



COLLEGE OF ENGINEERING AND TECHNOLOGY, AKOLA

**Accredited By NAAC With 'A' Grade
(CGPA 3.27)**

CRITERIA 1

1.3.1 Cross Cutting Issues: Professional Ethics, Gender, Human Values, Environment and Sustainability



Shri Shivaji Education Society, Amravati's

COLLEGE OF ENGINEERING AND TECHNOLOGY, AKOLA



Founder President : Late Dr. Panjabrao alias Bhausaheb Deshmukh

At. Post. Babhulgaon (Jh.) NH.6, Tal. Dist. AKOLA (M.S.) 444 104 Phone : 0724 - 2259024, 7387523332

President : Shri. Harshvardhan P. Deshmukh

Principal : Dr. S. K. Deshmukh

Date: 04/05/2023

Declaration

This is to declare that the information, reports, true copies and numerical data etc

Furnished in this file as supporting documents is verified by IQAC and found correct.

Dr. S. K. Patil

IQAC Coordinator

Dr. S. K. Patil

IQAC Coordinator

College of Engineering and Technology
Akola



Dr. S. K. Deshmukh

Principal

Principal
College of Engg.
& Tech., Akola

DIRECTION

No. 42/2021

Date :- 09/08/2021

Subject :- Examination leading to the Degree of B.E./ B.Text.E. /B.Tech. (Chem.Engg.) (Four Year Degree Course.. Semester Pattern) (C.B.C.S.) in the Faculty of Science & Technology, Direction 2021.

Whereas, Direction No. 29 of 2010 in respect of the Examination leading to the Degree of B.E./ B.Text.E. /B.Tech. (Chem.Engg.) (Four Year Degree Course .. Semester Pattern) (C.B.C.S.) in the Faculty of Engineering & Technology, Direction, 2010 of B.E. /B.Text. E.(Common to all branches) as per Credit Grade System in the Faculty of Engineering & Technology was in existence up to the session 2018-19 and abrogated stage wise vide Direction No. 26 /2019,

AND

Whereas, Direction Nos. 31/2011, 31/2012, 3/2013, 16/2014, 12/2016, 19/2016, 20/2016, 11/2017 and 37/2018 in respect of the Schemes of teaching & examination of Semesters III to VIII in the various branches of B.E. /B.Text.E. /B.Tech. (Chem. Tech.) as per Credit Grade System in the Faculty of Engineering & Technology are in existence,

AND

Whereas, the Honøble Vice-Chancellor had constituted a Committee of all the Chairpersons of the Board of Studies of Engineering & Technology under the Chairmanship of the Dean, Faculty of Science & Technology for preparing of the Schemes of teaching & examination of Under Graduated Courses of Semester III to VIII of B.E. /B.Text.E. / B.Tech. (Chem.Engg.) / B.Tech. (Chem.Tech.) as per the guidelines of A.I.C.T.E. Model Curriculum to be implemented from the session 2020-21 & onwards in phase wise manner,

AND

Whereas, the Committee in its series of meetings dtd. 6.6.2020, 22.6.2020 & 23.6.2020 has prepared, finalized and recommended the Schemes of teaching & examination of the branches Civil Engg., Mechanical Engg., Electronics & Telecommunication Engg., Computer Science & Engg. / Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical & Electronics Engg., Information Technology, Textile Engg., Chemical Engg., (C.B.C.S.) of Semester III to VIII as per guidelines of AICTE Model Curriculum to the office to be implemented from the session 2020-21 & onwards in phase wise manner,

AND

Whereas, the Honøble Vice-Chancellor had accepted and accorded approval to the schemes of teaching & examination of Semester III to VIII of B.E. /B.Text.E. /B.Tech. (Chem.Engg.) on behalf of Faculty of Science & Technology and Academic Council on 24.7.2020 to be implemented from the session 2020-21 & onwards in phase wise manner,

AND

Whereas, the above Schemes of teaching & examinations of Semesters Semester III to VIII of B.E. /B.Text.E./B.Tech.(Chem.Engg.) in the Faculty of Science & Technology are required to be regulated by the Ordinance /Regulation,

AND

Whereas, at the time of considering the directions issued underSection 12 (8) of 12 of the Maharashtra Public Universities Act, 2016, the Academic Council in its meeting held on 13.1.2020 vide item No. 04 has resoved as under :

Hereinafter, afresh Direction shall be issued by superceding earlier Direction if the relative legislation not be made in a stipulated period.

AND

Whereas, earlier Direction Nos. 26/2019 and 8/2020 issued in this regard have already been lapsed,

And

Whereas, the existing direction No. 21/2020 regarding Examination leading to the Degree of B.E./ B.Text.E. /B.Tech. (Chem.Engg.) (Four Year Degree Course.. Semester Pattern) (C.B.C.S.) in the Faculty of Science & Technology lapsed as per sub Section (8) of Section 12 of the Maharashtra Public Universities Act, 2016 and could not be converted into Ordinance / Regulation. Hence, now it is imperative to issue a fresh direction,

AND

Whereas, making the Ordinance /Regulation is a time consuming process,

Now, therefore, I, Dr. Vilas M. Bhale, Vice-Chancellor (Acting), Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of Section 12 of the Maharashtra Public Universities Act, 2016, do hereby direct as under :-

- (1) This Direction shall be called "Examination leading to the Degree of B.E./ B.Text.E. /B.Tech. (Chem.Engg.) (Four Year Degree Course..Semester Pattern) (C.B.C.S.) in the Faculty of Science & Technology, Direction, 2021".
- (2) This Direction shall come into force from the date of its issuance.
- (3) Subject to the conditions prescribed by the Government from time to time, for admission to First Year B.E./B.Text.E. / B.Tech. (Chem. Engg.) / B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. courses the candidate shall be considered eligible :

Passing 12th Standard examination of the Maharashtra State Board of Secondary and Higher Secondary Education, with subjects :

1. English (Higher or Lower)
2. Modern Indian Language (Higher or Lower)
3. Mathematics and Statistics.
4. Chemistry.
5. Physics.
6. Any other optional subject from out of the list prescribed by the said Secondary and Higher Secondary Education Board.

OR

- i) English (Higher or lower)
- ii) Mathematics and Statistics.
- iii) Chemistry
- iv) Physics
- v) Vocational subject (Defined by the said Board as a Technical Subject)

OR

An Examination recognised by the Sant Gadge Baba Amravati University as an equivalent to the above.

- (4) Subject to the conditions prescribed by the Govt. from time to time for direct admission to the second Year B.E. / B.Text.E. / B.Tech. (Chem. Engg.) / B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. the candidates shall be considered eligible :-

Passing Diploma in relevant branch in First Division, awarded by the Board of Technical Examination of Maharashtra State, Mumbai.

OR

Any Diploma equivalent to the corresponding Diploma of the Board of Technical Examination of Maharashtra State, Mumbai.

- (5) (a) The Degree of Bachelor of Engineering shall be awarded to examinee who in accordance with the provisions of this Direction qualifies for the award in any of the following branches.

- i. Civil Engineering
- ii. Mechanical Engineering
- iii. Electrical Engineering (Electronics & Power)
- iv. Electrical Engineering
- vi. Electrical and Electronics Engineering.
- vii. Electronics and Telecommunication Engineering
- viii. Computer Science & Engineering
- ix. Information Technology
- x. Computer Engineering
- xi. Chemical Engineering
- xii. Textile Engineering

(b) The Degree of Bachelor of Textile Engineering shall be awarded to examinee, who qualifies in accordance with the provisions of this Direction.

(c) The Degree of Bachelor of Technology (Chemical Engineering) shall be awarded to examinee who qualifies in accordance with the provisions of this Direction.

(d) The Degree of Bachelor of Technology (Chemical Technology) Polymer (Plastic) Tech. shall be awarded to examinee who qualifies in accordance with the provisions of this Direction.

- (6) (i) There shall be eight semester examinations leading to the Degree of B.E./B.Text.E./B.Tech. (Chem. Engg.) /B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. (First, Second, Third, Fourth, Fifth, Sixth, Seventh & Eight Semester)

(ii) The first & Second Semester Examinations shall be common for all the branches.

- (iii) The procedure for bifurcation of the students in Group - A & Group - B shall be as given in **Appendix -B**.

- (7) The period of Academic Session shall be such as may be notified by the University.

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(8) The main examination of first, third, fifth and seventh semester shall be held by the University in winter & supplementary examination in summer every year. And main examination of second, fourth, sixth & eighth semester shall be held in summer & the supplementary examination in winter every year.

(9) The Internal Assessment marks for theory should be based on Class Test and Attendance as follows:-

(a) Class Test Marks will be based upon two Class Tests.	-	15
(b) Attendance	-	Mark/s
75% to 80%	-	1
81% to 85%	-	2
86% to 90%	-	3
91% to 95%	-	4
96% to 100%	-	5

Wherever, if internal assessment marks are less than (10) then it should be converted out of 20.

(10) Subject to his/her compliance with the provisions of this Direction & other Ordinances pertaining to Examination in force from time to time, the applicant for admission, at the end of the course of study of a particular semester/session, to an Examination specified in column (1) of the table I below, shall be eligible to appear if,

- he/she satisfies with the conditions in the table and the provisions there under.
- he/she complies with the provisions of the ordinance pertaining to the Examination in general from time to time.
- he/she has prosecuted a regular course of study in a college affiliated to the University.
- he/she has in the opinion of the Principal shown satisfactory progress in his/her studies.

TABLE I

Name of Exam B.E./B.Text.E./ B.Tech. (Chem. Engg.)/B.Tech. (Chem.Tech.) Polymer (Plastic)Tech.	The student should have passed Exam. of	The Student should have satisfactorily completed the following semester	The student should have passed the following examination
1.	2.	3.	4.
First Semester Group A/Group B	XII standard Examination or equivalent	.....	.....
Second Semester Group A/Group B	.....	I Semester Group A/Group B	.....
Third Semester	.....	II Semester Group A/Group B	2/3rd heads of I & II Sem. combined together
Fourth Semester	.....	III Semester	.....
Fifth Semester	I & II Sem.	IV Semester	2/3rd heads of III & IV Sem. combined together
Sixth Semester	.....	V Semester	.....
Seventh Semester	III & IV Sem. combined together	VI Semester	2/3rd heads of V & VI Sem.
Eighth Semester	.....	VII Semester	.....

(11) An examinee who has passed 2/3 rd heads of passing shall be allowed to keep term in the next higher class.

Explanation:

- While calculating 2/3 rd heads of passing, fraction if any shall be ignored
- For considering the heads of passing, every theory and every practical shall be considered as separate head of passing.

(12) The schemes of teaching & examinations shall be as provided under **Appendix-A** appended with this Direction.

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(13) The fees for each B.E./B.Text.E./B.Tech. (Chem. Engg.)/B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. Examinations (Theory & Practical) shall be as prescribed by University from time to time.

(14) The computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) of an examinee shall be done as given below :-

The marks will be given in all examinations which will include college assessment marks and the total marks for each Theory / Practical shall be converted into Grades as per **Table II**.

SGPA shall be calculated based on Grade Points corresponding to Grade as given in Table II and the Credits allotted to respective Theory / Practical shown in the scheme for respective semester.

SGPA shall be computed for every semester and CGPA shall be computed only in VIII semester. The CGPA of VIII semester shall be calculated based on SGPA of VII and SGPA of VIII semester as per following computation :-

$$SGPA = \frac{C_1 \times G_1 + C_2 \times G_2 + \dots + C_n \times G_n}{C_1 + C_2 + \dots + C_n}$$

Where, C_1 = Credit of individual Theory / Practical

G_1 = Corresponding Grade Point obtained in the respective Theory / Practical

$$CGPA = \frac{(SGPA)_{VII} \times (Cr)_{VII} + (SGPA)_{VIII} \times (Cr)_{VIII}}{(Cr)_{VII} + (Cr)_{VIII}}$$

Where, $(SGPA)_{VII}$ = SGPA of VII Semester
 $(Cr)_{VII}$ = Total Credits for VII Semester
 $(SGPA)_{VIII}$ = SGPA of VIII Semester
 $(Cr)_{VIII}$ = Total Credits for VIII Semester

CGPA equal to 6.00 and above shall be considered as equivalent to First Class which shall be mentioned on Grade Card of VIII Semester as a foot note.

**TABLE II
THEORY**

Grade	Percentage of Marks	Grade Points
AA	80 ÷ Marks ÷ 100	10
AB	70 ÷ Marks < 80	9
BB	60 ÷ Marks < 70	8
BC	55 ÷ Marks < 60	7
CC	50 ÷ Marks < 55	6
CD	45 ÷ Marks < 50	5
DD	40 ÷ Marks < 45	4
FF	00 ÷ Marks < 40	0
ZZ	Absent in Examination	0

PRACTICAL

Grade	Percentage of Marks	Grade Points
AA	85 ÷ Marks ÷ 100	10
AB	80 ÷ Marks < 85	9
BB	75 ÷ Marks < 80	8
BC	70 ÷ Marks < 75	7
CC	65 ÷ Marks < 70	6
CD	60 ÷ Marks < 65	5
DD	50 ÷ Marks < 60	4
FF	00 ÷ Marks < 50	0
ZZ	Absent in Examination	0

- (15) (i) The scope of the subjects shall be as indicated in the syllabi.
(ii) The medium of instruction and examination shall be English.

