQM) by the Distance Education Council (DEC) of Indira Gandhi National Open University (IGNOU) came up for discussion. Dean Academics, PTU informed the members that DEC has granted recognition to the Distance Education Programme of PTU. This covers all programmes of distance education of PTU.
	Vote of thanks	The meeting ended with a vote of thanks to the Chair.

(sd/-)

Chairman, Board of Studeies

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Result status for May-2007

Sr. No	Course	Semester	Results Status	Declaration Date
1	B.E.	6th	Declared	12.07.2007
2	B.E.	1st / 2nd	Declared	17.08.2007
3	B.E.	5th	Declared	31.08.2007
4	B.Pharmacy	1st rp	Declared	30.07.2007
5	B.Pharmacy	2nd	Declared	30.07.2007
6	B.Pharmacy	4th	Declared	29.08.2007
7	B.Pharmacy	5th	Declared	13.09.2007
8	B.Pharmacy	7th	Declared	19.09.2007
9	B.Pharmacy	8th	Declared	02.08.2007
10	B.Pharmacy	6th	Declared	05.09.2007
11	B.Tech	8th	Declared	09.07.2007
12	B.Tech	6th	Declared	12.09.2007
13	B.Tech	7th	Declared	12.09.2007
14	B.Tech	1st / 2nd	Declared	30.07.2007
15	B.Tech	5th rp	Declared	18.09.2007
16	BBA	2nd	Declared	30.08.2007
17	BBA	4th	Declared	28.08.2007
18	BBA	6th	Declared	09.07.2007
19	BCA	6th	Declared	09.07.2007
20	BCA	4th	Declared	18.09.2007
21	BCA	2nd	Declared	19.09.2007
22	Hotel Mgt	All semester	Declared	18.09.2007
23	M.Sc.(MLT)	All semester	Declared	20.08.2007
24	M.Sc.(MLT)	All semester	Declared	29.08.2007
25	M.Sc.(MLT)	All semester	Declared	30.08.2007
26	M.Sc.(MLT)	All semester	Declared	20.08.2007
27	MBA	1st to 4th rp	Declared	06:09.2007
28	MBA	2nd reg	Declared	21.08.2007
29	MBA	4th reg	Declared	10.08.2007
30	MCA	All semester rp	Declared	31.08.2007
31	MCA	6th	Declared	13.07.2007
32	MCA	4th	Declared	13.07.2007
33	MCA	2nd	Declared	24.07.2007

List of colleges / institutes offering non-AICTE courses where variation in intake / introduction of new courses has been approved during the session 2007 - 08.

SI.No.	Institute	Branch / Course	Revised Intake
1.	Adesh Institute of Biomedical Science, Bathinda	B.Sc. (BT) B.Sc. (MLT)	40 60
2.	Adesh Institute of Engineering & Technology, Faridkot	B.Sc. (BT)	60
3.	Baba Isher Singh Institute of Science & Tech., Gagra	BCA B.Sc. (IT)	200 200
4.	Bhai Maha Singh College of IT & Life Sciences, Muktsar	BCA	80
5.	C.T. Institute of Management & IT, Jalandhar	BBA	80
6.	Chitkara School of Hospitality, Technology & Management, Rajpura	B.Sc. (FT)	40
7.	Desh Bhagat Institute of Advanced Computer Sciences, Village Saunti, Amloh Road, Mandi Gobind Garh.	B.Sc. (FT)	40
8.	Guru Gobind Singh Information Technology & Research, Talwandi Sabo	BCA	120
9.	Gujranwala Guru Nanak Institute of Mgt. & Tech., Ludhiana	BBA	100
10	GNA-Institute of Mgt. & Tech., Phagwara	B.Sc. (MEFT)	40
11	Maharaja Ranjit Singh College, Bathinda	BBA M.Sc. (IT)	40 40
12.	Malwa Institute of Management, Village Dhablan, Near Rakhra Sugar Mill, Nabha Patiala Road, Patiala	BCA	120
13.	Punjab College of Technical Education, Baddowal, Ludhiana	B.Sc. (HMCT) B.Sc. (ATHM) B.Sc. (MEFT) B.Sc.(Bio-Tech)	40 120 40 60
14.	S.M. Degree College, Lehragaga	BCA B.Sc.(IT) BBA	80 40 40
15.	Swami Satyanand College of Management & Technology, Ajnala Road, Amritsar	B.Sc. (ATHM) B.Sc.(HMCT)	40 40
16.	Swami Vivekanand Institute of Management & Tech., Banur	BBA BCA	40 80

STUDIES ON PROCESSING AND UTILIZATION OF SWEETPOTATO (*Ipomoea batatas*)

A THESIS SUBMITTED TO

PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

FOR THE AWARD OF

DOCTOR OF PHILOSOPHY

in

Food Technology

by

SUKHCHARN SINGH

DEPARTMENT OF FOOD TECHNOLOGY
SANT LONGOWAL INSTITUTE OF ENGINEERING AND
TECHNOLOGY, LONGOWAL -148106, INDIA

2006

Abstract

Sweetpotatoes *(Ipomoea batatas)* are perennial dicots in the morning glory family (Convolvulaceae) which are cropped as annuals, having high yield with a short harvest season, having a good adaptability to varying climatic and field conditions. The best soil types are well-drained, fine sandy loams. Sweetpotato plants produce primary fibrous roots, pencil roots, and storage roots. Skin color of storage roots ranges from white to brown to red-orange. Flesh color of storage roots can be red-orange, orange, yellow or white. Sweetpotatoes have a starchy and sweet taste with different varieties having their own unique flavor profiles. They are oftentimes grouped into two categories depending upon texture since some are firm, dry and mealy when cooked while others are soft and moist. The development cycle of sweetpotato from crop establishment to harvesting the storage roots takes place in three phases within a time span of 100-150 days.

Sweetpotatoes have been considered as an 'anti-diabetic food', offering a host of nutrients and an impressive array of antioxidants. This "blood sugar friendly" character of sweetpotato seems related to two aspects of its composition. First, sweetpotatoes are about twice as high in dietary fiber and this doubled fiber slows down digestion and the release of sugar. Second, sweetpotatoes are acknowledged for its specific "anti-diabetic" effects. Sweetpotatoes are a very good source of vitamin A (in the form of beta-carotene), B_6, C and a good source of many other nutrients like copper, fiber, potassium, phosphorous and pantothenic acid (vitamin B_5). Only the sweetpotato provides vitamin E without the fat and calories.

The vitamin C and beta-carotene in the sweetpotatoes work as powerful antioxidants to help to eliminate free radicals, molecules that damage cells and cell

membranes and which are associated with the development of conditions such as colon cancer, atherosclerosis, diabetic, and heart disease. Yet, the antioxidant profile of sweetpotatoes extends even further. Some of the proteins found in sweetpotato, usually referred to as root storage proteins, have been found to have antioxidant activity. This modest root vegetable is often overlooked and underrated. The sweetpotato is a good source of dietary fiber, which lowers the risk for constipation, diverticulosis, colon and rectal cancer, heart disease, diabetes and obesity. The fiber in sweetpotatoes provides a feeling of fullness and satiety, which helps to control food intake.

Sweetpotatoes are among the top three richest sources of potassium, along with bananas and white potatoes. Potassium plays a major role in maintaining fluid and electrolyte balance and cell integrity. Controlling potassium distribution is a high priority for the body because it affects many aspects of homeostasis, including a steady heartbeat. In India, the area covered under this crop in 1994 was 143,900Ha and production was 1,220,600 Mt and in 2004, the area was 100,000 Ha and production was 900,000 Mt. In Asia, in 1994, the area was 7,083,809Ha and production was 115,806,347 Mt and in 2004, it was 6,107,439 Ha and production was 113,411,880Mt. In India, the area covered under this crop was going to reduce because of non-commercial utility of sweetpotato.

Hence, keeping in view the studies were undertaken to develop processing technology and sweetpotato based products like sweetpotato chips, pasta and baked products and the results are presented in 9 chapters. The outcome of this study is as follows:

Chapter 1 and chapter 2 belong to the basic Introduction and review of literature.

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In *chapter 3*, the effect of air temperature and pretreatments (KMS: Citric acid) on drying kinetics of sweetpotato slices was investigated. Drying experiments were performed in a tray drier. In falling rate period, moisture transfer from sweetpotato slices was described by applying the unsteady state Fickian diffusion model, and the rate constant (k) were calculated. The effect of temperature on k could be interpreted according to Arrhenius law. Drying rate and therefore k values were found to be affected by pretreatments. Rehydration rates of dried sweetpotato slices at 25, 40, 80°C were also determined and found to be independent of drying conditions and rehydration temperature. The ΔE value was found to be the highest for slices treated at 50°C with 0.5%: 1.0% KMS and citric acid.

In *chapter 4*, the process for the preparation of flour was standardized and proximate analysis was done. The yield of flour from hand peeled root (86%) and flour (26%) was high as compared to the yield of abrasive and lye peeling (83.4% and 24.2, 76.4% and 19.6% respectively). Sweetpotato flour has moisture content of 8.7%, very low protein content (2.3%) and high fiber content (9.4%).