(16) The Schemes of teaching & examination of Semester I & II (Group A & B) of B.E. /B.Text. E./B.Tech. (Chem.Engg.)/ B.Tech. (Chem. Tech.) (Polymer) (Plastic) Tech. had been already implemented from the session 2019-2020 which was notified vide Direction No. 26/2019.

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(17) As per A.I.C.T.E. Model Curriculum, an Induction Program of three (3) weeks duration is mandatory to the students at the start of the first semester.

(18) The Schemes of teaching & examination of Semester III to VIII of B.E./ B.Text.E./ B.Tech. (Chem.Engg.) (C.B.C.S.) of the branches Civil Engg., Mechanical Engg., Electronics & Telecommunication Engg., Computer Science & Engg., Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical & Electronics Engg., Information Technology, Textile Engg., Chemical Engg., (C.B.C.S.) as per A.I.C.T.E. Model Curriculum shall be implemented in phase wise manner as under :

- (i) For Semester III & IV from the session - 2020-2021
- (ii) For Semester V & VI from the session - 2021-2022
- (iii) For Semester VII & VIII from the session - 2022-2023

(19) The Schemes of teaching & examination of Semester I & II of B.E. / B.Text.E./ B.Tech. (Chemical Engg.) (common to all branches) and Semester III to VIII of the branches Civil Engg., Mechanical Engg., Electronics & Telecommunication Engg., Computer Science & Engg., Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical & Electronics Engg., Information Technology, Textile Engg., Chemical Engg., (C.B.C.S.) as per A.I.C.T.E. Model Curriculum shall be as per Appendices A,B,C,D,E,F,G,H,I,J,K and L appended with this Direction.

- (20) (i) The Semester wise chart regarding the workload and Credits as per A.I.C.T.E. Model Curriculum guidelines for Engineering & Technology Courses for the Schemes of teaching & examination of Sem. III to VIII is as under :

CHART

Sem.	Theory	Pract.	Theory credits	Pract. Credits	Semester Credits	Hours/ week	Remarks
I	4	4	15	5	20	25	Started from session 2019-20
II	4	4	15	5	20	25	
III	5	4	16	4	20	26	ES 2T, 0 credit
IV	5	4	18	4	22	26	ES 2T, 2 credits
V	5	4	16	4	20	24	PE-1,OE-1
VI	5	4	16	4	20	24	PE-1,OE-1
VII	5	3	16	3+4	23	30	PE-2 or 3, Project seminar - 8 hrs, 4 credits
VIII	4	2	12	2+6	20	28	PE-1 or 2, Project seminar 12hrs, 6 credits
Total	37	29	124	41	165		

- (ii) The workload for the subject Environment Studies for Semester III & IV (3ES06 & 4ES06) which is common for all branches in all the Faculties as per Ordinance No. 42/2005 is as : 2 theory in III semester with no credits, 2 theory in IV semester with 2 credits and examination at the end of IV semester at college level having distribution as : 80 (Max. marks for Theory) + 20 (Internal) = 100 (Total marks) 6 40 (Minimum marks for passing)
- (iii) Open Electives (OE): Open Elective to be opted from the courses offered by other disciplines of Engineering & Technology of the university / Massive Open learning Courses (MOOC) such as SWAYAM pertaining to the profession.
- (iv) Students completing foreign language course or completing minimum 4 weeks internship (Full time in Vacations) or participating in sports at National / International level shall be exempted from O.E. in the same / adjacent semester.
- (v) An Orientation Program of 15 hours duration /MOOC to be offered to the students during (a)VthSemester : Indian Constitution (b) VIth Semester: Indian Traditional Knowledge.

(21) The Provisions of Ordinance No. 18 of 2001 in respect of an Ordinance to provide grace marks for passing in a Head of passing and improvement of division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks in a subject in all the Faculties prescribed by the Direction No. 15 of 2017 shall be applicable to each examination under this Direction.

(22) An examinee who does not pass; or who fails to present himself/herself for the examination shall be eligible for re-admission to the same examination/semester, on payment of fresh fees and such other fees as may be prescribed from time to time.

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(23) A candidate who could not complete a semester satisfactorily or who has failed will be eligible for readmission to the same semester.

However, re-admission to semester should be allowed only when a regular session is running for the particular semester.

(24) One who has passed the Final B.E./B.Text.E./B.Tech. (Chem. Engg.)/B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. examination of the University in one branch and who desires to take B.E./B.Text.E./B.Tech.(Chem. Engg.)/ B.Tech. (Chem. Tech.) Polymer (Plastic) Tech. Degree in another branch shall be admitted to the third Semester of that branch and shall be governed by this Direction for all other purposes.

(25) After examinations the Board of Examination & Evaluation shall publish the result of the examinees as early as possible and the branch wise merit list shall be notified as per Ordinance No.6.

(26) Notwithstanding anything to the contrary in this Direction, no one shall be admitted to any examination under this Direction, if he/she has already passed the said examinations or an equivalent examinations of any statutory University.

(27) (i) The examinees who have passed in all the subjects prescribed for all the examinations of the particular branch shall be eligible for award of the Degree of Bachelor of Engineering / Bachelor of Technology (Chemical Technology) Polymer (Plastic) in the branch concerned, Bachelor of Textile Engineering and Bachelor of Technology (Chemical Engineering).

(ii) The Degree certificate in the prescribed form shall be signed by the Vice-Chancellor.

(28) The Guidelines of the A.I.C.T.E. New Delhi and D.T.E., Govt. of Maharashtra, Mumbai shall be applicable from time to time after having noted / approved by the Competent Authority.

(29) The provisions in existing Direction Nos. 31/2011, 31/2012, 3/2013, 16/2014, 12/2016, 11/2017 and 37/2018 shall stand only be applicable to the students of Semester III to VIII of the branches Civil Engg., Mechanical Engg., Production Engg., Electronics & Telecommunication Engg., Electronics Engg., Instrumentation Engg., Computer Science & Engg., Computer Engg., Electrical Engg., Electrical Engg. (Electronics & Power), Electrical Engg. (Electrical & Power), Electrical & Electronics Engg., Information Technology, Textile Technology, Chemical Engg., Chemical Technology (Polymer) (Plastic) and Biomedical Engg. who have already sought their admissions as per its provisions and shall stand abrogated after exhausting the chances given to the failure students of Old Course by the University.

Date :- 08/08/2021

Sd/-
(Dr.Vilas M. Bhale)
Vice-Chancellor (Acting)

Four Year Degree Course in Bachelor of Engineering Branch : B.E./B.Tech./B.Text. E.(Common to all the Branches)
Semester Pattern (Choice Based Credit system)

Appendix-A

Semester :FIRST/ SECOND GROUP A																	
			TEACHING SCHEME						EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS		THEORY					PRACTICAL			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D				DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
														EXTERNAL	INTERNAL		
THEORY																	
01	1 A 1	Engineering Mathematics I	3	1	–	4	4		3	80	20	100	40	–	–	–	–
02	1 A 2	Engineering Physics	4	–	–	4	4		3	80	20	100	40	–	–	–	–
03	1 A 3	Engineering Mechanics	3	1	–	4	4		3	80	20	100	40	–	–	–	–
04	1 A 4	Computer Programming	3	–	–	3	3		3	80	20	100	40	–	–	–	–
PRACTICALS																	
05	1 A 5	Workshop Practice	–	–	4	4	2		–	–	–	–	–	25	25	50	25
06	1 A 6	Engineering Physics Laboratory	–	–	2	2	1		–	–	–	–	–	25	25	50	25
07	1 A 7	Engineering Mechanics Laboratory	–	–	2	2	1		–	–	–	–	–	25	25	50	25
08	1 A 8	Computer Programming Laboratory	–	–	2	2	1		–	–	–	–	–	25	25	50	25
		TOTAL	13	2	10	25	20					400				200	
	Note- An Induction Program of Three Weeks duration to be offered to the students at the start of First Year.														TOTAL	600	
Semester :FIRST/ SECOND GROUP B																	
THEORY																	
01	1 B 1	Engineering Mathematics II	3	1	–	4	4		3	80	20	100	40	–	–	–	–
02	1 B 2	Engineering Chemistry	4	–	–	4	4		3	80	20	100	40	–	–	–	–
03	1 B 3	Basic Electrical Engineering	3	1	–	4	4		3	80	20	100	40	–	–	–	–
04	1 B 4	Engineering Graphics	3	–	–	3	3		3	80	20	100	40	–	–	–	–
PRACTICALS																	
05	1 B 5	English Communication Skills Laboratory	–	–	4	4	2		–	–	–	–	–	25	25	50	25
06	1 B 6	Engineering Chemistry Laboratory	–	–	2	2	1		–	–	–	–	–	25	25	50	25
07	1 B 7	Basic Electrical Engineering Laboratory	–	–	2	2	1		–	–	–	–	–	25	25	50	25
08	1 B 8	Engineering Graphics Laboratory	–	–	2	2	1		–	–	–	–	–	25	25	50	25
		TOTAL	13	2	10	25	20					400				200	
															TOTAL	600	

Note- An Induction Program of Three Weeks duration to be offered to the students at the start of First Year.

Appendix – B

The procedure for bifurcation of the students in Group – A and Group-B of First Year Scheme for B.E. / B.Text.E. / B.Tech. (Chem. Engg.) / B.Tech. (Chem. Tech.) Polymer (Plastic) Tech.

- 1) The sanctioned intake and / or the number of candidates admitted to first year Engineering shall be divided into two groups as A and B in multiples of 60 preferably at the institute level.
- 2) Group-A candidates shall register for Group-A subjects in first semester and Group-B candidates shall register for Group-B subjects in first semester.
- 3) The candidates shall be examined for their subjects from the respective groups in first semester.
- 4) In the Second semester, candidates from Group-B shall register for subject of Group-A. Similarly, candidates from Group-A shall register for subjects of Group-B.
- 5) The candidates shall be examined for their subjects from the other groups in second semester.
- 6) Thus, at the end of the first year, all the subjects shall be studied by the candidates from both the groups.
- 7) The mark list shall show only the group obtained in respective Semester, like First Semester Group- B, First Semester Group-A.
- 8) The exercise on the part of the college shall be to ensure that the candidates fill up the examination forms correctly according to the subjects group they have registered in both the semesters.

Four Year Degree Course in Bachelor of Engineering Branch: **CIVIL ENGINEERING**
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3CE01	Engineering Mathematics-III	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	3CE02	Strength of Materials	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3CE03	Building Construction & Engineering. Geology	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3CE04	Transportation Engineering	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3CE05	Concrete Technology & RCC	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Science	2	--	--	2	--	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3CE07	Strength of Materials- lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3CE08	Building Construction & Engineering. Geology-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3CE09	Transportation Engineering-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3CE10	Concrete Technology & RCC-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			17	1	8	26	20	--	--	--	500	--	--	--	200	--
Grand Total															700	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester as per Direction No. 20/2021.

SEMESTER : FOURTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	4CE01	Building Planning Designing & CAD	3	--	--	3	3	4	80	20	100	40	--	--	--	--
02	4CE02	Hydrology & Water Resource Engg.	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	4CE03	Surveying	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	4CE04	Geotechnical Engineering- I	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4CE05	Structural Analysis - I	3	1	--	4	4	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Science	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	4CE07	Building Planning Designing & CAD -lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4CE08	Hydrology & Water Resource Engg. ó lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4CE09	Surveying ó lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4CE10	Geotechnical Engineering- I- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			17	1	8	26	22	--	--	--	600	--	--	--	200	--
Grand Total															800	

Note: **The Examination of Subject Environmental Science shall be conducted in IV Semester as per Direction No. 20/2021.