In *chapter 5*, the effect of frying on sweetpotato slices was investigated. Frying experiments were performed in a temperature controlled frying unit of 2.0 L oil capac Fryer. Models capable of predicting the product quality of sweetpotato chips have been developed using response surface methodology (RSM) and used to determine the optimum processing conditions. Moisture loss, oil uptake, crispness (measured using a bending-snapping test in the TA.XT2 Texture Analyser), sensory attributes like colour, flavour, and texture were used to assess the product quality in the preparation of sweetpotato chips. The optimum conditions which were attained for maximum moisture

loss (11.65% on wet basis), minimum oil uptake (2.57%), crispness (794.37 g), colour score (7), flavour score (7) and texture score (7) were: frying temperature, 174.7°C; salt concentration, 0.45 %; citric acid concentration, 0.37%; potassium meta bisulphite concentration, 0.65%; and frying time, 26 sec.

In *chapter 6*, sweetpotato starches were characterized to understand the changes upon modification by acid and heat-moisture treatment (HMT) in the rheological, DSC characteristics, and textural properties of starch isolated from the sweetpotato variety PSP-21 and were compared with commercially available arrowroot starch. The native sweetpotato starch had Type A pasting profile characterized by a high PV (741.5 rvu), with a high breakdown (378.8 rvu) and low CPV (417.6 rvu). After HMT, there was a marked decrease in the PV (639.1), a very slight breakdown (113.5 rvu) and an increase in CPV (759.5rvu), more like a Type C pasting profile. However, acid modification did not change much the pasting profile of native sweetpotato starch. DSC characteristics were also affected significantly after modifications. To decreased significantly after HMT and acid modified samples. The gelatinization enthalpy decreased during HMT from 15.98 to 14.42 J/g. Gel strength of acid modified starch was the highest as compared to that of heat moisture treated and native sweetpotato and arrowroot starches.

In *chapter 7*, sweetpotato flour was used for the development of a pasta product. The system known as response surface methodology (RSM) was used to analyze the effect of sweetpotato flour, soy flour, water, Arabic gum and carboxy methyl cellulose on quality responses (sensory, solids loss, and hardness) of the pasta product. A rotatable central-composite design was used to develop models for the responses. Responses were affected most by changes in soy flour and gum levels and to a lesser extent by

sweetpotato flour and water levels. Individual contour plots of the different responses were superimposed and regions meeting the maximum sensory score (33.8), minimum solids loss (16.6%) and maximum texture hardness (5616 g) were identified at 674 g kg-1 sweetpotato flour, 195 g kg^{-1} water, 110 g kg^{-1} soy flour, 10.6 g kg^{-1} Arabic gum and 10.1 g kg^{-1} carboxy methyl cellulose levels.

In *chapter 8*, the preparation of cookies from sweetpotato flour was discussed. Various combinations of sweetpotato flour and wheat flour were used to prepare cookies. Results showed that with increasing the proportion of sweetpotato flour, the water absorption of cookies dough increased. The hardness of cookies decreased with increasing the proportion of sweetpotato flour.

The general summary and conclusion of the thesis is given in *chapter 9*.

SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS INVOLVING DIFFUSION DISPERSION PHENOMENON USING WEIGHTED RESIDUAL METHODS

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Introduction

Past few decades have witnessed various applications of mathematics in different branches of engineering, medical, science, commerce and industry Mathematical modelling of real life problems has attained importance to such an extent that it has resulted into the evolution of a new branch of mathematics namely *Industrial Mathematics*. The main concepts of industrial mathematics are *modelling* and *simulation*. The essence of modelling and simulation within the framework of experimental applications is the characterization of real life objects by:

- A set of basic parameters defining the problem.
- A relationship between these basic parameters.
- Real world interpretation based on these parameters.

Two type of solution techniques are usually followed to solve the mathematical models

- Analytic
- Numeric

Analytic techniques give generalized solution of the problem over a complete range of the independent variable whereas numeric techniques produce the results on a discrete set of pre selected points.

A mathematical model can be classified as microscopic, macroscopic or semi quantitative depending upon the nature of the problem. Macroscopic models give overall description of the process where as microscopic models give an insight into the mechanism of the process. Semi quantitative models are the intermediate models between these two.

In the present study behavior of a brown stock washer used in *pulp and paper industry* is characterized mathematically. During the process of paper making various operations such as chipping, pulping, washing, bleaching, chemical recovery and effluent treatment are involved. Among all these washing is the key operation which significantly influences the environment as well as the economy of the mill.

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The aim of the washing is to remove the dissolved organic (lignin) and inorganic (Na, Mg, Ca and K ions) solids from the pulp either by water or weak wash liquor. Black liquor solids are removed mainly to obtain the clean pulp for further processing and recovery of cooking chemicals in the evaporator. Lignin, the major aqueous organic, if not separated from the pulp stream before bleaching, consumes excess of bleaching chemicals, generating more undesirable effluents such as AOX, color, BOD and COD. This leads to the environment decay as well as air and water pollution. The ideal situation of no overflow of solids as well as of the fibers with the filtrate leaving the washing plant can never be met in the industry. Hence the pulp should be washed optimally with maximum removal of solids by using minimum amount of wash liquor.

Two types of washing operations are followed in the industry, these are:

- Dilution thickening
- Displacement

In the *dilution thickening* washing, the pulp slurry is diluted with weak wash liquor or with clean water and then thickened by filtering or pressing. In *displacement* washing, wash liquor or clean water passes through the pulp bed in a piston like situation, pushing out the liquor associated with the pulp bed. However, displacement washing is more effective than dilution thickening, if the amount of water to be added is same.

Vast literature is available in the field of mathematical modelling based on the phenomenon of adsorption-desorption, diffusion-dispersion and advection diffusion [Neretneiks,1974; Dudukovic & Lamba, 1978; Raghvan & Ruthven, 1983; Kiil et. al., 1995; Eriksson et. al., 1996; Liu & Bhatia,1999; Szukiewicz, 2000; Carara et. al., 2003; Khan & Loughlin, 2003]. Majority of these models are based on spherical glass beads or granular particles. There is paucity of the literature related to the modelling of cylindrical solid or semi solid particles [Grahs, 1974; Edward & Rydin, 1976; Perron & Lebeau, 1977; Lindsay, 1994; Al-Jabari et. al., 1994; Eriksson, 1996]. Moreover, little work is available in the field of washing of insoluble material adsorbed on the surface of solid or semi solid particles as compared to the adsorption on the same [Grahs, 1974; Perron & Lebeau, 1977; Eriksson, 1996; Potucek, 1997].

Majority of the earlier investigators have followed the axial dispersion model with suitable modifications [Grahs, 1974; Edward & Rydin, 1976; Perron & Lebeau, 1977; Al-Jabari et. al., 1994; Potucek, 1997]. The axial dispersion model is mainly dependent on a single parameter called Peclet

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number. It is the ratio of the advection to dispersion. Peclet number is directly proportional to interstitial velocity and cake thickness, but inversely proportional to axial dispersion coefficient. Other factors which influences the concentration profiles are intrafiber diffusion, consistency of fibers, fiber porosity, radius of swollen fibers and fluid film mass transfer coefficient. These factors differentiate the pulp fibers from the granular particles. Along with these parameters, the geometry of the particles also plays an evitable role.

Grahs [1974] has presented a model based on the peculiar features of the pulp fibers including consistency of fibers, fiber porosity and mass transfer coefficients. The model is very comprehensive in nature, but the radius of swollen fibers is taken to be constant. Fluid film mass transfer coefficient and diffusion in fiber pores are completely ignored.

Perron & Lebeau [1977] has presented the axial dispersion model for pulp washing ignoring the axial dispersion coefficient. The model involves the global mass transfer coefficient, bed porosity and particle porosity. Trinh *et. al.* [1989] has presented the experimental study of the pulp washing on a displacement washing cell.

Al-Jabari *et. al.* [1994] has presented a model related to the adsorption of fillers on the fiber surface. The model is based on the non linear adsorption isotherm in the dynamic form instead of static one as discussed by the earlier investigators [Grahs, 1974; Edward & Rydin, 1976; Trinh *et. al.*, 1989]. The isotherm reduces to the Langmuir kinetics at equilibrium.

Kukreja *et. al.* [1995] and Potucek [1997] have followed the axial dispersion model to describe the washing behavior of pulp fibers. They have followed the linear adsorption isotherms to relate the bulk fluid concentration and the concentration of solute adsorbed on fiber surface.

Eriksson *et. al.* [1996] have proposed a model based on the fact that time factor is directly proportional to the ratio L/u instead of R^2/D_F. The non linear relation of intrapore solute concentration and the concentration of solute adsorbed on the fiber surface is totally ignored. The boundary condition imposed at $z = 0$ is step input based on the exponential function and not the Danckwart's boundary condition.

Mathematical Model

In the present study a comprehensive model is formulated which includes the features of the models of Grahs [1974] and Al-Jabari et.al. [1994]. The model is divided into two parts namely particle phase and bulk fluid phase. Rasmuson and Neretnieks [1980] have introduced the film model to correlate the bulk fluid phase and particle phase. Later Raghvan and Ruthven [1983] and Sridhar et. al. [1994] have proposed that film model can be replaced by introducing the condition at the boundary of the particle.