SEMESTER : FIFTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
THEORY																
01	5CE01	Design of Reinforced & Prestressed Concrete Structures	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	5CE02	Surveying & Geomatics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5CE03	Numerical Methods &Computer Programming	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	5CE04	Professional Elective 6I	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5CE05	Open Elective 6 I	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	5CE06	Design of Reinforced & Prestressed Concrete Structures- lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5CE07	Surveying & Geomatics -lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5CE08	Numerical Methods &Computer Programming -lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5CE09	Professional Elective 6I -lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			15	1	8	24	20	--	--	--	500	--	--	--	200	--
Grand Total														700		
Note : Open Elective – I to be opted from the Courses offered by the other Engineering & Technology courses from the College / Deptts. of the University.																
5CE04 & 5CE09 Prof. Elective I : (i) Highway Construction & Management (ii) Repairs & Rehabilitation of Structures (iii) Sustainable Construction Methods iv) Watershed Engg. & Management																
5CE05: Open Elective I : (i) Basic to Building Construction (ii) Disaster Management (iii) Soft Skills and Interpersonal Communication																

SEMESTER : SIXTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	6CE01	Design of Steel Structures	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	6CE02	Environmental Engineering - I	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	6CE03	Fluid Mechanics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6CE04	Prof. Elective - II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6CE05	Open Elective - II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6CE06	Design of Steel Structures-lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6CE07	Environmental Engineering & I-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6CE08	Fluid Mechanics-lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6CE09	Mini Project	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			15	1	8	24	20	--	--	--	500	--	--	--	200	--
Grand Total															700	
Note : i) Open Elective – II to be opted from the Courses offered by the other Engineering & Technology courses from the College / Deptts. of the University. ii) Students need to do compulsory Two (2) weeks Internship after 6 th Semester and that shall be monitored by allotted Final year Project Guides.																
6CE04 : PE (II) : (i) Advanced Construction Materials (ii) Geographic Information Systems & Science (iii) Masonry Structures (iv) Solid & Hazardous Waste Management (v) Traffic Engineering & Management																
6CE05 : OE (II) : (i) Environmental Management (ii) Human Resource Development & Organizational Behavior (iii) Introduction to Earthquake Engineering																

SEMESTER : SEVENTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	7CE01	Structural Analysis - II	3	--	--	3	3	3	80	20	100	40	--	-	--	--
02	7CE02	Geotechnical Engineering - II	3	--	--	3	3	3	80	20	100	40	--	-	--	--
03	7CE03	Hydraulic Engineering	3	--	--	3	3	3	80	20	100	40	--	-	--	--
04	7CE04	Environmental Engineering -II	3	--	--	3	3	3	80	20	100	40	--	-	--	--
05	7CE05	Professional Elective- III	3	--	--	3	3	3	80	20	100	40	--	-	--	--
PRACTICALS / DRAWING / DESIGN																
06	7CE06	Computational Structure Analysis ólab.	--	--	2	2	1	-	--	--	--	--	25	25	50	25
07	7CE07	Geotechnical Engineering ó II- lab.	--	--	2	2	1	-	--	--	--	--	25	25	50	25
08	7CE08	Environmental Engineering óII- lab.	--	--	2	2	1	-	--	--	--	--	25	25	50	25
09	7CE09	Project & Seminar	--	--	8	8	4	-	--	--	--	--	50	-	50	25
Total			15	0	14	29	22	-	--	--	500	--	--	-	200	--
Grand Total															700	

7CE05 Prof Elect. III : (i) Analysis & Design of Structures for Earthquake & Wind (ii) Environmental Impact Assessment & Life Cycle (iii) Pavement Design (iv) Water Power Engineering

SEMESTER : EIGHT																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	8CE01	Construction Project Management	3	--		3	3	3	80	20	100	40	--	--	--	--
02	8CE02	Construction Economics & Estimating - Costing	3	--		3	3	3	80	20	100	40	--	--	--	--
03	8CE03	Professional Elective- IV	3	--		3	3	3	80	20	100	40	--	--	--	--
04	8CE04	Professional Elective-V	3	--		3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8CE05	Construction Economics & Estimating & Costing & lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
06	8CE06	Professional Elective- IV & lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	8CE07	Project & Seminar	--	--	12	12	6	--	--	--	--	--	75	75	150	75
Total			12	0	16	28	20	--	--	--	400	--	--	--	250	--
Grand Total															650	
8CE03 : Prof. Elect IV:		(i) Advanced Design of Steel Structures (ii) Advanced Pre-stressed Concrete Structures (iii) Advanced Water Treatment (iv) Industrial Waste Water Treatment (v) Structural Analysis by Matrix Methods														
8CE04 : Prof Elect V :		(i) Advanced Geotechnical Engineering (ii) Advanced Structural Analysis (iii) Advanced Design of RCC Structures (iv)Advanced Waste Water Engineering (v) Construction Equipment & Machinery (vi) Finite Element Methods														

Four Year Degree Course in Bachelor of Engineering Branch: **MECHANICAL ENGINEERING**
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
Int.	Ext.															
THEORY																
01	3ME01	Mathematics-III	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	3ME02	Manufacturing Processes	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3ME03	Mechanics of Materials	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3ME04	Engineering Thermodynamics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3ME05	Fluid Mechanics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Studies	2	--	--	2	--	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3ME07	Manufacturing Processes- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3ME08	Mechanics of Materials- lab .	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3ME09	Fluid Mechanics- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3ME10	Machine Drawing- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			17	1	8	26	20	--	--	--	500	--	--	--	200	--
Grand Total															700	

Note: **The Examination of the Subject Environmental Studies shall be conducted in IV Semester as per Direction No. 20/2021.

SEMESTER : FOURTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	4ME01	Material Science	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	4ME02	Energy Conversion - I	3	1	--	4	4	3	80	20	100	40	--	--	--	--
03	4ME03	Manufacturing Technology	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	4ME04	Basic Electrical Drives & Control	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4ME05	Hydraulic & Pneumatic Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Studies	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	4ME07	Material Science-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4ME08	Manufacturing Technology-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4ME09	Basic Electrical Drives & Control -lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4ME10	Hydraulic & Pneumatic Systems-lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			17	1	8	26	22	--	--	--	600	--	--	--	200	--
Total															800	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester as per Direction No. 20/2021.

SEMESTER : FIFTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	5ME01	Heat Transfer	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	5ME02	Metrology & Quality Control	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5ME03	Kinematics of Machines	3	1	--	4	4	3	80	20	100	40	--	--	--	--
04	5ME04	Measurement Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5ME05	Open Elective 6 I (OE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	5ME06	Heat Transfer- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5ME07	Metrology & Quality Control- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5ME08	Kinematics of Machines- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5ME09	Measurement Systems lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			15	1	8	24	20	--	--	--	500	--	--	--	200	--
Grand Total															700	

Open Elective – I (For other Disciplines) : (i) Production Management (ii) Manufacturing Techniques

An Orientation Program of 15 Hours duration / MOOCs on Advanced Courses like Machine learning, 3-D Printing, Virtual Reality, Supply Chain Management, Numerical Computation for Mechanical Engineers, Bio-mechanics, Fundamentals of nano-Engineering, Micro-Electro Mechanical Systems, Nano-to-Macro Transport Processes, Fundamentals of Photo Voltaics, Machine Tools etc. be offered during V semester.

Open Elective-I to be opted from the University's faculty of Engineering & Technology offered inter-disciplinary courses or MOOCs courses pertaining to the Engineering Profession.

SEMESTER : SIXTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	6ME01	Design of Machine Elements	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	6ME02	Dynamics of Machines	3	1	--	4	4	3	80	20	100	40	--	--	--	--
03	6ME03	Control System Engineering	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6ME04	Prof. Elective - I	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6ME05	Open Elective - II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6ME06	Design of Machine Elements- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6ME07	Dynamics of Machines- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6ME08	Prof. Elective - I - lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6ME09	Research Skills - lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			15	1	8	24	20	--	--	--	500	--	--	--	200	--
Grand Total														700		

An Orientation Program of 15 Hours duration / MOOCs on Entrepreneurship Development to be offered during VI Semester.

6ME04: Prof. Elect. (I) : (i) Tool Engineering (ii) Non- Conventional Energy Sources (iii) Computer Aided Design & Simulation

6ME05: Open Elect. (II) [For other Disciplines] : (i) Non- Conventional Energy Sources (ii) Automobile Engineering

Open Elective-II to be opted from the University's faculty of Engineering & Technology offered inter-disciplinary courses or MOOCs courses pertaining to the Engineering Profession.

SEMESTER : SEVENTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	7ME01	Mechatronics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7ME02	Productivity Techniques	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7ME03	Industrial Management & Costing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	7ME04	Energy Conversion - II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7ME05	Professional Elective- II	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	7ME06	Mechatronics- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7ME07	Energy Conversion ó II- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7ME08	Professional Elective- II ó lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	7ME09	Technical Seminar & Project	--	--	8	8	4	--	--	--	--	--	50	--	50	25
Total			15	0	14	29	22	--	--	--	500	--	--	--	200	--
Grand Total															700	
	7ME05: Prof. Elect.-II : (i) Computer Integrated Manufacturing (ii) Robotics (iii) Artificial Intelligence															

SEMESTER : EIGHT																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	8ME01	Operation Research Techniques	3	--		3	3	3	80	20	100	40	--	--	--	--
02	8ME02	I.C. Engines	3	--		3	3	3	80	20	100	40	--	--	--	--
03	8ME03	Professional Elective-III	3	--		3	3	3	80	20	100	40	--	--	--	--
04	8ME04	Professional Elective- IV	3	--		3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8ME05	I.C. Engines- lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
06	8ME06	Prof. Elective-IV ólab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	8ME07	Project	--	--	12	12	6						75	75	150	75
Total			12	--	16	28	20	--	--	--	400	--	--	--	250	--
Grand Total															650	
	8ME03 Prof. Elect. –III : (i) Automobile Engineering (ii) Production Planning & Control (iii) Product Design															
	8ME04 : Prof. Elect. IV: (i) Design of Transmission Systems (ii) Refrigeration & Air Conditioning (iii) Finite Element Analysis															

Four Year Degree Course in Bachelor of Engineering Branch: **COMPUTER SCIENCE & ENGINEERING**
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3KS01	Mathematics-III	3	1	--	4	4	3	80	20	100	40	--	--	--	--
02	3KS02	Discrete Structure & Graph Theory	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3KS03	Object Oriented Programming	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3KS04	Data Structures	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3KS05	Analog & Digital Electronics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	Environmental Studies *	2	--	--	2	0	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3KS06	Object Oriented Programming Jawa-Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3KS07	Data Structures Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3KS08	Analog & Digital Electronics Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3KS09	C Skill-Lab I (#)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			17	1	8	26	20	--	--	--	500	--	--	--	200	--
Total															700	

Note: **The Examination of the Subject Environmental Science shall be conducted in IV Semester as per Direction No. 20/2021.

C Skill Lab I - based on technology like **-Python/Django** etc. to be decided by Individual Dept. of respective College.

SEMESTER : FOURTH

Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	4KS01	Artificial Intelligence	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	4KS02	Data Communication & Networking	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	4KS03	Operating System	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	4KS04	Microprocessor & Assembly Lang. Prog.	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4KS05	Theory of Computation	3	1	--	4	4	3	80	20	100	40	--	--	--	--
06	4ES06	Environmental Studies *	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	4KS06	Data Communication & Networking Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4KS07	Operating System Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4KS08	Microprocessor & Assembly Lang. Prog. Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4KS09	C Skill-Lab II (#)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			17	1	8	26	22	--	--	--	600	--	--	--	200	--
Total															800	

Note: ****The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester as per Direction No. 20/2021.**

C Skill Lab II - based on technology like -**PHP, Web Technology, Raspberry Pi/Ardino**, etc. to be decided by Individual Dept. of respective College.

SEMESTER : FIFTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	5KS01	Database Management Systems	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	5KS02	Compiler Design	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5KS03	Computer Architecture & Organization	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	5KS04	Professional Elective 6I (PE-I) *	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5KS05	Open Elective 6 I (OE-I) **	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	5KS06	Database Management Systems - Lab (@)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5KS07	Compiler Design Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5KS08	Emerging Tech. Lab-I	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5KS09	C Skill Lab III (*)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			16	0	8	24	20	--	--	--	500	--	--	--	200	--
Total															700	
Prof. Elect I (*) : i) Cognitive Technologies (ii) Data Science and Statistics (iii)Internet of Things (iv)Introduction to Cyber Security Open Elect : I (**) (i) Fund. of Fin. & Acctg. (ii) Prin. of Marketing for Engg. (iii)Entrepreneurship * C Skill Lab III - based on technology like - Angular & React, Express, Node.js etc. to be decided by Individual Dept. of respective College (@ Practicals using Mongo DB,MySQL Emerging Technology Lab# I : AI : IBM Watson, Microsoft Cognitive Toolkit , Tensor Flow, Apache System ML, Caffe, Open NN, Torch, Neuroph DS : R, Python, Cassandra, Apache Hadoop IoT : Arduino, DeviceHive, Kaa, Home Assistant CS : Kali Linux, Open VPN, NMAP, Metasploit Framework An Orientation Program of 15 hours duration /MOOC on Indian Constitution to be offered to the students during the Vth Semester Open Elective I to be opted from the courses offered by other engineering technology boards of the university /Massive Open learning Courses (MOOC) such as SWAYAM pertaining to the profession																

SEMESTER : SIXTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	6KS01	Security Policy & Governance	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	6KS02	Design & Analysis of Algorithms	4	--	--	4	4	3	80	20	100	40	--	--	--	--
03	6KS03	Software Engg.	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6KS04	Prof. Elective -II (PE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6KS05	Open Elective - II (OE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6KS06	Design & Analysis of Algorithms- Lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6KS07	Software Engg. 6 lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6KS08	Emerging Tech. Lab-II	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6KS09	C Skill Lab IV (*)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
Total			16	0	8	24	20	--	--	--	500	--	--	--	200	--
Total															700	

Prof. Elect II (*) : i) Natural Language Processing
(ii) Big Data Analytics
(iii)Sensors & Actuators
iv) Cryptography

Open Elect : II (**) (i) Computational Biology
(ii) Cyber Law & Ethics
(iii) Intellectual Property Right

FOSS Tools & Technology for Practicals :
Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, Text Blob
KNIME, Spark, Neo4J, MongoDB, Hive, Storm
Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring
VeraCrypt, ModSecurity, AdBlocker, CheckShortURL, SPAMfighter, SpamBully

* C Skill Lab IV - based on technology like - DevOp to be decided by Individual Dept. of respective College
An Orientation Program of 15 hours duration /MOOC on Indian Constitution to be offered to the students during the Vth Semester .
Open Elective II to be opted from the courses offered by other engineering technology boards of the university /Massive Open learning Courses (MOOC) such as SWAYAM pertaining to the profession