The present work concentrates on the features of particle phase and bulk fluid phase. Microscopic models based on the mechanism of the washing process are presented. The transport of solute within the particles (fibers) is effectively described by the diffusion equation involving both concentration of solute adsorbed on the fiber surface (n) and concentration of solute with in the fiber pores (q). The consistency of fibers (C_F) and the ratio of the volume not available for flow $(1-\beta)$ to the volume available for flow (β) are presented with the accumulation term. The mathematical representation of the model is given by the following equations:

$$D_F\left(\frac{\partial^2 q}{\partial r^2} + \frac{1}{r}\frac{\partial q}{\partial r}\right) = \frac{\partial q}{\partial t} + C_F \frac{(1-\beta)}{\beta}\frac{\partial n}{\partial t} \tag{1}$$

The concentration gradient is assumed to be zero at the centre of the particle, i.e.,

$$\frac{\partial q}{\partial r} = 0 \qquad \text{at } r = 0 \text{ and } t > 0 \tag{2}$$

The external mass transfer resistance exists, i.e., the mass transfer to the surface of the fiber is controlled by film resistance mass transfer coefficient. Hence the boundary condition at the surface of the fiber is given by:

$$-D_F\left(\frac{\partial q}{\partial r}\right) = \frac{k_f \beta}{K}(q|_{r=R} - c) \qquad \text{at } r = R \text{ and } t > 0 \tag{3}$$

The adsorption isotherm correlating the intrapore solute concentration and the concentration of solute adsorbed on the fiber surface are taken to be non-linear.

$$\frac{\partial n}{\partial t} = k_1 \frac{q}{C_F}(N_t - N_s - n) - k_2 n \tag{4}$$

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equilibrium the adsorption isotherm equation (4) reduces to the Langmuir kinetics.

he transport phenomenon in the porous media having void fraction (ε) is described by the one mensional axial dispersion model involving the axial dispersion or longitudinal dispersion efficient. The model equations for the bulk fluid phase are given by :

$$D_L \frac{\partial^2 c}{\partial z^2} = u \frac{\partial c}{\partial z} + \frac{\partial c}{\partial t} + \frac{2(1-\varepsilon)k_f \beta}{\varepsilon KR}(c - q|_{r=R}) \qquad (5)$$

he boundary condition at z = 0 is imposed by the requirement that there is no loss of solute from e bed through the plane at which the displacing fluid is introduced. The ambiguity, that solute asses through the maximum or minimum in the interior of the bed is avoided by assuming the oncentration gradient to be zero at the bed outlet.

$$uc - D_L \frac{\partial c}{\partial z} = uC_S \qquad \text{at } z = 0 \qquad (6)$$

$$\frac{\partial c}{\partial z} = 0 \qquad \text{at } z = L \qquad (7)$$

nitially $q(r,z,0) = c(z,0) = C_i$ and $n(r,z,0) = N_i$ $\qquad (8)$

Numerical Technique

The method of orthogonal collocation on finite elements was first proposed by Carey and Finlayson [1975]. It combines the features of both the orthogonal collocation method and finite element method. The orthogonal collocation method gives accuracy to the results whereas finite element method gives stability to the numerical solutions. In this method the whole domain [0,1] is divided into small sub-domains called 'elements'. With in each element the orthogonal collocation is applied. In case of stiff system of boundary value problems, the stiffness of the system is overcome by using the technique of orthogonal collocation on finite elements.

Finlayson [1980], Ma & Guiochon [1991] and Sridhar [1999] have applied this method to different problems. In all the cases the method is applied to the axial domain only and not on the radial domain. Liu & Bhatia [1999] in their study have discussed the method of fitted mesh collocation using DASSL, but in the FMCMD the radial and axial domain are divided into two meshes only. The method is suitable for spherical catalyst pellet where inner and outer pellet is divided by taking

the two meshes representing the inner and outer pellet. For porous pulp fibers having cylindrical geometry, the FMCMD does not give good results at the boundary where the solute leaves the bed. Sridhar [1999] and Liu & Bhatia [1999] have solved the system of differential algebraic equations using DASSL package. In this package the system of differential algebraic equations is first converted into the system of differential equations and then integrated numerically. It consumes a lot of time. In the present study the system of differential algebraic equations is integrated numerically using MATLAB with ode15s system solver.

In orthogonal collocation method, the trial function is a series of orthogonal polynomials. The collocation points are taken to be the zeros of these orthogonal polynomials in the interval [0,1]. The domain of interest [0,1] is divided into small sub intervals by placing the dividing points at x_ℓ where $\ell = 1, 2, 3, ..., ne$ with $x_1 = 0$ and $x_{ne+1} = 1$. To apply the orthogonal collocation in the ℓth interval a new variable is introduced in such a way that as the global variable varies from the lower limit to upper limit of ℓth interval, local variable varies from 0 to 1 as shown in figure 1 and figure 2. To avoid the problem of double calculation the trial function and its first order derivative are assumed to be continuous at the node points of ℓth and $(\ell+1)^{th}$ intervals. With in each element u is introduced as $u = \dfrac{x - x_\ell}{x_{\ell+1} - x_\ell}$ such that as x varies from x_ℓ to $x_{\ell+1}$, u varies from 0 to 1. By applying the orthogonal collocation directly on u with in each element, one gets the collocation equations in terms of the solutions at the collocation points.

Figure 1 :- Application of Finite Element on the global domain

Figure 2 :- Application of Orthogonal Collocation on the local domain

choice of collocation points is an important and sensitive part of the orthogonal collocation hod. It influences the problem to a great extent. Collocation points are the discrete set of points at ch the desired problem is discretized. The collocation points are chosen to be the zeros of the ogonal polynomials employed to discretize the approximate solution. Usually, the zeros of bi, Legendre and Chebyshev polynomials are taken as collocation points. Chebyshev and endre polynomials are the special cases of Jacobi polynomial, hence in broad sense zeros of bi polynomial is followed for collocation points. Chebyshev polynomial gives good results at corners but not at the center or for averages. Legendre polynomial gives good results both at the ers as well as on the centre and for averages. In the present study results are required both at the ers and average. Therefore zeros of Chebyshev polynomial is employed as collocation points in radial direction whereas the zeros of Legendre polynomial are followed in the axial direction.

discretization end points are fixed as $u_1 = 0$ and $u_{m+1} = 1$. The zeros of shifted Chebyshev nomials have been used as collocation points for the radial domain, because these polynomials the tendency to keep the error down to a minimum [Nielsen & Hesthaven, 2002; Chen *et. al.*, 3] and yield satisfactory results for the unsymmetrical BVP's. The collocation points are ined by mapping the computational domain of the interval [-1, 1] to [0, 1] with the help of wing relationship:

$$_{2-j} = \frac{x_j}{2} + \frac{1}{2}$$

(9)

re x_j is the jth collocation point in the interval [-1, 1]. The $m+1$ interpolation points are chosen to e extreme values of an mth order shifted Chebyshev polynomial.

$$\cos\frac{\pi(j-1)}{m} \;;\; j = 1, 2, \dots, m+1$$

(10)

zeros of Legendre polynomial are calculated from the following formula:

$$1)P_{j-1}(x) = (2j-3)xP_{j-2}(x) - (j-2)P_{j-3}(x); j = 2,\dots,m$$

(11)

$P_0(x) = 1$ and $P_{-1}(x) = 0$. In case of Legendre polynomial, 0 and 1 are taken to be the boundary s. x_j's are also transformed onto u_j's using the relation given by (9).

Application of the Method

To apply the method of orthogonal collocation on finite elements, both the radial and axial domains are first divided into small number of elements and with in each element the orthogonal collocation is applied. The radial domain is divided into w elements and the axial domain is divided into ne elements. In radial domain a new variable v' is introduced whereas in axial direction the variable v is introduced within each element. Chebyshev and Legendre zeros have been used as collocation points in radial and axial directions. In axial direction $m+1$ collocation points are taken with in each element. In radial direction p collocation points are taken with in each element. The method can be applied in the following manner.

For particle diffusion:

$$\frac{dQ_\ell^l(k,j)}{d\tau} = \frac{1}{h_l^2}\sum_{i=1}^{p}B_{ji}^{\bullet}Q_\ell^l(k,i) + \frac{1}{h_l(v'_j h_l + \eta_l)}\sum_{i=1}^{p}A_{ji}^{\bullet}Q_\ell^l(k,l) - \left(\frac{1-\beta}{\beta}\right)N'\frac{dN_\ell^l(k,j)}{d\tau} \quad (12)$$

$Q_\ell^l(k,j)$ stands for the collocation solution for j^{th} collocation point in the lth element in radial direction and k^{th} collocation point in the ℓth element in axial direction. h_l is the length of the lth element in radial direction.

$$\frac{dN_\ell^l(k,j)}{d\tau} = P_1\left(C'Q_\ell^l(k,j)(1-N_\ell^l(k,j)) - k^{\bullet^{-1}}N_\ell^l(k,j) + C''(1-N) - N''(k^{\bullet^{-1}} + C'' + QC'')\right) \quad (13)$$

continuity conditions:

$$Q_\ell^l(k,p) = Q_\ell^{l+1}(k,1) \quad (14)$$

$$\frac{1}{h_l}\sum_{i=1}^{p}A_{pi}^{\bullet}Q_\ell^l(k,i) = \frac{1}{h_{l+1}}\sum_{i=1}^{p}A_{1i}^{\bullet}Q_\ell^{l+1}(k,i) \quad (15)$$

boundary conditions:

$$\sum_{i=1}^{p}A_{1i}^{\bullet}Q_\ell^1(k,i) = 0 \qquad \text{at } \eta = 0 \quad (16)$$

$$\frac{1}{h_w}\sum_{i=1}^{p}A_{pi}^{\bullet}Q_\ell^w(k,i) = -Bi(Q_\ell^w(k,p) - C_k^\ell) \qquad \text{at } \eta = 1 \quad (17)$$