SEMESTER : SEVENTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	7KS01	Social Science & Engineering Economics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7KS02	Computer Graphics	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7KS03	Cloud Computing	4	--	--	4	4	3	80	20	100	40	--	--	--	--
04	7KS04	Prof. Elective - III (PE-III) (*)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7KS05	Prof. Elect.- IV (PE-IV) (**)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	7KS06	Computer Graphics- Lab.	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7KS07	Emerging Tech. Lab-III	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7KS08	Emerging Tech. Lab-IV	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	7KS09	** Project & Seminar	--	--	8	8	4	--	--	--	--	--	--	50	50	25
Total			16	0	14	30	23	--	--	--	500	--	--	--	200	--
Total															700	

Prof. Elect III (*) :
 (i) Robotics
 (ii) Data Warehousing & Mining
 (iii) Embedded Systems
 iv) Digital Forensic

Prof. Elect : IV ()**
 (i) Block Chain Fundamentals
 (ii) Image Processing
 (iii) Optimization Techniques

Emerging Technology Lab# V :
 Ethereum,Bigchain DB, Corda
 OpenCV, Simple CV, Keras, Caffe
 Open Eaagles, Repast, Open Simulator

SEMESTER : EIGHT																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	8KS01	Object Oriented Analysis & Design	3	--		3	3	3	80	20	100	40	--	--	--	--
02	8KS02	Professional Ethics & Management	3	--		3	3	3	80	20	100	40	--	--	--	--
03	8KS03	Prof. Elective-V (PE-V)	3	--		3	3	3	80	20	100	40	--	--	--	--
04	8KS04	Prof. Elective-VI (PE-VI)	3	--		3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
05	8KS05	Emerging Tech. Lab-V	--	--	2	2	1	--	--	--	--	--	25	25	50	25
06	8KS02	Emerging Tech. Lab-VI	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	8KS03	Project & Seminar	--	--	12	12	6	--	--	--	--	--	75	75	150	75
Total			12	--	16	28	20	--	--	--	400	--	--	--	250	--
Total															650	

Prof. Elect V (*) : (i) Virtual & Augmented Reality
(ii) Machine Learning and AI
(iii) Wireless Sensor Networks
iv) System & Software Security

Prof. Elect : VI ()** (i) Distributed Ledger Technology
(ii) Multimedia Computing
(iii) Modeling & Simulation

Emerging Tech. Lab# V : i)Google's ARCore, AR.js, ARToolKit, , **Emerging Tech. Lab# VI :** i) Hyperledger, HydraChain, MultiChain, Elements
DroidAR Brio, Adobe Aero
ii) R Studio, Orange, D3.js, Ggplot2, Jupyter Notebooks
iii) Wireshark, Burp Suit, Nessus

ii) Google Colab, GPUImage, Cuda, Aforge/Accord.NET
iii) OR-Tools, Locust.io, httpperf, Apache JMeter, Siege

L : Theory Lecture
T : Tutorial
P : Practical
D : Drawing / Design

FOUR YEAR DEGREE COURSE IN BACHELOR OF TECHNOLOGY
BRANCH: **CHEMICAL ENGINEERING**
CREDIT GRADE SYSTEM
SEMESTER PATTERN
SEMESTER : FOURTH

Sr. No	Category	Subject Code	Subject	Teaching Scheme					Examination Scheme									
				L	T	P/D	Total Hours/week	Credits	Duration of Papers (Hrs.)	Maximum Marks		Total	Min. Pass Marks	Max. Marks Practical		Total Marks	Maximum Passing Marks	
										Theory Paper	College Assessment			External	Internal			
1	Engineering Science Course	4CH01	Physical Chemistry	3	-	-	3	3	3	80	20	100	40	---	---	---	---	
2	Engineering Science Course	4CH02	Machine Design & Drawing	3	-	-	3	3	3	80	20	100	40	---	---	---	---	
3	Professional Core Course	4CH03	Fluid Flow Operation	3	-	-	3	3	3	80	20	100	40	---	---	---	---	
4	Professional Core Course	4CH04	Chemical Engg. Thermodynamics-II	3	-	-	3	3	3	80	20	100	40	---	---	---	---	
5	Professional Core Course	4CH05	Chem. Engg. Operation of I (Mech. Operation)	3	-	-	3	3	3	80	20	100	40	---	---	---	---	
6	Humanities & Social Science	4ES06	Environmental Studies	2	-	-	2	2	3	80	20	100	40	---	---	---	---	
7	Engineering Science Course	4CH07	Physical Chemistry-Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25	
8	Professional Core Course	4CH08	Fluid Flow Operation-Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25	
9	Professional Core Course	4CH09	Chem. Engg. Thermo.-II of Lab.	-	-	2	2	1	---	---	---	---	---	25	25	50	25	
10	Professional Core Course	4CH10	Chem. Engg. Operation of I (Mech. Operation)- Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25	
Total				17	-	08	25	21				600				200		
Grand Total												600					200	800
Note of (i) Environmental Science as per Direction No. 20/2021. (ii) For subject 4CH02 Machine Design & Drawing, Students are expected to submit minimum 5 drawing sheets.																		

L : Theory Lecture
T : Tutorial
P : Practical
D : Drawing / Design

FOUR YEAR DEGREE COURSE IN BACHELOR OF TECHNOLOGY
BRANCH: CHEMICAL ENGINEERING
CREDIT GRADE SYSTEM
SEMESTER PATTERN
SEMESTER : FIFTH

Sr N o.	Category	Subject Code	Subject	Teaching Scheme					Examination Scheme								
				L	T	P/D	Total Hour/ week	Credits	Duration of Papers (Hrs.)	Maximum Marks		Total	Min. Pass Marks	Max. Marks Practical		Total Mark s	Maximum Passing Marks
										Theory Paper	College Assessment			External	Internal		
1	Professional Core Course	5 CH 01	Heat Transfer	3	1	-	4	4	3	80	20	100	40	---	---	---	---
2	Professional Core Course	5 CH 02	Chem. Engg. Process-I (Inorganic Chemical Technology)	3	1	-	4	4	3	80	20	100	40	---	---	---	---
3	Professional Core Course	5 CH 03	Material Science & Engineering	4	-	-	4	4	3	80	20	100	40	---	---	---	---
4	Professional Core Course	5 CH 04	Professional Elective-I	3	-	-	3	3	3	80	20	100	40	---	---	---	---
5	Professional Elective Course	5 CH 05	Open Elective- I	3	-	-	3	3	3	80	20	100	40	---	---	---	---
6	Professional Core Course	5 CH 06	Heat Transfer- Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
7	Professional Core Course	5 CH 07	Material Science & Engineering Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
Total				16	2	4	22	20				500				100	
Grand Total												500				100	600

NOTES:

1. An Orientation Program / MOOC Courses of 15 hours duration on **Indian Constitution** to be offered to the students during the Fifth Semester.
2. Students have to select the **Open elective-I** from the other disciplines, offered by other departments or specialize expertise available in the institute.
3. List of **Open Elective-I** offered by Chemical Engineering Department:

A) **Risk & Safety Management**

4. List of **Professional Elective-I** :

- a) Air Pollution Control
- b) Economics and Management

Polymer Science and Technology Subject can be opt by students from chemical engineering and all other engineering discipline ó **Offered by expertise from Polymer Technology**

L : Theory Lecture T : Tutorial P : Practical D : Drawing / Design	FOUR YEAR DEGREE COURSE IN BACHELOR OF TECHNOLOGY BRANCH: CHEMICAL ENGINEERING CREDIT GRADE SYSTEM SEMESTER PATTERN SEMESTER : SIXTH
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Sr. N o.	Category	Subject Code	Subject	Teaching Scheme					Examination Scheme								
				L	T	P/ D	Total Hours /week	Cre dits	Duration of Papers (Hrs.)	Maximum Marks		Total	Min. Pass Marks	Max. Marks Practical		Total Marks	Maximum Passing Marks
										Theory Paper	College Assessment			External	Internal		
1	Professional Core Course	6 CH 01	Chemical Engg. Operation-II (Mass Transfer-I)	3	1	-	4	4	3	80	20	100	40	---	---	---	---
2	Professional Core Course	6 CH 02	Chemical Engg Process óII (Organic Chemical Technology)	3	-	-	3	3	3	80	20	100	40	---	---	---	---
3	Professional Core Course	6 CH 03	Computer Programming & Application	3	1	-	4	4	3	80	20	100	40	---	---	---	---
4	Professional Core Course	6 CH 04	Professional Elective- II	3	-	-	3	3	3	80	20	100	40	---	---	---	---
5	Professional Elective Course	6 CH 05	Open Elective - II	3	-	-	3	3	3	80	20	100	40	---	---	---	---
6	Professional Core Course	6 CH 06	Chemical Engg. Operation-II (Mass Transfer)- I Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
7	Professional Core Course	6 CH 07	Computer Programming & Application-Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
8	Project	6 CH 08	Minor Project/Skill Laboratory /Innov. Lab.	-	-	2	2	1	---	---	---	---	---	25	25	50	25
Total				15	2	6	23	20				500				150	
Grand Total												500				150	650

NOTES:

1. Orientation Program / MOOC Courses of 15 hours duration on '**Indian Traditional Knowledge**' to be offered to the students during the Sixth Semester

2. Students have to select the Open elective-II from the other disciplines, offered by other departments or specialize expertise available in the Institute.

3. **List of Open Electives-II** offered by Chemical Engineering Department :

A) Renewable Energy Sources

B) Composite Technology –

- Composite Technology – Subject can be opt by students from chemical engineering and all other engineering descipline- Which **Offered by expertise from Polymer Technology.**

4. **List of Professional Elective-II :**

(a) Process equipment Design and Drawing

(b) Fuel Technology

L : Theory Lecture T : Tutorial P : Practical D : Drawing / Design	FOUR YEAR DEGREE COURSE IN BACHELOR OF TECHNOLOGY BRANCH: CHEMICAL ENGINEERING CREDIT GRADE SYSTEM SEMESTER PATTERN SEMESTER : SEVENTH
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Sr. No.	Category	Subject Code	Subject	Teaching Scheme					Emamination Scheme								
				L	T	P/ D	Total Hours/ Week	Credits	Duration of Papers (Hrs.)	Maximum Marks		Total	Min. Pass Marks	Max.Marks Practical		Total Marks	Maximum Passing Marks
										Theory Paper	College Assessment			External	Internal		
1	Professional Core Course	7 CH 01	Chemical Engg Operation ó III (Mass Transfer- II)	3	-	-	3	3	3	80	20	100	40	---	---	---	---
2	Professional Core Course	7 CH 02	Chem. Reaction Engineering ó I	3	-	-	3	3	3	80	20	100	40	---	---	---	---
3	Professional Core Course	7 CH 03	Process Dynamics & Control	3	-	-	3	3	3	80	20	100	40	---	---	---	---
4	Professional Core Course	7 CH 04	Plant Design & Process Engg.	3	-	-	3	3	3	80	20	100	40	---	---	---	---
5	Professional Elective Course	7 CH 05	Professional Elective ó 3	3	-	-	3	3	3	80	20	100	40	---	---	---	---
6	Professional Core Course	7 CH 06	Chemical Engg Operation ó III (Mass Transfer- II)-Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
7	Professional Core Course	7 CH 07	Chem. Reaction Engineering ó I- Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
8	Professional Core Course	7 CH 08	Process Dynamics & Control	-	-	2	2	1	---	---	---	---	---	25	25	50	25
9	Professional Elective	7 CH 09	Professional Elective-III Lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
10	Project	7 CH 10	Project & Seminar			8	8	4	---	---	---	---	---	-	50	50	25
Total				15	-	16	31	23				500				250	
Grand Total												500				250	750

NOTE 1: For Professional Elective -III

- The Elective course will be offered as per the availability of the faculty with College /institute & only if the number of students opting for such elective are higher.

7CH05: PROFESSIONAL ELECTIVE –III :

1. Industrial Waste Treatment
2. New Separation Techniques
3. Optimization of chemical Process
4. Smart Materials.

NOTE 2: For Industrial Training/ Internship :

During the course of study from III to VII semester each student is expected to undertake a minimum of two industrial visits and undertake a minimum of two weeks of industry/ field training/Internship. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of VII semester.

L : Theory Lecture T : Tutorial P : Practical D : Drawing / Design	FOUR YEAR DEGREE COURSE IN BACHELOR OF TECHNOLOGY BRANCH: CHEMICAL ENGINEERING CREDIT GRADE SYSTEM SEMESTER PATTERN SEMESTER : EIGHTH
---	--

Sr. No.	Category	Subject Code	Subject	Teaching Scheme					Examination Scheme								
				L	T	P/D	Total Hours/ week	Credits	Duration of Papers (Hrs.)	Maximum Marks		Total	Min. Pass Marks	Max. Marks Practical		Total Marks	Maximum Passing Marks
										Theory Paper	College Assessment			External	Internal		
1	Professional Core Course	8 CH 01	Transport Phenomenon	3	-	-	3	3	3	80	20	100	40	---	---	---	---
2	Professional Core Course	8 CH 02	Chem. Reaction Engineering - II	3	-	-	3	3	3	80	20	100	40	---	---	---	---
3	Professional Core e Course	8 CH 03	System Modelling	3	-	-	3	3	3	80	20	100	40	---	---	---	---
4	Professional Elective Course-II	8 CH 04	Professional Elective ó IV	3	-	-	3	3	3	80	20	100	40	---	---	---	---
5	Professional Elective Course	8 CH 05	Professional Elective ó IV Lab.	-	-	2	2	1	---	---	---	---	---	25	25	50	25
6	Professional core Course	8CH06	Chem. Reaction Engineering-II lab	-	-	2	2	1	---	---	---	---	---	25	25	50	25
7	Professional Elective Course	8 CH 07	Project & Seminar	-	-	12	12	6	---	---	---	---	---	75	75	150	75
Total				12	-	16	28	20				400				250	
Grand Total												400				250	650

Note: The Elective will be offered as per the availability of the faculty with the college /Institute & only if the number of student opting for such elective are minimum thirty.