For bulk fluid:

$$\frac{dC_k^\ell}{d\tau} = \frac{\psi}{h_\ell^2 Pe}\sum_{s=1}^{m+1}B_{ks}C_s^\ell - \frac{\psi}{h_\ell}\sum_{s=1}^{m+1}A_{ks}C_s^\ell - \theta Bi\left(C_k^\ell - Q_\ell^l(k,p)\right) \quad (18)$$

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C_k^ℓ stands for the collocation solution for k^{th} collocation point in the ℓth element in axial direction. h_ℓ ; the length of the ℓth element in axial direction

Continuity conditions:

$$C_{m+1}^\ell = C_1^{\ell+1} \tag{19}$$

$$\frac{1}{h_\ell}\sum_{s=1}^{m+i} A_{1s}C_s^\ell = \frac{1}{h_{\ell+1}}\sum_{s=1}^{m+1} A_{m+1s}C_s^{\ell+1} \tag{20}$$

Boundary conditions:

$$C_1^1 - \frac{1}{h_\ell Pe}\sum_{s=1}^{m+1} A_{1s}C_s^1 = 0 \qquad \text{at } \xi = 0 \tag{21}$$

$$\sum_{s=1}^{m+1} A_{m+1s}C_{m+1}^{ne} = 0 \qquad \text{at } \xi = 1 \tag{22}$$

Initially

$$C = \overline{Q} = N = 1 \qquad \text{at } \tau = 0 \tag{23}$$

A stiff system of $[(w(2p-3)+2)\,ne\cdot m]+1$ coupled differential algebraic equations appears. The lumped matrix structure is presented in figure 3 by two block diagonal structures having boundary conditions, differential equations and continuity conditions for particle phase and bulk fluid phase.

Exit solute concentration is calculated at $C|_{\xi=1}$. To calculate the average solute concentration following formula is used:

$$C_{av} = \sum_{\ell=1}^{ne} h_\ell \sum_{s=1}^{m+1} W_s C_s^\ell \tag{24}$$

W_s's are the weight functions of the Legendre polynomial to be calculated at the collocation points.

Convergence of the Method

To check the convergence of the method, the procedure described by Onah [2002] is followed. In this method Onah [2002] has shown that the collocation methods converge asymptotically. The functions dependent on time variable converge to steady state solutions for infinite time. The convergence of the method is checked by the following formula:

$$L^* = h^2 \|M^{-1}\| Y \tag{25}$$

where Y is the lumped coefficient matrix of collocation solutions. The maximum value of the collocation solutions is 1. Therefore $L^* \le h^2 \|M^{-1}\|$ and the method will converge for $\|L^*\| \le 1$.

Hence, for large values of the parameters, the system of equations become stiff and the element size should be small enough to make $\left\| L^* \right\| \leq 1$.

Figure 3 : Block diagonal matrix structure for OCFE, the crosses arise after the application of OCM with in each element and the boxes represented by empty circles are for boundary conditions and continuity conditions. The single column on the right hand side arises from the time derivatives of the collocation solutions.

Validity of the Model

The proposed model is validated by using the data of earlier investigators [Grahs, 1974; Kukreja, 1996]. Grahs [1974] has used a displacement washing cell to wash the cellulose pulp fibers of softwood (black spruce). The behavior of the solution profiles at $\xi=1$ is similar to that of Grahs [1974]. In this case orthogonal collocation method on finite elements has proved to be an efficient technique to solve the stiff system of differential equations for wide range of parameters where as global collocation method fails to give results for wide range of parameters. Kukreja [1996] has used a lab scale pilot plant to wash the pulp slurry mainly consisting of hardwood (eucalyptus). The

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erimental results are compared with the numerical results obtained from the proposed model and presented in Table-I. The deviation of less than 1% is found between the results.

Table-I : Comparison of experimental and numerical results

Experimental values (C_{ei})	Numerical values (C_{nm})	Relative error
0.2554	0.2543	4.3076×10^{-3}
0.2457	0.2474	-6.6743×10^{-3}
0.2514	0.2506	3.2220×10^{-3}
0.2031	0.2019	5.9087×10^{-3}
0.2067	0.2074	-3.8227×10^{-3}

To check the applicability of the model for an industrial brown stock washer, the actual industrial data of the 4th stage of a rotary vacuum washer of diameter 5.7912 m and length 4.8768 m is reported. The paper mill is using non wood (wheat straw) as the raw material. The Kappa number of the pulp is 15, pH 12 and temperature during washing of pulp is 323 K. Degree of beating of pulp is 24-25 °SR. The fractional submergence of the drum is 40 %. Pressure drop is 20,000 Pa. The inlet and outlet consistencies are in the range of 1-2 % and 10-12 % respectively. Concentration of black liquor solids inside the vat is 8-9 kg/m^3 and fresh water is sprayed to wash the pulp. The time of one revolution was 24 s.

On the basis of pulp samples collected from the industry, experiments for consistency, concentration of black liquor solids, density of fibers, density of liquor, viscosity of black liquor and concentration of sodium adsorbed on the fiber surface are performed in the laboratory. Results obtained from the experiments are listed in the Table-II.

Table – II : Range of different parameters

Parameter	Range	Unit
Inlet consistency of pulp (Cy_i)	1.75-2.2	%
Outlet consistency of pulp (Cy_d)	9-11	%
Density of liquor (ρ)	1003.5	kg/m^3
Viscosity (μ)	7.2×10^{-4}	kg/ms
Consistency of fibers (C_F)	50.215-68.760	kg/m^3
Density of fibers (ρ_f)	1600	kg/m^3

The values of different parameters like cake thickness, bed porosity and interstitial velocity have been calculated using the mathematical equations given by [Kukreja et. al., 1995; Potucek, 1997].

These values are listed in Table-III. The effect of different base case parameters such as axial dispersion coefficient, cake thickness, interstitial velocity, intrafiber diffusion coefficient, bed porosity and inlet solute concentrations have been checked. The solute concentration profiles are evaluated with respect to time in the form of breakthrough curves.

Table – III : Results from the experimental study

Parameter	Range	Unit
C_0	$(8.3341-8.3782) \times 10^0$	kg/m^3
C_F	$(4.7059-6.6176) \times 10^1$	kg/m^3
u	$(1.9321-1.9584) \times 10^{-3}$	m/s
D_F/R^2	$(2.2700-6.9400) \times 10^{-2}$	1/s
L	$(0.6960-1.0531) \times 10^{-1}$	m
k_1/k_2	$(2.9389-4.1104) \times 10^{-3}$	-
k_r	$(1.8394-1.8415) \times 10^{-6}$	m/s
β	$(8.8400-9.1800) \times 10^{-1}$	-
ε	$(9.5500-9.6800) \times 10^{-1}$	-

Effect of Peclet number: The effect of Peclet number (Pe) on exit solute concentration is shown in figure (4). Peclet number is inversely proportional to axial dispersion coefficient. Axial dispersion is basically a convective mixing process that arises due to the velocity profiles in the individual pores and because of the complex branching and intertwining of flow paths in a porous medium. With the increase in the axial dispersion coefficient, Peclet number decreases, as a result more back mixing occurs, leading to less removal of the black liquor solids from the solute. Figure (4) indicates that for large values of the Peclet number, the breakthrough becomes broaden as a resu* *ess time is evolved in the recovery of black liquor solids and hence better washing can be achieved. For efficient washing operations higher Peclet number is preferred.

Effect of distribution ratio: The effect of distribution ratio D_F/R^2 on breakthrough curves can be seen from figure (5). The solution profiles converge to zero more rapidly as the value of ψ increases with the decrease in the value of D_F/R^2. It is due to the fact that both the ψ and τ are effected by distribution ratio. With the increase in the value of D_F/R^2, ψ decreases whereas τ increases, resulting in the increase in the retention time. Due to this fact concentration profiles are elongated and take large time to converge to the steady state condition. However in case of small values of

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D_F/R^2 retention time decreases and the solution profiles converge to zero more rapidly [Neretnieks, 1974].

Correlation with Industrial Parameters

To check the applicability of the proposed model it is correlated with the different industrial parameters. Brief description of these parameters is presented hereunder.

Displacement ratio is the ratio of the actual possible reduction in the dissolved solids to the maximum possible reduction of the dissolved solids. It is calculated using the formula:

$$DR = \frac{C_0 - c_d}{C_0 - C_S} \tag{26}$$

% Efficiency signifies the percentage of black liquor solids removed during the washing operation It is calculated using the formula is:

$$\%efficiency = \left(1 - \frac{(c_d - C_S)(100 - C_{yd})}{(C_0 - C_s)(100 - C_{yi})}\right)100 \tag{27}$$

Dilution factor is the difference between the wash liquor entering and the liquor in the washed pulp. Its formula is:

$$DF = L_s - L_d \tag{28}$$

Wash yield of any stage is the ratio of dissolved solids removed to the dissolved solids entering with unwashed pulp. Its formula is:

$$Y = \left(\frac{C_{yd} - C_{yi}}{C_{yd}(100 - C_{yi})}\right)100 \tag{29}$$

Equivalent Displacement Ratio is a useful tool to compare the performance of two washers of different design. The actual washer is compared with the hypothetical washer of standard consistencies of 1% and 12%. The formula to calculate EDR is:

$$EDR = 1 - (1 - DR) \times DCF \times ICF \tag{30}$$

$DCF = L_d/7.333$

$ICF = 99(L_0 + DF)/[L_0(99 + DF) - L_d(99 - L_0)(1 - DR)]$

where DCF is discharge consistency factor and ICF is inlet consistency factor.
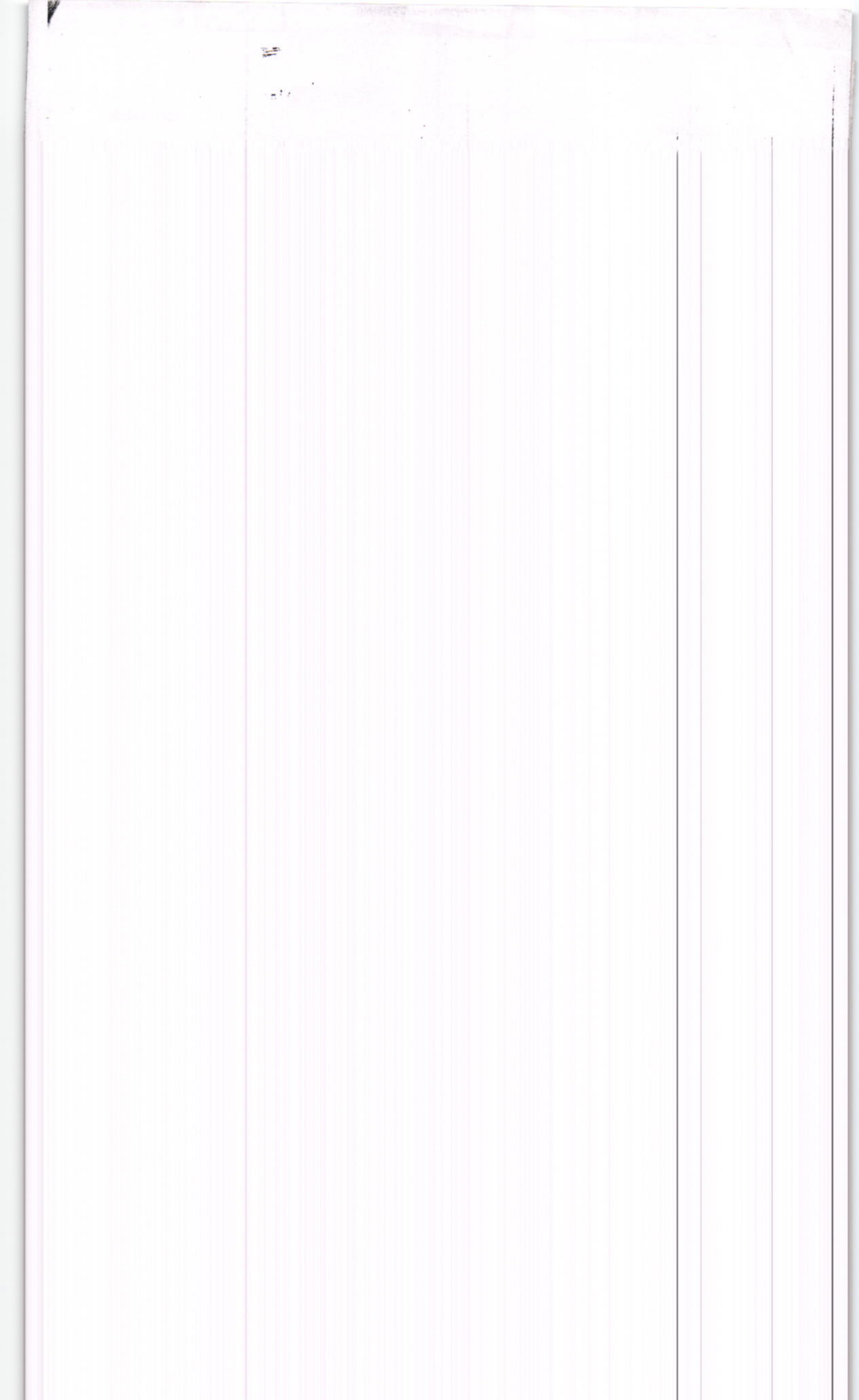
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Conclusions

A comprehensive non linear mathematical model related to the washing behavior of solid or semi solid particles having cylindrical geometries, e.g., fibers have been developed. The method of orthogonal collocation on finite elements has been followed to discretize the mathematical model. The method is quite efficient for a wide range of parameters and gives convergence of order h^2 which is better than the simple orthogonal collocation method. The physical features of fibers such as radius of swollen fibers, intrafiber diffusion, consistency of fibers, porosity of fibers etc. are incorporated in the model to differentiate it from the granular or spherical particles, e.g., glass beads. The proposed model is validated for both the displacement washing cell and lab scale pilot plant with different types of pulp fibers namely softwood, hardwood and non wood. The industrial data of Indian non wood pulp fibers (wheat straw) has been used to check the applicability of the model on an industrial rotary vacuum washer. The model is also correlated with the efficiency parameters employed in the industry. Model can be extended for optimization of the industrial process.

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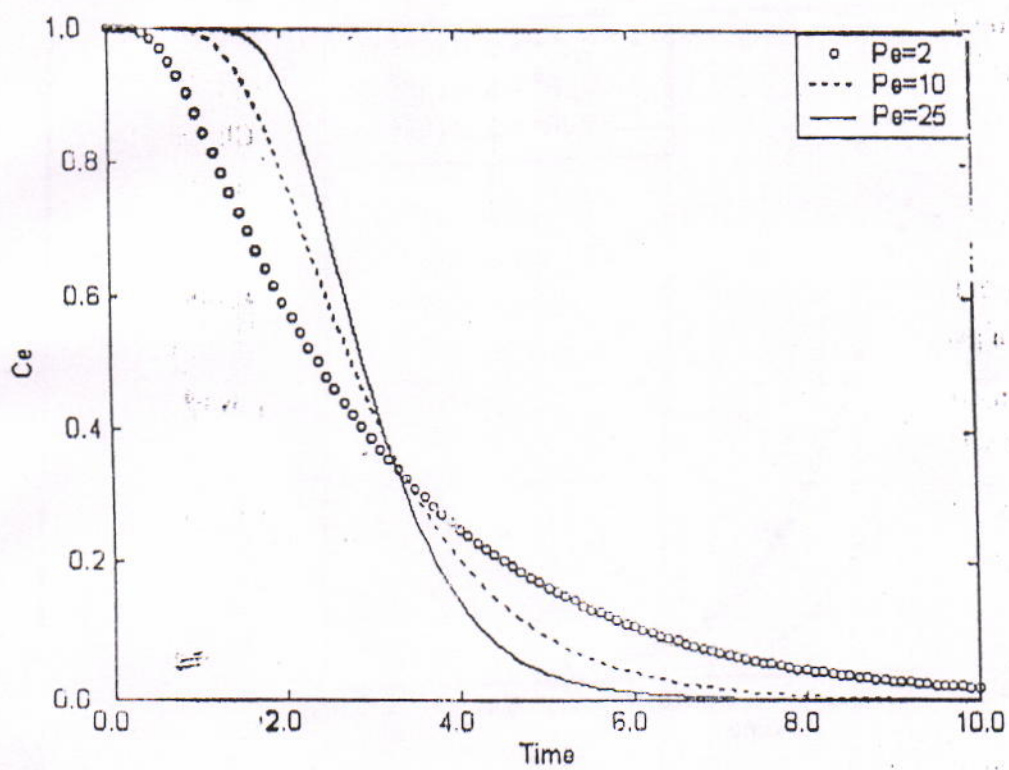
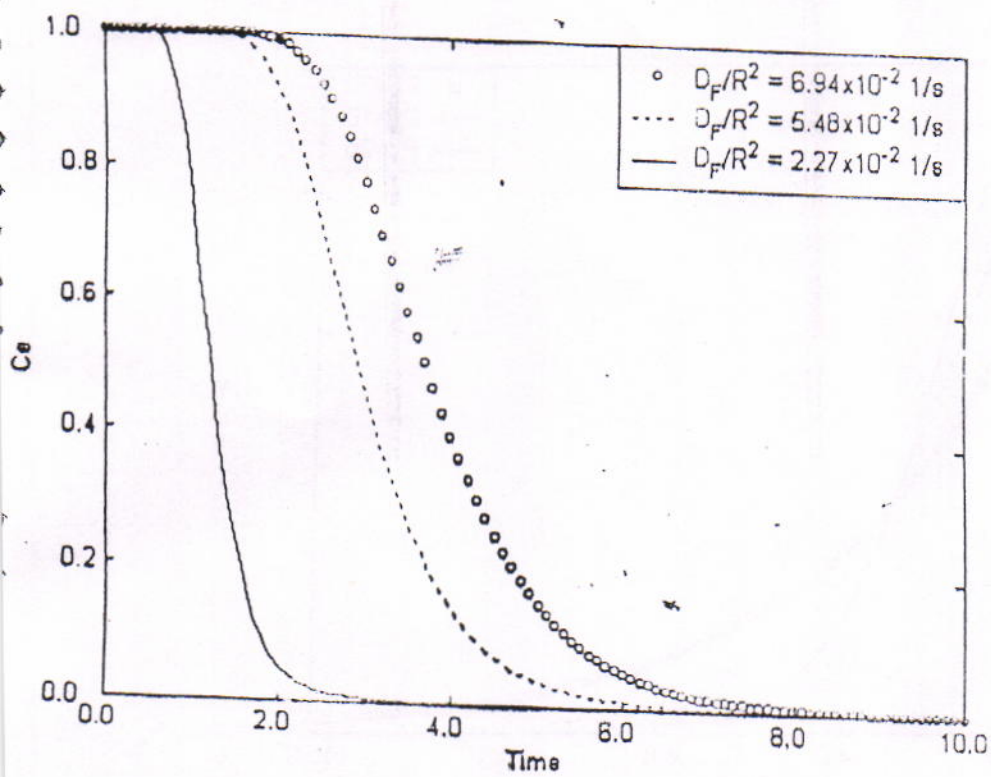Figure 4 :- Effect of Peclet number on exit solute concentration.