8CH04 PROF. ELECTIVE –IV

1.Petrochemical Technology

2. Industrial Piping

3.Energy & Environment Enginneing

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SANT GADGE BABA AMRAVATI UNIVERSITY

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	: Enrolment of Students.
Ordinance No. 2	: Admission of Students
Ordinance No. 4	: National cadet corps
Ordinance No. 6	: Examinations in General (relevant extracts)
Ordinance No. 18/2001	: An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001.
Ordinance No. 9	: Conduct of Examinations (relevant extracts)
Ordinance No. 10	: Providing for Exemptions and Compartments
Ordinance No. 19	: Admission of Candidates to Degrees.

Ordinance No. 109	: Recording of a change of name of a University student in the records of the University.
Ordinance No. 5/2010	: For improvement of Division/Grade.
Ordinance No.19/2001	: An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dineshkumar Joshi

Registrar

Sant Gadge Baba Amravati University

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be broadly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

DIRECTION

No. 31/2011

Date : 10-06-2011

Subject :- Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology.

Whereas faculty of Engineering & Technology in its meeting held on 6th June, 2011 vide Item No.39 accepted and recommended schemes of teaching & examinations of semesters III to VIII/X as per Credit Grade System of various branches in the faculty of Engineering & Technology for its implementation from the session 2011-2012 in phase wise manner,

AND

Whereas the schemes of teaching & examinations of semesters III to VIII/X as per Credit Grade System of various branches in the faculty of Engineering & Technology were accepted by the Hon'ble Vice Chancellor u/s Section 14(7) of M.U.Act, 1994 on behalf on Academic Council on 9th April, 2011,

AND

Whereas these schemes of teaching & examinations of various branches as per Credit Grade System in the faculty of Engineering & Technology are required to be regulated by the Regulation,

AND

Whereas the process of making the Regulation is likely to take some time,

AND

Whereas the schemes of various branches as per Credit Grade System in the faculty of Engineering & Technology are to be implemented from the academic session 2011-2012,

AND

Whereas syllabi of various branches in the faculty of Engineering & Technology are to be sent for printing,

Now, therefore, I, Dr.Mohan K.Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers conferred upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994 hereby direct as under :-

- 1) This Direction shall be called "Schemes of teaching & examinations of III to VIII/X Semesters as per Credit Grade System of various branches in the faculty of Engineering & Technology, Direction, 2011".
- 2) This Direction shall come into force from the date of its issuance.
- 3) Schemes of teaching and examinations of III to VIII/X semesters as per Credit Grade System of the following branches shall be as per respective Appendices appended with this Direction :-

BRANCH**Appendix No.**

1) Civil Engineering	A
2) Mechanical Engineering	B
3) Production Engineering	C
4) Electrical Engineering (Electronics & Power)	D
5) Electrical and Electronics Engineering	E
6) Electrical Engineering (Electrical & Power)	F
7) Electrical Engineering	G
8) Electronics & Telecommunications Engineering	H
9) Electronics Engineering	I
10) Instrumentation Engineering	J
11) Computer Science & Engineering	K
12) Computer Engineering	L
13) Architecture	M
14) Textile Engineering	N
15) Chemical Engineering	O
16) Chemical Technology (Polymer) (Plastic) Technology	P
17) Chemical Technology (Food, Pulp & Paper, Oil & Paint and Petrochemical Technology)	Q
18) Information Technology	R
19) Biomedical Engineering	S

sd/-

Dr.Mohan K.Khedkar
Vice Chancellor

Appendix - A

			TEACHING SCHEME				EXAMINATION SCHEME									
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
													EXTERNAL	INTERNAL		
THEORY																
01	7CE01	Theory of Structures-II	3	1	-	4	4	3	80	20	100	40	-	-	-	-
02	7CE02	Geotechnical Engineering-II	3	1	-	4	4	3	80	20	100	40	-	-	-	-
03	7CE03	Structural Design-II	4	-	-	4	4	4	80	20	100	40	-	-	-	-
04	7CE04	Environmental Engineering-I	4	-	-	4	4	3	80	20	100	40	-	-	-	-
05	7CE05	Professional Elective-I	4	-	-	4	4	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
06	7CE06	Theory of Structures-II - Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
07	7CE07	Geotechnical Engineering-II - Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	7CE08	Structural Design-II - Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	7CE09	Project & Seminar	-	-	2	2	4	-	-	-	-	-	-	50	50	25
Total			18	2	8	28	27	500					200			
GRAND TOTAL : 700																
Professional Elective-I (i) Advanced Water Treatment (ii) Advanced Geotechnical Engineering (iii) Water Power Engineering (iv) Prestressed Concrete (v) Artificial Neural Network & Fuzzy Logic (vi) Advanced Concrete Technology (vii) Environmental Pollution & Rural Sanitation (viii) Advanced Earthquake Engineering																
SEMESTER : EIGHTH																
THEORY																
01	8CE01	Water Resources Engineering-II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
02	8CE02	Environmental Engineering-II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
03	8CE03	Project Planning & Management	3	-	-	3	3	3	80	20	100	40	-	-	-	-
04	8CE04	Professional Elective-II	4	-	-	4	4	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
05	8CE05	Water Resources Engineering-II-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
06	8CE06	Environmental Engineering-II - Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
07	8CE07	Project & Seminar	-	-	6	6	12	-	-	-	-	-	75	75	150	75
Total			13		10	23	27	400					250			
GRAND TOTAL : 650																
Professional Elective-II *(i) Advanced Design of Steel Structures (ii) Advanced Waste Water and Industrial Waste Treatment (iii) Finite Element Method (iv) Dam Engineering (v) Advanced Engineering Geology (vi) Matrix Computer Analysis of Structures (vii) Advanced Structural Analysis (viii) Rock Mechanics *(ix) Advanced Design of RCC Structures * PAPER 4 HOURS DURATION.																

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH - MECHANICAL ENGINEERING -SEMESTER PATTERN(CREDIT GRADE SYSTEM)

SEMESTER- SEVENTH

Appendix - B

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D			Duration of Paper (Hrs.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													External	Internal		
THEORY																
01	7ME01	Machine Design & Drawing-II	3	-	-	3	3	4	80	20	100	40	-	-	-	-
02	7ME02	Energy Conversion-II	3	1	-	4	4	3	80	20	100	40	-	-	-	-
03	7ME03	Industrial Management and Costing	3	1	-	4	4	3	80	20	100	40	-	-	-	-
04	7ME04	Automation Engineering	3	1	-	4	4	3	80	20	100	40	-	-	-	-
05	7ME05	Professional Elective-I	3	1	-	4	4	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
06	7ME06	Project & Seminar	-	-	2	2	4	-	-	-	-	-	-	50	50	25
07	7ME07	Machine Design & Drawing-II-Lab.	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	7ME08	Energy Conversion-II-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
09	7ME09	Automation Engineering-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
10	7ME10	Professional Elective-I - Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
Total			15	4	10	29	27	500					250			
GRAND TOTAL : 750																

Professional Elective-I (1) Non Conventional Energy System (2) Tool Engineering (3) Artificial Intelligence & Expert Systems (4) Mechatronics

Professional Elective - I (1) Non Conventional Energy System (2) For Engineering (3) Artificial Intelligence & Expert Systems (4) Mechanisms																
SEMESTER : EIGHTH																
THEORY																
01	8ME01	Elective-II	3	-	-	3	3	3	80	20	100	40	-	-	-	-
02	8ME02	Elective-III	3	-	-	3	3	3	80	20	100	40	-	-	-	-
03	8ME03	I.C. Engines	3	-	-	3	3	3	80	20	100	40	-	-	-	-
04	8ME04	Operations Research Techniques	3	-	-	3	3	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
05	8ME05	Project & Seminar	-	-	6	6	12	-	-	-	-	-	75	75	150	75
06	8ME06	Professional Elective-III-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
07	8ME07	I.C. Engines-Lab	-	-	2	2	1	-	-	-	-	-	25	25	50	25
08	8ME08	Operations Research Techniques-Lab	-	-	2	2	2	-	-	-	-	-	25	25	50	25
Total			12	-	12	24	27	400					300			
GRAND TOTAL : 700																

Professional Elective-II (1) Automobile Engineering (2) Production Planning & Control (3) Management Information Systems (4) Advanced Manufacturing Systems
Professional Elective-III 1) Refrigeration & Air Conditioning 2) Machine Tool Design 3) Finite Element Methods 4) Robotics

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING

BRANCH- ELECTRICAL ENGINEERING(ELECTRONICS & POWER)- SEMESTER PATTERN(CREDIT GRADE SYSTEM)

SEMESTER- SEVENTH

Appendix - C

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
													EXTERNAL	INTERNAL		
THEORY																
01	7EP01	Control System II	4	–	–	4	4	3	80	20	100	40	–	–	–	–
02	7EP02	Power System Operation & Control	4	–	–	4	4	3	80	20	100	40	–	–	–	–
03	7EP03	Electrical Power - II	4	–	–	4	4	3	80	20	100	40	–	–	–	–
04	7EP04	Switchgear & Protection	4	–	–	4	4	3	80	20	100	40	–	–	–	–
05	7EP05	Professional Elective - I *	4	–	–	4	4	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
06	7EP06	Project & Seminar	–	–	2	2	4	–	–	–	–	–	0	50	50	25
07	7EP07	Electrical Power - II- Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
08	7EP08	Switchgear & Protection- Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
		TOTAL	20	–	6	26	26				500				150	

TOTAL 650

* Professional Elective - I 1] Process Control System 2] Computer organisation 3] Computer Methods in Power System Analysis 4] Artificial Intelligence

SEMESTER- EIGHTH																
THEORY																
01	8EP01	Power System Stability	3	–	–	3	3	3	80	20	100	40	–	–	–	–
02	8EP02	High Voltage Engineering	4	–	–	4	4	3	80	20	100	40	–	–	–	–
03	8EP03	Digital Signal Processing	4	–	–	4	4	3	80	20	100	40	–	–	–	–
04	8EP04	Professional Elective - II**	3	–	–	3	3	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
05	8EP05	Project & Seminar	–	–	6	6	12	–	–	–	–	–	75	75	150	25
06	8EP06	Digital Signal Processing- Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
		TOTAL	14	0	8	22	27				400				200	

TOTAL 600

** Professional Elective - II 1] Electric Drives & Control 2] Power Quality 3] Embedded Systems 4] Generalised Machine Theory

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH- ELECTRICAL & ELECTRONICS ENGINEERING -SEMESTER PATTERN(CREDIT GRADE SYSTEM)

SEMESTER- SEVENTH

Appendix - D

			TEACHING SCHEME					EXAMINATION SCHEME										
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL					
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D			Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks		
													External	Internal				
THEORY																		
01	7EX01	Utilisation of Electrical Energy	4	–	–	4	4	3	80	20	100	40	–	–	–	–		
02	7EX02	Electronic Communication	4	–	–	4	4	3	80	20	100	40	–	–	–	–		
03	7EX03	Computer Organisation	4	–	–	4	4	3	80	20	100	40	–	–	–	–		
04	7EX04	Power Electronics - II	4	–	–	4	4	3	80	20	100	40	–	–	–	–		
05	7EX05	Professional Elective - I *	4	–	–	4	4	3	80	20	100	40	–	–	–	–		
PRACTICALS / DRAWING / DESIGN																		
06	7EX06	Project & Seminar	–	–	2	2	4	–	–	–	–	–	–	50	50	25		
07	7EX07	Utilisation of Electrical Energy-Lab.	–	–	2	2	1	–	–	–	–	–	25	25	50	25		
08	7EX08	Computer Organisation-Lab.	–	–	2	2	1	–	–	–	–	–	25	25	50	25		
09	7EX09	Power Electronics - II-Lab.	–	–	2	2	1	–	–	–	–	–	25	25	50	25		
		TOTAL	20	–	8	28	27				500				200			
															TOTAL			700

* Professional Elective - I 1) Process Control System 2) Power System Simulation 3) High Voltage Engineering 4) Wind Electrical Systems

SEMESTER : EIGHTH																
THEORY																
01	8EX01	Power System Operation & Control	3	—	—	3	3	3	80	20	100	40	—	—	—	—
02	8EX02	Switchgear & Protection	3	—	—	3	3	3	80	20	100	40	—	—	—	—
03	8EX03	Embedded Systems	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	8EX04	Professional Elective - II**	4	—	—	4	4	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
05	8EX05	Project & Seminar	—	—	6	6	12	—	—	—	—	—	75	75	150	25
06	8EX06	Embedded Systems-Lab.	—	—	2	2	1	—	—	—	—	—	25	25	50	25
		TOTAL	14	—	8	22	27				400				200	
															TOTAL	600

** Professional Elective - II 1) Power System Management 2) Fuzzy Logic & Control 3) RPC & Facts Controller 4) Power Quality

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH- ELECTRICAL ENGINEERING (ELECTRICAL & POWER)-SEMESTER PATTERN(CREDIT GRADE SYSTEM)