Figure 5 :- Effect of distribution ratio D_F/R^2 on exit solute concentration.

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Punjab Technical University, Jalandhar

Abstract of the Research Work for the Ph. D. Degree

1. Name of the Candidate : **Sushil Kumar Kansal**

2. Regd. No. : 03.16.03. dated 17.11.2003

3. Name of the Guide : Dr. Manohar Singh, Professor, Chemical Technology, SLIET, Longowal-148106

(i) Specialization : Chemical Engg.

4. Name of the Co-guide : Dr. Dhiraj Sud, Assistant Professor, Chemistry, SLIET, Longowal-148106

(i) Specialization : Applied Chemistry, Environmental Chemistry

Area of Research : **Chemical Engineering**

Title of Thesis : **Studies on Heterogeneous Photocatalytic Systems for Detoxification of Industrial Effluents**

Abstract

Wastewater streams are posing a serious threat to human life, plants and animal and also to eco-systems of receiving water bodies. One of the main cause of surface water and ground water contamination is industrial discharge from various industries viz. pulp and paper, textile, pharmaceutical and other chemical industries. Organic pollutants such as alkanes, haloalkanes, aromatic and haloaromatics, polymers, surfactants, herbicides, pesticides and dyes are commonly present in industrial effluents. These compounds are quite toxic and degrade slowly in the environment. Moreover, these substances persist in the environment for long time and result in number of adverse effects and disorders in

level has not been met with much success. This is due to high operating cost of photocatalytic oxidation process relative to existing biological treatment. Since in tropical countries like India, sunshine is available in abundance. Therefore application of AOPs using solar light can be a cost and energy effective detoxification technology.

The present work has been undertaken with the following aims:

1. To characterize the effluent from bleaching section of pulp and paper mills by various physico-chemical techniques such as potentiometric, spectrophotometric, total solids, BOD, COD and chloride content.

2. To conduct experiments on photochemical degradation of the individual constituents of effluent such as phenol, catechol and their chloroderivatives, and on real effluent. The photocatalytic process will also be applied to some dyestuffs.

3. To develop modified photocatalytic oxidation systems by employing mixed catalyst and fixed catalyst approach.

4. To investigate the effect of various parameters such as amount of catalyst, pH, oxidant concentration etc. on the efficiency of photocatalytic process.

5. To analyze the findings of the experimental results by mathematical modeling and optimization of the process parameters.

To fulfill these objectives, industrial effluents were collected from nearby pulp and paper mills and their characterization was done by determining pH, total solids, total suspended solids, total dissolved solids, chloride content, residual chlorine content, COD (open reflux), and BOD (5-day) using standard methods. Bleach effluent was generated at lab scale by doing bleaching (C-stage and E-stage) of unbleached pulp under controlled conditions. Photodegradation experiments for the different organic compounds like phenol, catechol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, dyes (Methyl Orange, Rhodamine 6G, Methylene Blue and Methyl Blue) and lignin were performed in a specially designed reaction vessel in the photoreactor equipped with 5 UV tubes each of 30W (Philips). Using magnetic stirrers insured constant stirring of solution. The temperature was maintained constant throughout the reaction time by circulating the water in the jacketed wall reactor. For solar experiments, the borosilicate glass reactors of diameter 0.17m and 800 ml capacity were made.

The degradation of these organic compounds have been investigated in terms of

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change in concentration of the compound by measuring the absorbance, reduction in COD, chloride ion concentration, change in pH etc. under optimized conditions. The experiments were performed with different photocatalysts (TiO_2, ZnO, ZnS, CdS, V_2O_5 etc.) in slurry mode as well as in immobilized mode under UV/solar light irradiation. Various process parameters like catalyst dose, pH, amount of oxidant, initial substrate concentration were varied and their effect have been analyzed. An attempt has also been made to explore the possibility of using mixed catalysts in different ratios. Similar experiments were performed for treatment of real effluent under UV/solar photocatalytic systems.

The proposed work done has been presented in five chapters. After introducing the problem and its contents in the first chapter, the study begins with the literature review on photocatalytic degradation of various compounds in the second chapter. In the third chapter experimental procedures, description of reactor, instruments used and analytical techniques have been discussed in detail. Chapter four deals the results and discussion of photocatalytic degradation of model compounds and real effluent using different types of catalysts and non-concentrating reactor.

Photocatalytic degradation of phenol and catechol as model compounds was investigated in the presence of TiO_2 illuminated with UV/solar irradiation. The variables studied are: catalyst dose, solution pH, amount of oxidant (NaOCl) and substrate concentration. The degradation rate was favorable at pH value 8 for phenol and pH value 5 for catechol. The optimum value of catalyst dose was 1 g/l for both compounds and amount of oxidant were found to be 6 ml for phenol and 4 ml for catechol respectively. The disappearance of the model compounds obeyed first order kinetics with the apparent first decay rate constant values being 0.6740 hrs^{-1} for phenol and 1.12 hrs^{-1} for catechol. COD analysis indicated the complete mineralization of organic compounds on TiO_2 surface. The complete degradation of phenol was achieved in five hours under UV irradiation whereas in solar light phenol was degraded completely in 2.5 hrs. and catechol was degraded in 2.5 hrs and 1.5 hrs under UV/solar light.

The photodegradation of 2,4-dichlorophenol (2,4-DCP) was studied by monitoring the change in substrate concentration (percentage degradation), decrease in

Photo catalytic degradation of 2,4,6,-trichloro phenol and optimization of process parameters.

S.K. Kansal, Manohar Singh and Dhiraj Sud

Indian Environment Congress, Thiruvananthapuram, 16-18, Dec. 2004.

5. Characterization and Degradation of Chlorination and Extraction Stage Effluents of Pulp & Paper Mill.

S.K. Kansal, Manohar Singh and Dhiraj Sud

All India seminar on Emerging Tech. for sustainable Environment in Chemical and Allied Industries, Rourkela, Oct., 2-3, 2004.

6. Optimization of Process Parameters for Photo catalytic Degradation of Catechol

S.K. Kansal, Manohar Singh and Dhiraj Sud

20th National Convention of Chemical Engineers & All India Seminar on Sustainable Development in Chemical and Allied Industries during 4-5 September, 2004, Pune.

7. Photo-Oxidation of Methylene Blue Using Mixed Photocatalysts Systems

B.S. Sidhu, S.K. Kansal, M.P. Kaur, D. Sud

National Seminar on Recent Trends in Chemistry- Trends and Perspectives at SLIET, Longowal, 19-20 December 2003, pp 58.

8. Degradation of Phenol using Titanium Dioxide as a Photocatalysts

S.K. Kansal, Manohar Singh and Dhiraj Sud

National Seminar on Recent Trends in Chemistry- Trends and Perspectives at SLIET, Longowal, 19-20 December, 2003, pp 59.

9. Titanium Dioxide Photo catalyzed Degradation of Phenol and its Derivatives

S.K. Kansal, Manohar Singh and Dhiraj Sud

7th Punjab Science Congress at GNDU, Amritsar during 7-9 February 2004, CP 3.

Papers Communicated to Journals

1. Parametric Optimization of Photocatalytic Degradation of Catechol in Aqueous Solutions by Response Surface Methodology

Sushil Kansal[1], Manohar Singh[1] and Dhiraj Sud

Indian Journal of Chemical Technology, 2005.

Studies on photodegradation of two commercial dyes in aqueous phase using different photocatalysts

S.K.Kansal, M.Singh, and D. Sud

Journal of Hazardous Materials, 2006.

3. Optimization Of Photocatalytic Process Parameters For The Degradation Of 2,4,6-Trichlorophenol In Aqueous Solutions

S. K. Kansal, M. Singh and D. Sud

Chemical Engineering Communications, 2006.

Thermal Processing of Pureed Mint and Coriander Leaves

Abstract
of
the proposed research work for the Ph. D. Degree

Submitted to

Punjab Technical University, Jalandhar, India

by
Salini Gaur

Department of Food Technology
Sant Harchand Singh Longowal Central Institute of
Engineering & Technology, Longowal (Punjab) -148 106

Thermal Processing of Pureed Coriander and Mint Leaves

Ph.D. Thesis by Shalini Gaur (2006)

Reg. No. 06.06.03, Dated 22.10.03

Supervisors: 1. Prof. B.C. Sarkar

Head, Dept. of Food Technology

Sant Longowal Institute of Engg. & Tech., Sangrur, Punjab

2. Prof. U.S. Shivhare

Dept. of Chemical Engg. & Tech., Panjab University, Chandigarh

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Extended Abstract of the thesis

In this manuscript, the procedure to manufacture coriander and mint leaves puree was standardized. The effects of heat treatment on enzymatic, rheological, pigment degradation and microbiological properties of the puree were studied and mathematical models ascertained for the same. This thesis provides the appropriate models to monitor the effect of processing parameters on the physico-chemical and microbiological profile of coriander and mint leaves.

The blanching treatment for coriander and mint was standardized for maximum retention of chlorophyll. Optimum condition for coriander leaves was found to be blanching in boiling water for 2.5 min followed by cooling in refrigerator. This allowed 96% chlorophyll retention in the leaves after blanching and pureeing treatment. The blanching treatment for mint leaves was found the best to blanch the leaves in water at 85°C for 3.5 min and then cooling in forced air at room temperature (86% chlorophyll retention).

Peroxidase inactivation kinetics in coriander and mint leaves extract was studied at temperatures ranging from 70 to 100°C and appropriate models available in literature were tested to describe the inactivation behaviour. These experiments were conducted in capillary tubes of 2.5 mm internal diameter immersed in water bath to maintain quasi-isothermal conditions. Guaiacol was the substrate for conducting these studies, and U.V.-

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Vis-spectrophotometer was used to monitor the rate of reaction. Peroxidase inactivation behaviour in coriander leaves was best explained ($R^2 > 0.97$, S.E. < 0.02) by the two-fraction model elucidated by Chen and Wu (1998)*. The coefficients of the model did not follow the Arrhenius relationship as a function of temperature. The mint peroxidase inactivation behavior was found to fit best with the Weibull distribution ($R^2 > 0.99$, S.E. < 0.000). The mean, mode, variance and skewness of the distribution was also determined.

Rheological behavior of coriander and mint leaf puree was determined at temperatures ranging from 30° to 80°C. Apparent viscosity of coriander puree followed Arrhenius relationship as a function of temperature (R^2 was 0.94 and S.E. equaled 0.043). For coriander puree the yield stress varied between 10.9 and 36.15 Pa while the magnitude was much higher for mint puree (26 to 489 Pa). None of the models (Herschel-Bulkley, Casson, Modified Casson) were found adequate for estimating the yield stress values. The use of experimental yield stress values in the models for rheological parameters estimation was therefore inferred. Model for best fit to the shear stress-shear strain data was determined using the Mean Residual Quadratic Error (MRQE). The Herschel-Bulkley model provided the best description of the flow behavior of coriander and mint leaf puree over the temperature range of 30-80°C. The Arrhenius model successfully described the effect of temperature on consistency index of coriander and mint puree. The activation energy of flow for coriander and mint puree was computed to be 23.99 and 32.62 kJ/mol respectively.

Thermal degradation kinetics of chlorophyll a, b and total chlorophyll in coriander and mint leaves puree was investigated at varying levels of pH (4.5-8.5) and temperature (80-145°C). The puree at pH 4.5 was processed at 80° to 100°C, while that at pH 5.5 to 8.5 was processed at 105° to 145°C in an oil bath (± 0.1°C). Chlorophyll degradation followed first order reaction kinetics. Good agreement was found between estimated and
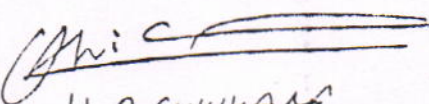
*Chen, C.S. and Wu, M.C. (1998). Journal of Food Science 63: 747-750

experimental chlorophyll retention in all cases ($R^2 > 0.80$). Fit of the model was also tested by the MRQE (< 0.36). Activation energies for chlorophyll degradation ranged from 6.45 to 95.99 kJ/mol. Transition state theory was applied to estimate the thermodynamic parameters enthalpy, entropy and Gibbs free energy of activation. Enthalpy of activation ($\Delta H^\#$) for chlorophylls degradation ranged from 3.14 to 91.99 kJ/mol while entropy of activation ($\Delta S^\#$) ranged from -0.266 to -0.047 kJ/(mol.K). The results for testing the existence of thermodynamic compensation effect indicated that, the compensation effect did not exist for chlorophyll degradation in coriander and mint puree during thermal processing.

Screening of selected zinc salts to stabilize chlorophyll in coriander and mint puree was carried out at inherent pH, pH 4.5 and 8.5. Incorporation of zinc sulphate was most effective in complexing with pheophytins in acidic (pH 4.5) coriander and mint puree at 60 and 75 ppm respectively. At inherent and alkaline pH, zinc oxide @ 50 ppm ionic concentration gave better results for coriander puree. In mint puree, incorporation of zinc acetate and zinc stearate at 75 ppm ionic concentration was found to be most effective at inherent and alkaline pH respectively. Results for retention of greenness at 40°C for three months indicated that the greenness of salt incorporated samples was much higher than the control samples. At acidic and inherent pH, coriander was found to be 18 times greener than control after storage for 3 months while mint puree at inherent pH was found to be 9 times greener than control.

Thermal death kinetics of *B. stearothermophilus* spores during processing of coriander and mint purees at pH 4.5 to 8.5 was studied at 105-145°C. The isothermal data was treated with non-linear regression. First order thermal death kinetics was found most appropriate to explain the survival ratio of spores ($R^2 > 0.91$, S.E < 0.76). The computed D values were in the range of 70.57 at 105°C to 0.32 at 145°C, which were in agreement with results obtained from literature. The effect of temperature on death rate was modeled using Arrhenius, Davey's modified Arrhenius and Glasstone equation. Activation shoulder observed in some survival curves was successfully modelled by the use of Geeraerd model for log linear decrease without tailing.

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(R.C. SARKAR)
Supervisor

U.S. SHIVHARE
(Co-supervisor)

Proceedings of the PTU Sports Council Meeting held on 06/09/2007 at PTU premises

The following members of PTU Sports Council were present

1. Brigd. Labh Singh, **Chairman**
2. Dr. R.P. Singh, Director RIE&IT, Nawanshahr
3. Dr. S.S. Sangha, Director GNIMT, Ludhiana
4. Dr. H.K. Grewal, Principal GNDEC Ludhiana
5. Sh. C. L. Kochhar, Principal DAVIET, Jalandhar
6. Dr. Suman Sharma, GCW, Amritsar
7. Sh. Manjit Singh Dhall, R.C. of GNDU Jalandhar
8. Sh. Ram Partap, Sports College, Jalandhar
9. Sh. Mukhbains Singh, SP Retd., Jalandhar

In addition to above members Dr. V.K. Arora, Dean Academics, Dr. N. P. Singh, Dean Examination, Sh. Rajneesh Sachdeva, Dy. Dean Estt., Sh Paramjit Singh, Asst. Registrar and D.P.Es of various institutes as per attendance sheet were also present.

Dr. N.P. Singh welcomed the Chairman and other members of the Council. Dr. V.K. Arora started the proceedings by taking agenda items one by one. Review of the sports activities in session 2006-07 was undertaken for each game. The problems encountered were discussed and the following decisions were taken :

1. Pending certificates prior to 2004 and inter-university participation will be prepared with help from concerned D.P.E.s.
2. Institutes will be sending list of officials game wise for preparing the panel of officials. University will decide the panel for each game.
3. Institutes will settle their advances after conduct of tournament within one month of conduct of tournament.
4. University will be sending observer(s) for each tournament.

Item No.-2   **Proposed Sports Calendar for session 2007-08.**

Proposed sports calendar was discussed. It was decided that in case some change in proposed dates is desired by any host institute, it is to be intimated to Sh. Sachdeva with in next two days. The finalised calendar is annexed at **flag A**

Item No.-3   **Sports Calendar for Session 2006-07**

Venues for inter-college tournaments were discussed. The criteria adopted was as under

1. The host institute must have necessary infrastructure for conduct of tournament along with stay arrangement for students, officials and faculty.
2. In case more than one institute opts for one game then the preference will be given to that institute which has not hosted that game for last two consecutive years, otherwise will be decided through a draw.
3. In case there is only one contender for a particular game that the same shall be allotted to them even if they have organized the game in the previous year.

The finalized sports calendar along with venues is annexed at **flag B**

Item No.-4   **Proposed budget allocations (session 2007-08) for conduct of tournaments for discussion**

The proposed budget allocations based on AIU ceiling limits game wise were discussed. It was agreed by all present. The finalized ceiling limits are annexed at **flag C**

Certain discrepancies in officiating fee of various conduct officials were pointed out by the members particularly in Swimming, Cross Country, Power Lifting and Cycling. For athletics fees were not mentioned. In such cases fee as per Panjab University norms shall be applicable. Similarly the requirement of diet money during inter-university tournament was also pointed out. It was decided that the diet money at par with Panjab University rules be given.

Item No.-5 **Officiating fee of various conduct officials for various Games & Athletic Meet**

The officiating fee of various conduct officials of various games and athletics as was finalized is annexed at **flag D**.

Item No.-6 **TA/DA Rules for participants for PTU Inter College Tournaments**

TA/DA rules for participants applicable to PTU inter-college tournaments are annexed at **flag E**.

Item No.-7 **TA/DA Rules for participants for PTU Inter University Tournaments including Coaching Camps**

The finalized TA/DA rules (amended as decided) for participants applicable to inter-university tournaments are annexed at **flag F**.

Dr.V.K. Arora invited Brig.Labh Singh(Chairman) for guiding Sports Council in getting effective and greater participation of Youth in Sports & physical activities. The Chairman emphasized the role of technology in sports, Innovative methods, importance of data in improving fitness among youth and producing better citizens with good physique. He prevailed upon serious participation of Principals of Colleges to ensure quick and effective implementation of the decisions taken.

Meeting ended with vote of thanks to chair.