Appendis - E

SEMESTER- SEVENTH

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
													EXTERNAL	INTERNAL		
THEORY																
01	7EL01	Control System II	4	—	—	4	4	3	80	20	100	40	—	—	—	—
02	7EL02	Power System Operation & Control	4	—	—	4	4	3	80	20	100	40	—	—	—	—
03	7EL03	Electrical Power - II	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	7EL04	Switchgear & Protection	4	—	—	4	4	3	80	20	100	40	—	—	—	—
05	7EL05	Professional Elective - I *	4	—	—	4	4	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
06	7EL06	Project & Seminar	—	—	2	2	4	—	—	—	—	—	0	50	50	25
07	7EL07	Electrical Power - II-Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
08	7EL08	Switchgear & Protection-Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
		TOTAL	20	—	6	26	26				500				150	
TOTAL															650	

* Professional Elective - I 1] Process Control System 2] Wind Electric Systems 3] Computer Methods in Power System Analysis 4] Artificial Intelligence

THEORY								Semester : Eighth									
01	8EL01	Power System Stability	3	—	—	3	3	3	80	20	100	40	—	—	—	—	
02	8EL02	High Voltage Engineering	4	—	—	4	4	3	80	20	100	40	—	—	—	—	
03	8EL03	Digital Signal Processing	4	—	—	4	4	3	80	20	100	40	—	—	—	—	
04	8EL04	Professional Elective - II**	3	—	—	3	3	3	80	20	100	40	—	—	—	—	
PRACTICALS / DRAWING / DESIGN																	
05	8EL05	Project & Seminar	—	—	6	6	12	—	—	—	—	—	75	75	150	25	
06	8EL06	Digital Signal Processing Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25	
		TOTAL	14	—	8	22	27			400				200			
															TOTAL		600

** Professional Elective - II 1] Electric Drives & Control 2] Power Quality 3] Power System Management 4] Generalised Machine Theory

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH : ELECTRICAL ENGINEERING - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

SEMESTER - SEVENTH

Appendix - F

			TEACHING SCHEME					EXAMINATION SCHEME									
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL				
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D			Duration of Paper (Hr.)	Max. Marks Theory Paper	Max. Marks College Assessment	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks	
													External	Internal			
THEORY																	
01	7EE01	Control System II	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
02	7EE02	Power System Operation & Control	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
03	7EE03	Electrical Power - II	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
04	7EE04	Switchgear & Protection	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
05	7EE05	Professional Elective - I *	4	–	–	4	4	3	80	20	100	40	–	–	–	–	
PRACTICALS / DRAWING / DESIGN																	
06	7EE06	Project & Seminar	–	–	2	2	4	–	–	–	–	–	0	50	50	25	
07	7EE07	Electrical Power - II -Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
08	7EE08	Switchgear & Protection -Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25	
		TOTAL	20	–	6	26	26				500				150		
															TOTAL		650

* Professional Elective - I 1] Process Control System 2] Wind Electrical Systems 3] Computer Methods in Power System Analysis 4] Artificial Intelligence

Semester : Eighth																
THEORY																
01	8EE01	Power System Stability	3	—	—	3	3	3	80	20	100	40	—	—	—	—
02	8EE02	High Voltage Engineering	4	—	—	4	4	3	80	20	100	40	—	—	—	—
03	8EE03	Digital Signal Processing	4	—	—	4	4	3	80	20	100	40	—	—	—	—
04	8EE04	Professional Elective - II**	3	—	—	3	3	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
05	8EE05	Project & Seminar	—	—	6	6	12	—	—	—	—	—	75	75	150	25
06	8EE06	Digital Signal Processing -Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
		TOTAL	14	—	8	22	27				400				200	
															TOTAL	600

** Professional Elective - II 1] Electric Drives & Control 2] Power Quality 3] Power System Management 4] Generalised Machine Theory

Appendix - G

Note: Consider one hour Lecture / Tutorial and P/D is equal to one credit for the subjects of Architectural Design and for all other subjects consider 1hour Lecture & Tutorial = 1credit & 2hour Practical /Design studio. = 1 credit .

Semester : Eighth																	
THEORY																	
1	08AR01	Architectural Design - VIII	2	–	–	2	2		24	200	–	200	80	–	–	–	–
2	08AR02	Advance Construction - II	2	–	–	2	2		4	80	20	100	40	–	–	–	–
3	08AR03	Environmental Services - II	3	–	–	3	3		3	80	20	100	40	–	–	–	–
4	08AR04	Sustanaible Architecture	3	–	–	3	3		3	80	20	100	40	–	–	–	–
5	08AR05	Landscape Design	2	–	–	2	2		3	80	20	100	40	–	–	–	–
6	08AR06	Professional Elective - I	3	–	–	3	3		3	80	20	100	40	–	–	–	–
SESSIONAL / PRACTICAL																	
7	08AR07	Architectural Design Studio - VIII	–	–	6	6	6		–	–	–	–	–	100	100	200	100
8	08AR08	Advance Construction Studio - II	–	–	4	4	2		–	–	–	–	–	25	25	50	25
9	08AR09	Landscape Design Studio	–	–	4	4	2		–	–	–	–	–	25	25	50	25
		TOTAL	15	–	14	29	25					700				300	
TOTAL1000																	
Professional Elective-I 1) Housing 2) Environmental Planning 3) Construction Management																	

			TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY				PRACTICAL				
Sr. No.	Subject Code	Subject	Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
												EXTERNAL	INTERNAL			
SESSIONAL / PRACTICAL																
1	09AR01	Practical Training	-	-	-	-	-	-	-	-	-	150	150	300	150	
Total			-	-	-	-	-	-	-	-	-	-	-	300	-	
Practical Training shall be for six month in architectural firms approved by the institutions														Total	300	
SEMESTER: TENTH																
THEORY																
1	010AR01	Professional Elective – II	2	1	-	3	3	3	80	20	100	40	-	-	-	-
SESSIONAL / PRACTICAL																
2	010AR02	Architectural Project / Thesis	-	6	12	18	18	-	-	-	-	200	100	300	150	
3	010AR03	Seminar	-	-	6	6	13	-	-	-	-	-	100	100	50	
Total			2	7	18	27	24	100	-	-	-	-	-	400	-	
Professional Elective – II 1) Industrial Architecture 2) Climate Responsive Architecture 3) Vernacular Architecture														Total	500	

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH : INFORMATION TECHNOLOGY - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

Appendix - H

SEMESTER - SEVENTH

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
													EXTERNAL	INTERNAL		
THEORY																
01	7IT01	Digital Signal Processing	4	–	–	4	4	3	80	20	100	40	–	–	–	–
02	7IT02	Object Oriented System Analysis & Design	4	–	–	4	4	3	80	20	100	40	–	–	–	–
03	7IT03	Web Technology	4	–	–	4	4	3	80	20	100	40	–	–	–	–
04	7IT04	Real Time Embedded Systems	4	–	–	4	4	3	80	20	100	40	–	–	–	–
05	7IT05	Professional Elective I*	4	–	–	4	4	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
06	7IT06	Digital Signal Processing-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
07	7IT07	Web Technology-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
08	7IT08	Real Time Embedded Systems-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
09	7IT09	Project & Seminar	–	–	2	2	4	–	–	–	–	–	–	50*	50	25
		TOTAL	20	–	8	28	27				500				200	
													TOTAL		700	

Professional Elective I* (i) Distributed DBMS (ii) Modelling & Simulation (iii) Artificial Intelligence & Expert Systems (iv) Multimedia Technologies

Semester : EIGHTH																
THEORY																
01	8IT01	Digital & Wireless Communication	3	–	–	3	3	3	80	20	100	40	–	–	–	–
02	8IT02	Network Administration & Security	3	–	–	3	3	3	80	20	100	40	–	–	–	–
03	8IT03	Software Engineering	3	–	–	3	3	3	80	20	100	40	–	–	–	–
04	8IT04	Professional Elective II*	3	–	–	3	3	3	80	20	100	40	–	–	–	–
PRACTICALS / DRAWING / DESIGN																
05	8IT05	Network Administration & Security-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
06	8IT06	Software Engineering-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
07	8IT07	Computer Lab-V (Content Management System)	–	–	2	2	1	–	–	–	–	–	25	25	50	25
08	8IT08	Project & Seminar	–	–	6	6	12	–	–	–	–	–	75	75	150	75
TOTAL			12	–	12	24	27				400				300	
															TOTAL	700

Professional Elective II* (i) Data Warehousing & Data Mining (ii) Web-Commerce (iii) Cloud Computing (iv) Neural Networks & Fuzzy Logics

FOUR YEAR DEGREE COURSE IN BACHELOR OF ENGINEERING
BRANCH : BIOMEDICAL ENGINEERING - SEMESTER PATTERN (CREDIT GRADE SYSTEM)

SEMESTER - SEVENTH

Appendix - I

			TEACHING SCHEME					EXAMINATION SCHEME								
Sr. No.	Subject Code	Subject	HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			DURATION OF PAPER (Hr.)	MAX. MARKS THEORY PAPER	MAX. MARKS COLLEGE ASSESSMENT	TOTAL	MIN. PASSING MARKS	MAX. MARKS		TOTAL	MIN. PASSING MARKS
													EXTERNAL	INTERNAL		
THEORY																
01	7BM01	Bio Signal Processing	4	–	–	4	4	3	80	20	100	40	–	–	–	–
02	7BM02	Artificial Organs and Rehabilitation Engineering	4	–	–	4	4	3	80	20	100	40	–	–	–	–
03	7BM03	Medical Expert Systems	4	–	–	4	4	3	80	20	100	40	–	–	–	–
04	7BM04	Hospital Engineering & Management	4	–	–	4	4	3	80	20	100	40	–	–	–	–
05	7BM05	Professional Elective-I *	4	–	–	4	4	3	80	20	100	40				
PRACTICALS / DRAWING / DESIGN																
06	7BM06	Bio Signal Processing-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
07	7BM07	Medical Expert Systems-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
08	7BM08	Hospital Engineering & Management-Lab	–	–	2	2	1	–	–	–	–	–	25	25	50	25
08	7BM09	Project and Seminar	–	–	2	2	4	–	–	–	–	–	–	50	50	25
		TOTAL	20	–	8	28	27				500				200	
TOTAL															700	

Professional Elective-I * (i) Tissue Engineering
(ii) Bio Informatics

Semester : Eighth																
THEORY																
01	8BM01	Professional Ethics & Values	3	—	—	3	3	3	80	20	100	40	—	—	—	—
02	8BM02	Bio Medical Imaging Systems	3	—	—	3	3	3	80	20	100	40	—	—	—	—
03	8BM03	Professional Elective-II*	3	—	—	3	3	3	80	20	100	40	—	—	—	—
04	8BM04	Bio Medical Embedded System Design	4	—	—	4	4	3	80	20	100	40	—	—	—	—
PRACTICALS / DRAWING / DESIGN																
05	8BM05	Bio Medical Imaging Systems-Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
06	8BM06	Bio Medical Embedded System Design-Lab	—	—	2	2	1	—	—	—	—	—	25	25	50	25
07	8BM07	Project and Seminar	—	—	6	6	12	—	—	—	—	—	75	75	150	75
		TOTAL	13	—	10	23	27				400				250	
															TOTAL	650

Professional Elective - II i) Bio-Inspired Algorithm ii) Biofluids & Dynamics

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
CIVIL ENGINEERING
SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

SEMESTER SEVEN

7CE01 THEORY OF STRUCTURES – II

SECTION - A

- Unit-I:** 1. Moment distribution method, application to portal frames with sway. Multibay, multistoried, symmetrical frames subjected to symmetric loads only.
2. Slope deflection method: Application to portal frames with side sway.
- Unit-II:** 1. Kani's method: Continuous beams and single bay single storey portal frames with side sway.
2. Multi-bay, multi storeyed frames subjected to symmetric loads.
- Unit-III:** 1. Castigliano's second theorem, principle of least work, Analysis of redundant frames. (up to two degree redundancy).
2. Analysis of redundant trusses (up to second degree of redundancy), lack of fit, temperature effect.

SECTION - B

- Unit-IV :** 1. Maxwell's reciprocal theorem, Betti's theorem, Muller - Breslau's principle, Influence line diagrams for continuous beams, upto two span only.
2. Tension coefficient method & its applications to simple space trusses.
- Unit-V:** 1. Flexibility method, static redundancy, flexibility coefficients, compatibility condition application to beams.
2. Introduction to plastic analysis of steel structure, shape factor, plastic section modulus, Redistribution of moment, upper and lower bound theorems, collapse loads for beams, single bay, single storey portals.
- Unit-VI:** Stiffness method, kinematic redundancy, stiffness coefficients, direct stiffness approach, application to continuous beams and single - bay, single - storey portal.