FLAG-A&B

PUNJAB TECHNICAL UNIVERSITY JALANDHAR
PROPOSED PTU SPORTS CALENDER FOR 2007-08

Sr. NO.	Game	Dates for 2007-08 Inter college	Last date for receipt of entry	Venue for 2007-08 Inter college	Date of Inter University 2007-08	Venues for Inter University 2007-08
1.	Swimming (M&W)	26.09.07 to 27.09.07	20.09.07	IET- Bhaddal		
2.	Badminton (M&W)	22.09.07	20.09.07	BBSBEC- Fatehgarh Sahib	20.10.07	MDU, Rohtak
3.	Table Tennis (M&W)	01.12.07	20.09.07	CEC- Landran		Kurukshetra
4.	Cross Country (M&W)	03.11.07	20.09.07	DAVIET- Jalandhar	30.01.08	
5.	Kabaddi N/S (M)	10.11.07	20.09.07	LIT- Phagwara		
6.	Power lifting (M&W) Weight lifting (M&W) Best Physique (M)	16.11.07 to 18.11.07	20.09.07	GNDEC- Ludhiana	21.11.07	Punjabi University Patiala
7.	Foot Ball (M)	19.10.07 to 21.10.07	20.09.07	GNDEC- Ludhiana		
8.	Hockey (M&W)	03.11.07 to 04.11.07 (W)	20.09.07	GNDEC- Ludhiana	19.11.07 (M) (W)	PAU, Ludhiana (M) Manipur University Canchipur (W)
9.	Cycling (M&W)	17.11.07	20.09.07	GNIMt- Ldh.	22.12.07	Osmania Unive., Hyderabad
10.	Yoga (M&W)	06.10.07	20.09.07	SBSCET- Ferozepur		
11.	Basket Ball (M&W)	27.10.07	20.09.07	SUSCET- Tangori		MIP, Rohilkhand (M)
12.	Lawn Tennis (M&W)	13.10.07	20.09.07	BCET- Gurdaspur	26 to 31 10.07 (M	PAU, Ldh (M)
13.	Hand ball (M&W)	13.10.07	20.09.07	DAVIET-Jalandhar		GNDU, Amritsar
14.	Volley Ball (M&W)	09.02.08	20.09.07	LIT- Phagwara		MIP, Rohilkhand (M) Calcutta Univ. (W)
15.	Cricket (M) Zonal	16.02.08	20.09.07	Vacant		
16.	Cricket (M) Final	29.02.08	20.09.07	SUSCET- Tangori		JMI, New Delhi (M)
17.	Cricket (W)	23.02.08	20.09.07	LIT- Phagwara		Delhi Univ. (W)
18.	Athletics (M&W)	08.03.08 or 15.03.08	20.09.07	BBSBEC- Fatehgarh	15.10.07	Kerala , T. Puram

PUNJAB TECHNICAL UNIVERSITY JALANDHAR
PROPOSED BUDGET ALLOCATIONS FOR SESSION 2007-08:-

Based on AIU Norms

(A) Event wise

Sr. No.	Game	AIU based	Proposed (in Rs.)
1.	Cross Country (M&W)	1,00000/- (All India)	30,000/-
2.	Power lifting (M&W) Weight lifting (M&W) Best Physique (M)	1,00000/- (All India)	50,000/-
3.	Table Tennis (M&W)	30,000/- for each zone (5 zones)	30,000/-
4.	Swimming (M&W)	1,00000/- All India	40,000/-
5	Hockey (M&W)	1.5 lakh (women) All India 40,000/- (men) for each zone (5 zones)	40,000/-
6	Foot Ball (M)	40,000/- for each zone (5 zones)	40,000/-
7	Foot Ball (W)	1.5 lakh (women) All India	40,000/-
8.	Kabaddi N S (M)	15,000/- for each zone (5 zones)	15,000/-
8	Kabaddi (W)	25,000/- for each zone (3 zones)	25,000/-
9.	Badminton (M&W)	30,000/- (5 zones)	30,000/-
9	Basket Ball (M&W)	40,000/- (men) for each zone (5 zones) 50,000/- (women) for each zone (3 zones)	50,000/-
10	Hand ball (M&W)	50,000/- for each zone (3 zones)	50,000/-
11	Lawn Tennis (M&W)	25,000/- (Men) for each zone (3 zones) 30,000/- (women) All India	25,000/-
12	Cycling (M&W)	50,000/- All India	25,000/-
13	Cricket (M) Zonal (4 zone)		25000/- for each zone
14	Cricket (M) Final	40,000/- (Men) for each zone (5 zones)	25,000/-
15	Cricket (W)	1.5 lakhs (Women) All India	
16	Volley Ball (M&W)	40,000/- (Men) for each zone (5 zones) 50,000/- (Women) for each zone (3 zones)	50,000/-
17	Athletics (M&W)	2.5 lakhs (All India)	1,00,000/-
18.	Yoga (M-&W)	Nil	20,000/-
	TOTAL		**Rs. 7,85,000/-**

PUNJAB TECHNICAL UNIVERSITY JALANDHAR
OFFICIATING FEE FOR CONDUCT OFFICIALS OF GAMES & ATHLETICS

S.No.	Game	Officiating Rates
1.	Ball Badminton	Rs. 150/-per official per match
2.	Basketball	Rs. 150/-per official per match
3.	Football	Rs. 150/-per official per match
4	Handball	Rs. 150/-per official per match
5	Hockey	Rs. 150/-per official per match
6	Kabaddi (NS)	Rs. 150/-per official per match
7	Kabaddi (PS)	Rs. 150/-per official per match
8	Kho kho	Rs. 150/-per official per match
9	Softball	Rs. 150/-per official per match
10	Squash	Rs. 150/-per official per match
11	Table Tennis	Rs. 150/-per official per match
12	Volley ball	Rs. 150/-per official per match
13	Waterpolo	Rs. 150/-per official per match
14	Badminton	Rs. 150/-per official per match
15	Tennis	Rs. 150/-per official per match
16	Netball	Rs. 150/-per official per match
17	Korfball	Rs. 150/-per official per match
18	Cross Country	Rs. 150/-per official per day
19	Archery	Rs. 250/-per official per day
20	Boxing	Rs. 250/-per official per day
21	Chess	Rs. 250/-per official per day
22	Cycling	Rs. 250/-per official per day
23	Fencing	Rs. 250/-per official per day
24	Gymnastics	Rs. 250/-per official per day
25	Judo	Rs. 250/-per official per day
26	Best Physique	Rs. 250/-per official per day
27	Power Lifting	Rs. 250/-per official per day
28	Weight Lifting	Rs. 250/-per official per day
29	Relay Races	Rs. 250/-per official per day
30	Rowing	Rs. 250/-per official per day
31	Shooting	Rs. 250/-per official per day
32	Swimming	Rs. 250/-per official per day
33	Wrestling	Rs. 250/-per official per day
34	Yoga	Rs. 250/-per official per day
35	Athletics	Rs. 250/-per official per day
36	Cricket	Rs. 250/-per official per match
37	DA to officials	Rs. 80/- per day (for outside officials) & actual bus/ 2nd class railway fare
38	Local conveyance	Rs. 50/- per shift (for local officials)
39	Local conveyance	Rs.100/- both ways for out stationed officials

TA/DA RULES FOR PARTICIPANTS FOR PTU INTER COLLEGE TOURNAMENTS
(To be paid by concerned institute)

1.(a) For participation in inter college tournaments the players will be paid second class Rail fare / bus fare for covering their to and fro journey.

(b) They will also be paid local conveyance for going and coming back as per actuals from Residence to Railway Station / Bus stand and from the Buy stand/ Railway Station of the particular venue.

2. They will be paid diet money a Rs. 100/- per head per day. (including refreshment)

3. Full diet money at the above prescribed rate will be paid both on the day of departure and arrival.

4. The expenditure incurred to buy pain killers, spray, glucose, first aid etc. and for photograph of the team would be reimbursed as per actuals.

5. Lodging of teams will be the responsibility of the host college. The teams have to bring their own bedding.

6. In case a participant falls sick or gets injured the medical expenses would be reimbursed on actual basis by the college of the participant

TA/DA RULES FOR PARTICIPANTS FOR PTU INTER UNIVERSITY TOURNAMENTS
(To be paid by the PTU)

1. (a) The players will be paid second class Rail / Bus fare for covering their to and fro journey.

   (b) They will be paid local conveyance as per actuals from residence to Railway Station / bus stand and from Railway Station / bus stand to the particular venue and the same amount for return journey.

2. They will be paid diet money a Rs. 145/- per head per day. (including refreshment).

3. The player / team getting 1st. 2nd and 3rd position will be awarded as follows:-
   (a) North Zone   Track Suit only
   (b) All India inter university   Blazer, University Neck-tie and Univ. Colour.

4. During Coaching camp diet money would be paid @ Rs. 100/- per day per player alongwith refreshment.

5. For attending summer coaching camp at hill station the diet money would be paid @ Rs. 100/- per head per day including refreshment.

6. For inter university tournaments the players would be supplied with sports uniform free of cost.

7. Coach / Manager would be paid honorarium @ Rs. 300/- per head per day since they have to escort the team in the second class rail compartment they would be paid one side first class rail fare also.

8. A player who attends the camp but is not selected for the university team, would be entitled for bus fare from venue of camp to bus stand and back to his destination/ residence.

9. The expenditure incurred to buy pain killers, spray, glucose, first aid etc and for photograph of the team would be reimbursed as per actuals.

10. The staff members nominated for selecting players for inter university tournaments out of the participants in inter college tournaments would be paid TA/DA according to PTU rules.

11. In case participant falls sick or gets injured the medical expenses would be reimbursed as per actuals by PTU.