BOOKS RECOMMENDED:

1. Junnarkar, S. B., Mechanics of Structure, Volume I and II
2. Jain and Arya, Theory and Analysis of Structures

3. Reddy. C. S., Basic Structural Analysis, Tata McGraw Hill
4. Wang, C. K., Elementary Analysis of Structures
5. Norris and Wilbur, Elementary Structural Analysis

**7CE02 GEOTECHNICAL ENGINEERING – II
SECTION – A**

- Unit I:** Exploratory Programme : Field exploration, objectives and methods of exploration planning of exploration programme soil boring , hand augers, percussion boring, rotary wash boring, collection of sample, split spoon sampler, area ratio, disturbed and undisturbed sample, SPT test, field vane shear test, geophysical methods, electrical resistivity and soil refraction methods. Soil log bore presentation and interpretation exploration data.
- Unit II:** Bearing Capacity of Shallow foundation :- Different theories: Terzaghi's, Skempton's, Meyerhof's, BIS method for bearing capacity , determination bearing capacity of granular soils based on SPT value. concept of raft foundation and floating foundation. In situ methods of evaluation of bearing capacity, plate load test, static cone penetrometer, pressure meter test contact pressure distribution diagram below the base of footing.
- Unit III:** Earth pressure at rest, general & local Stages of plastic equilibrium, Rankine's and Coulomb's theory of active and passive earth pressure on retaining wall. Influence of surcharge, water table, wall friction, Rebhann's and Culmann's simple graphical methods Ground Improvement : methods of soil stabilization use of admixture (lime, cement, flyash) in stabilization) Mechanism of reinforced soil, use of Geo synthetics material as a reinforcement, vibroflotation, sand drain installation and preloading.

SECTION – B

- Unit IV:** Pile foundation : Classification of piles and their uses, static analysis, formula for determination of pile capacity for driven and bored pile in sandy and in clayey soil , dynamic pile formula Negative skin friction, factor affecting it, piles in groups and their capacity, group efficiency, factors affecting group efficiency, behavior of group of pile in sandy and in clayey soil, pile load test, effect of pile cap. Criteria for spacing and depth of piles. IS design criterion for underreamed Pile in clay and sands
- Unit V:** Settlement Evaluation of soils settlement : immediate, primary and secondary settlement for footing resting on homogenous isotropic, cohesive and cohesion less soils related to single footing, combined footing, raft foundation etc, standard for requirement of settlement,

total as well as differential settlement, concept of differential settlement, factors and causes for differential settlement, service loads, proportioning of footing for uniform settlement computation of total and differential settlement of a single pile and group of piles in sandy and clayey soil.

- Unit VI:**
1. Well foundation : Component & their function, sinking of well, types of force system, and their computation, design criteria for various components of wells, tilting and shifting
 2. Design of cantilever retaining wall and counterfort retaining Bearing capacity of well as per IS. Cofferdam purpose, various types their suitability

BOOKS RECOMMENDED:

- 1) Craig : Soil Mechanics.
- 2) Bowles J.E. : Foundation Design Analysis.
- 3) Hanson : Theoretical Soil Mechanics.
- 4) Peck and Hanson : Foundation Engineering.
- 5) Tomlinson : Foundation Engineering.
- 6) Leoner : Foundation Engineering.
- 7) Bramha : Foundation Engineering.
- 8) Prakash S. : Analysis and Design of Foundation and Retaining Structure.
- 9) Kasmalkar : Foundation Engineering.
- 10) Arora K.R. : Foundation Engineering.
- 11) Venkataramiah : Soil Mechanics and Foundation Engineering.
- 12) Rao G.V. : Engineering with Geosynthetics.

7CE03 STRUCTURAL DESIGN – II

SECTION-A

(R.C.C. STRUCTURES BY LIMIT STATE METHOD)

- Unit-I:**
1. Design of interior panel of flat slab by direct design method. (Problem on square panel only)
 2. Design of cantilever retaining wall and Counterfort retaining wall.
- Unit II:**
1. Design of combined footing.
 2. Complete design of simple, small structures like Canopies & Parking shed.

SECTION - B

(PRESTRESSED CONCRETE)

- Unit-III:**
1. Introduction to Prestressed concrete: Materials and their characteristics, types of prestressing, Methods and various prestressing systems, Losses of prestress

2. Analysis of beams for flexure, under working load for Rectangular and flanged sections.

- Unit-IV:**
1. Basic Design of rectangular sections for flexure by limit state method, Design of one way single span slabs.
 2. Design of prestressed concrete circular water tanks by IS code method.
Students may be shown video CD, slides, transparencies, and photograph of actual structures.

BOOKS RECOMMENDED:

1. Jain, A. K., Reinforced Concrete (Limit State Design)
2. Jaikrishna and Jain, Plain and Reinforced Concrete, Volume I and II
3. Sinham S. N., Reinforced Concrete (Limit State Design)
4. Edward G. Nawy òPrestressed Concrete- A fundamental Approachö, Prentice Hall
5. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
6. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi)
7. Dr. Shah V.L. & Karve S.R.: Limit State Design.

7CE04 ENVIRONMENTAL ENGINEERING – I

SECTION - A

- Unit-I:** Quantity Estimation of water: Demand of water. Consumption for various purposes. Fire demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population, and design periods for water supply components.
Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection.
Intake works: Intakes, type, location, requirement & features.

- Unit-II:** Water quality: Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works.

- Unit-III:** Aeration: Purpose, type of gravity, aerator & spray aerators. Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, coagulant, feeding and mixing devices. Flocculation, clarrifloculator. Design criteria for sedimentation tanks, surface loading, simple problems of design of sedimentation tanks.

SECTION - B

Unit-IV : Filtration :- Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters modifications of filters. (Dual media, multimedia, upflow, biflow, Diatomaceous earth).

Unit V : Disinfection :- Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination forms of chlorine. Use of bleaching powder - Simple problems. Introduction to tertiary treatments like Softening, Ion Exchange, Reverse Osmosis, Defloridation, Desalination.

Unit-VI : Distribution system: - Types of supply - Continuous, and intermittent, Types of system - Gravity; Pumping and combined gravity and pumping, Layouts of distributions system, Dead end, Grid iron, Circular system and Radial system. Maintenance of distribution system. Equalising storage, Type of storage reservoirs, capacity, Types of conduits, Relative merits, selection, joints, hydraulic design. Pipe laying and

BOOKS RECOMMENDED:

1. Steel E. W. , Water Supply and Sewerage, Mc-Graw Hill.
2. Kshirsagar S. R., Water Supply Engineering, Roorkee Pub house, Roorkee.
3. Birde G. S. , Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, Delhi.
4. Punmia B. C. water Supply Engineering.

7CE05

PROFESSIONAL ELECTIVE –I**(i) ADVANCED WATER TREATMENT****SECTION-A**

Unit - I : Requirements of water treatment facilities different unit operations and unit processes.

Coordination of unit operations. Common attributes of water affected by conventional unit operations and processes.

Aeration: rate of gas absorption and desorption, objectives of aeration, gravity aerators and spray aerators, governing factors, design of aerators, removal of methane, CO₂, H₂S taste, design and odour.

Unit-II : Objectives of flocculation, chemical coagulation, concept of surface charge, coagulating effects of electrolytes, zeta potential, coagulants and coagulant aids, factors affecting coagulation.

Perikinetic and orthokinetic flocculation - mixing and stirring devices, flash mixing flocculators, construction and operation of flocculators, problems on design of flocculators. Pebbled bed flocculator.

Unit-III : Sedimentation: objectives, theory of sedimentation discrete settling and hindered settling, settling of flocculant suspension. Ideal settling basin and its efficiency. Design, construction and operation of sedimentation tanks.

Inlet and outlet hydraulics, sludge, removal and disposal, tube and plate settlers. Problems on design of sedimentation tanks.

SECTION-B

Unit-IV : Filtration: objectives, design, construction and operation of rapid and slow sand filters, filtering sand, grain size and size distribution, preparation of filter sand, hydraulics of filtration. Hydraulics of fluidized beds. Scour intensification, high rate, declined rate, upflow biflow, dual media, diatomaceous earth filters.

Unit-V : Disinfection : objectives, different disinfectants, chemical disinfection, theory, factors governing, and kinetics. Disinfection by Ozone. Disinfection by chlorine; free available and combined. available chlorine, break point chlorination, chemical technology and other uses of chlorine, manageable variables.

Unit-VI : Miscellaneous methods of treatment : Water softening: limesoda and zeolite process, split treatment problems on calculation of dose of lime and soda ash. Iron and Manganese Removal : Fluoridation and defluoridation. Desalination. Taste and Odour Removal.

BOOKS RECOMMENDED:

- 1) Fiar, Geyer & Okun : Water and Waste Water Engg., John Wiley & Sons.
- 2) Mark J. Hammer : Water and Waste Water Technology, John Wiley & Sons.
- 3) Steel E.W. & Ghee M.C. : Water Supply & Sewerage, McGraw Hill Co.

7CE05

PROFESSIONAL ELECTIVE –I**(ii) ADVANCED GEOTECHNICAL ENGINEERING****SECTION-A**

Unit - I : Clay mineralogy : Introduction, atomic bonds, classification and nomenclature, structure of clay mineral, K Ionite. Illite and Montmorillonite groups, physical properties, clay-water relations,

diffused double layer, thixotropy, base exchange capacity formation of different structure in soil deposits, electrical effects, electroosmosis, electrophoresis, stemming potential, zeta potential, clay mineral identification, DTA analysis, X ray diffraction method.

Unit II- Seepage : Flownet for anisotropic soil media, construction of flownet for hydraulic structure on non- homogenous soil, directional variation of permeability in anisotropic medium. Numerical analysis of seepage in layered soil computation of seepage force, seepage through earthen dam resting on confined and unconfined medium entrance discharge and Transfer condition of line of seepage through earth dam.

Unit-III: Three dimensional consolidation. Equation, solution of 3dimensional consolidation equation, consolidation by vertical sand drain and its design aspect, free strain consolidation with no smear, effect of smear zone on radial consolidation. Calculation of the degree of consolidation with radial drains and solutions of problems based on this.

SECTION – B

Unit IV : Expansive soils: origin of soil, intensification of expansive soil, swelling potential, factors affecting the swelling, different systems of classification, concept of swelling pressure and its measurements in the laboratory, special constructional measures adopted for the construction on expansive soils, special foundations adopted for the construction in expansive soils, concept of cohesive non-swelling techniques and its effect on expansive soil.

Unit V : Soil stabilization concept of mechanical stabilization, physical and chemical stabilization with organic and inorganic material like lime, cement, lime, fly ash and mechanisms, various factors affecting stabilization, determination of bearing capacity of stabilized soil, laboratory and field methods of stabilization, On various properties of soil.

Unit VI: Geotextile: types, specifications, functions and various applications in the field of Geotechnical engineering. Reinforced earth, mechanism of reinforced earth, various constructional methods and its effect towards altering, the properties of soil, field situations for application of this techniques. Theory of Arching, effect of arching, design of yield strip, computation of vertical stresses.

BOOKS RECOMMENDED :

- 1) Scoth R.F. : Principles of Soil Mechanics.
- 2) Das B.M. : Advanced Soil Mechanics.
- 3) Terzaghi : Theoretical Soil Mechanics.
- 4) International Conference on Expansive Soils.
- 5) International Conference on Geotextiles.
- 6) Soil Mechanics for Road Engineers, AMSO Series.

7CE05

PROFESSIONAL ELECTIVE – I (iii) WATER POWER ENGINEERING

SECTION – A

Unit I : Introduction, sources of energy, importance of water power, estimation of water power potential, primary and secondary power, load factor, pondage and pondage factor, load curve.

Type of hydropower plants:- low and high head, run of river, valley dam, diversion canal, high head diversion, pumped storage underground, general description, layout, topographical requirements of each of above.

Unit-II : Penstocks: general classification, design criteria, economical dia, anchorages and accessories.
Water hammer :- meaning, rigid and elastic water column theory, Allievi's charts.

Unit-III : Surge tanks: Necessity, types, function, location, effect of sudden load change, Hydraulic design of simple surge tanks, stability of surge tanks.

SECTION – B

Unit-IV : Intakes: types, locations, requirements, trashrack and other components, control gates, emergency gates.

Unit-V : Hydel channel:- power canal and forebay, general principles of alignment and capacity, balancing tank.
Turbines:-types, hydraulic features, size, general description of components and layout, specific speed, choice, approximate costs.

Unit-VI : Power house:- types, general layout and approximate dimensions.
Non conventional sources of energy: - tidal power, wind power, geothermal power, solar power, elementary principles and description, application of water power in drilling and blasting of rocks.

BOOKS RECOMMENDED :

- 1) Dandekar M.M. & Sharma : Water Power Engineering, Vikas Pub. House, Delhi.

- 2) Brown J.G., Blackie and Practice : Hydro Electric Engg., Vol. I, II & III, W. Sons, London.
- 3) Mosonyi E. : Water Power Development, Hungarian Academic Sciences, Budapest.
- 4) Deshmukh M.M. : Water Power Engineering.
- 5) Davin C. and Sorenson K.C. : Hand Book of Applied Hydraulics, McGraw Hill.

7CE05 PROFESSIONAL ELECTIVE – I
(iv) PRESTRESSED CONCRETE

SECTION-A

- Unit I :** a) Analysis and design of beams - Rectangular, flanged and I sections, for Limit State of flexure, ultimate flexural strength, recommendations of I.S. codes.
- b) Analysis and design of end blocks in post tensional members -primary and secondary distribution zones, Bursting and spalling tensions.
- Unit II :** a) Shear strength of prestressed concrete beams - mode of failure in beams, recommendations of I.S. code, ultimate shear strength of concrete, Design of shear reinforcement.
- b) Deflection and bond in prestressed concrete.
- Unit III :** Analysis and design of continuous (upto two spans) and fixed beams. Elastic analysis, secondary moments, concordant cable, linear transformations.

SECTION – B

- Unit IV :** Analysis and design of prestressed concrete structures such as concrete pipes, poles, sleepers, water tanks etc.
- Unit V :** Analysis and design of portal frames, single storey and limited to two bays (fixed and hinged)
- Unit VI :** Design of prestressed concrete bridges (simply supported) for I.R.C. loadings or equivalent uniformly distributed loads.

NOTE : Candidates should use the latest I.S. Codes.

BOOKS RECOMMENDED:

1. Guyon Y. : Prestressed Concrete, Vol. I & II, John Wiley and Sons, New York.
2. Krishna Raju, N. : Prestressed Concrete, Tata McGraw Hill Pub. Company, New Delhi.
3. Lin, T. Y. : Prestressed Concrete, Tata McGraw Hill, New Delhi.
4. Dayaratnam, P. : Prestressed Concrete Structures, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.

7CE05 PROFESSIONAL ELECTIVE – I
(v) ARTIFICIAL NEURAL NETWORK & FUZZY LOGIC

SECTION - A

- Unit I :** Artificial intelligence, introduction, classification of artificial intelligence, tools of artificial intelligence, applications of A. I. in Civil Engineering.
- Unit-II :** Expert systems, introduction, classification, tools, applications of expert system in Civil Engineering.

SECTION – B

- Unit-III :** Neural network, introduction, classification, tools, applications of neural network in Civil Engineering.
- Unit-IV :** Fuzzy logic, introduction, classification, tools, applications of expert system in Civil Engineering.

BOOKS RECOMMENDED:

1. Rolston D.W. : Principles of Artificial Intelligence and Expert System, McGraw Hill International Edition, 1988.
2. Waterman D.A. : A Guide to Expert Systems, Addison-Wesley Pub. Co., 1985.
3. Koestem C.N. and Maher : Expert System in Civil Engineering, ASCE, 1986.
4. ASCE Journal of Computing in Civil Engineering.

7CE05 PROFESSIONAL ELECTIVE – I
(vi) ADVANCED CONCRETE TECHNOLOGY

SECTION-A

- Unit-I :** Admixtures and construction chemicals: Introduction, admixtures, plasticizers (Water reducers), action of plasticizers, dispersion, retarding effect, superplasticizers (High range water reducers), site problems in the use of plasticizers, retarders, accelerators, air-entraining admixtures, pozzolanic or mineral admixtures, fly ash, silica fume, rice husk ash, metakaolin, ground granulated blast furnace slag (GGBFS), damp and water proofing admixtures, IS code provisions for admixtures.
- Unit-II :** Durability of concrete: Introduction, strength and durability relationship, volume change in concrete, significance of durability, impact of water cement ratio on durability, factors affecting durability, methods of predicting durability, IS code provisions for durability of concrete.

Unit-III : Deformation in concrete: Introduction, deformation of concrete in Indian climate, permeability, factors contributing cracks in concrete, sulphate attack, alkali aggregate reaction, corrosion of embedded steel, controlling measures.

SECTION – B

Unit-IV: Special concrete and concreting techniques: Introduction to special concrete, Lightweight, aerated, no-fines, high density, fibre reinforced, polymer, prepacked, self-compacted (self leveled), and high volume fly ash (HVFA) concrete.

Introduction to special concreting techniques, Guniting or shotcrete, ferrocement, roller compacted concrete, and ready mix concrete casting and applications.

Unit-V: Repairs and rehabilitations: Introduction, need for repairs, crack width, interaction between permeability, volume change and cracking, polymer modified mortar, bond aid for plasters, guniting aid, silicon based water repellent materials, protective and decorative coatings, injection grout for cracks, coatings to embedded reinforcement, concrete repair systems, stages of repair works.

Unit-VI: Non-destructive testing of concrete: Introduction, rebound hammer, limitations, rebound number and strength of concrete, penetration technique, pullout test, resonant frequency, pulse velocity method, corrosion analyser, rebar locators. Students must be shown video CD, slides, transparencies and photograph of actual structures.

BOOKS RECOMMENDED:

1. Lea, F. M.: The Chemistry of Cement and Concrete, Edward Arnold (Publishers) Ltd.
2. Neville, A. M. : Properties of Concrete, Pitman Publishing Company.
3. Neville, Brooks : Concrete Technology, ELBS
4. Orchard, D. F. : Concrete Technology, Applied Science Pub Ltd.
5. Shetty, M. S. : Concrete Technology, S. Chand
6. Varshney, R. S. : Concrete Technology, Oxford Pub. House.
7. Krishna Raju : Design of Concrete Mixes, McGraw Hill.
8. Shah and Kale : Reinforced Cement Concrete Design,
9. Sushil Kumar : Treasure of Reinforced Cement Concrete

7CE05 PROFESSIONAL ELECTIVE – I (vii) ENVIRONMENTAL POLLUTION & RURAL SANITATION

SECTION - A

Unit I : General components of environment. Nature and scope of Environmental pollution, population growth, Degradation due to human activity. Episodes of Environmental pollution.

Unit-II: Water pollution-sources of water pollution, effects on water bodies, D.O. sag curve, pollution control measures, water pollution act
Noise pollution: sources of noise pollution, human tolerance levels, levels of exposure due to various sources, preventive and curative methods.

Unit-III : Report of field visit to municipal waste water treatment plant/ Industrial Effluent treatment plant.

SECTION-B

Unit-IV: Land pollution: solids its effect on the environment, various methods of collection, treatment and disposal of solid waste, Hazardous waste and risk analysis.

Unit V : Environmental Impact assessment : Need for EIA, elements of EIA, Environmental attributes, Nature of Impact -Primary, Secondary, Tertiary, Short Term & Long terms, Local & Regional.

Unit-VI: 1) Rural Sanitation ó Collection & disposal of night soil, Sanitary Latrines.
2) Biogas plant - Capacity & Design.

BOOKS RECOMMENDED :

- 1) Mishra P.C. : Fundamentals of Air & Water Pollution.
- 2) Mohan I. : Environmental Pollution & Management, Ashish Pub. House, New Delhi-110026
- 3) Gilbert M. Masters : Introduction to Environmental Engg. & Science.

7CE05 PROFESSIONAL ELECTIVE – I (viii) ADVANCED EARTHQUAKE ENGINEERING

SECTION-A

Unit I : Behaviour of structures in past earthquakes : lessons learnt with regards to weak / strong aspects of structural systems.
Ground motion characteristics : choice of ground motion for a major project site.

Unit II: Detailed study of IS : 1893 - 2002 : seismic analysis of buildings using codal provisions, design considerations.

Unit III: Introduction to seismic design : Considerations for bridges, dams, chimneys.

SECTION-B

Unit IV : Vulnerability of buildings : use of Vulnerability Atlas and understanding techno legal issues with regard to buildings.

Unit V : Concepts in repair, restoration and seismic strengthening: retrofitting weakness in existing buildings, aging, weathering, development of cracks, material and equipment for repairs of masonry and concrete structures, study of IS : 13935.

Unit VI : Methodologies for repairs : for walls, roofs, slabs, columns and foundations of buildings in stone, brick or reinforced concrete.

BOOKS RECOMMENDED :

- 1) Anil K. Chopra : Dynamics of Structures, Prentice Hall of India Pvt. Ltd.
- 2) James L. Stratta : Manual of Seismic Design, Pearson Education.
- 3) Jaikrishna, Chandrashekhar, Brajesh Chandra : Element of Earthquake Engineering, Sarita Pub., Meerat.

7CE06 THEORY OF STRUCTURES-II –Lab

PRACTICALS:

The laboratory work will be based on the following experiments (Any five experiments):

1. Influence line diagram for continuous beams.
2. Horizontal reaction of two hinge arch.
3. Forces and displacements in redundant trusses and frames.
4. Minimum two exercise based on theoretical course work.
5. Verification of Betty theorem
6. Verification of Maxwell Reciprocal Theorem.
7. Basic exposure to software for analysis.
8. Computer aided design of structures

Software: Anyone of the following software STAAD, SAP, NASTRAN, ANSYS, BUILD MASTER, SCADDS & STRUDS and any other reputed software (Any TWO)

1. Analysis and design of minimum three storied building
2. Cantilever or counterfort retaining wall
3. Analysis and design of steel structure

A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

7CE07 GEOTECHNICAL ENGINEERING-II–Lab

LIST OF EXPERIMENTS: (Any six)

1. To determine the shear strength by conducting Field Vane shear test.
2. To identify the subsoil strata by conducting soil resistivity / seismic refractivity method
3. To determine the bearing capacity of soil by conducting standard penetration test
4. To determine the soil characteristic by conducting standard penetration test
5. To determine the soil properties by conducting the static cone penetration test.
6. Computation of bearing capacity by analytical approach to verify with field test
7. To determine the C- characteristic with respect to soil log bore presentation and interpretation of exploration
8. To examine the soil characteristic with respect to soil log bore presentation and interpretation of exploration

Compulsory: Introduction to Geotechnical Software, determination of bearing capacity, earth pressure etc. using this software.

7CE08 STRUCTURAL DESIGN-II –Lab

PRACTICALS:

1. Candidates are required to prepare at least two designs based on theoretical course detailed workings are necessary.
A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

7CE09 PROJECT & SEMINAR

Seminar based on Project shall be delivered in Seventh Semester only. 50 marks shall be given through the internal evaluation done by three member committee one of them will be guide.

Seminar shall be delivered with POWER POINT presentation.

SEMESTER: EIGHT**8CE 01 WATER RESOURCES ENGINEERING - II****SECTION-A**

Unit-I: Reservoir Planning : Investigation, selection of site, control levels, Reservoir Sedimentation, Reservoir Capacity, Calculation of life Reservoir.

Dams : Different types and their suitability-factors governing the selection of types of dam for project

Earth Dams : Types of dams, causes of failure seepage and drainage arrangement, phreatic line, stability analysis, seepage control measures

Unit II : Gravity Dams: Types of dams forces acting, modes of failure; principles of design of straight gravity dams, Elementary and practical profile, Galleries, Earthquake and its effect on dams.

Unit-III: Diversion Head Works :- Selection of site and layout, components of diversion head works, design of weirs on permeable foundation, construction details of Kolhapur type weirs.

Spillways: Types of spillway, spillway capacity, Flood routing through spillways, types of crest gates. Energy dissipaters: meaning, objectives, location. Types hydraulic jump, jet diffusion and Bucket type,

SECTION-B

Unit-IV : Canal Irrigation: Types of canals, Parts of Canal irrigation system, Canal alignment, Design of unlined and lined Canals, Balancing depth, cross section of canal, propose and types of canal lining

Unit-V : Canal Masonry Works: Types and only design principles and description of

1. Regulation works: Canal fallø, Head Regulator, Cross regulator, Canal escapes and canal outlets.
2. Cross drainage works: Aqueduct, Syphon aqueducts, super passage, canal siphon, level crossing

Unit-VI : Well Irrigation : open wells and tube wells, types of tube walls, duty of tube well water.

Water Management : Water management and distribution, co-operative water userø organization, warabandi, conjunctive use of water. Water shed Management : Need of watershed management, importance of soil conservation measures, techniques ground water harvesting.

River Training Works : Need and types of river training works.

BOOKSRECOMMENDED :

- 1) Dr. Modi P.N. : Irrigation, Water Resources & Water Power Engg.

- 2) Punmia : Irrigation & Water Power Engg.
- 3) Garg S.K. : Irrigation & Water Power Engg.
- 4) Dahigaonkar J.G. : T.B. of Irrigation Engg., Wheeler & Co.
- 5) Varshaney R.S. : Theory of Irrigation Structures, Vol. I & II, Nemchand, Roorkee.
- 6) Birdie G.S., Das R.C. : Irrigation Engg., Dhanpatrai & Sons.
- 7) Michael A. M. : Irrigation (Theory & Practice)

8CEO2 ENVIRONMENTAL ENGINEERING-II**SECTION-A**

Unit-I: Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers design of sewers Laying out of circular sewers-Boning rod and sight rail method, Testing & maintenance of sewers

Unit-II: Waste water characteristic, sampling of sewage, physical chemical and biological examinations, B.O.D. and C.O.D., B.O.D. equation, problems on B.O.D Pollution due to domestic and industrial waste. Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant. Preliminary Treatment:- Screening, Grit chamber, detritus tank. Primary Treatment:- Sedimentation of sewage

Unit-III: Biological treatment: Trickling filters, low rate & high rate trickling filters, construction details, Re- circulation Modification of trickling filters Activated sludge process - Process description, Methods of aeration, loading rates, Different modified forms of A.S.P., MLSS & SVI, F/M.

SECTION-B

Unit-IV: Low cost waste treatments - Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Effluent standards for disposal on land, into stream and into sewers. MINAS. Self purification capacity of stream

Unit-V: Characteristics of solid waste:- Physical, chemical, biological Analysis
Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins Disposal of solid wastes:- Different methods, sanitary land fill, composting, incineration

Unit-VI: Air pollution: Introduction to air pollution, various pollutants their sources and their effects on man and material, prevention of air pollution at sources, introduction to control devices electrostatic precipitator & cyclones only human tolerance level Introduction to EIA and Environmental Audit.

BOOKS RECOMMENDED:

- 1) Kshirsagar S.R. : Sewerage and Sewage Treatment, Roorkee Pub House, Roorkee.
- 2) Steel E.W. Steel : Water Supply & Sewerage, McGraw Hill Book Co.
- 3) Birdie G.S. : Water Supply and Sanitary Engineering, Dhanpat Rai & Sons.
- 4) Garg S.K. : Waste Water Engineering.
- 5) Dr. Bhide A.D., Sunderson B.B. : Solid Waste Management in Developing Countries.
- 6) Rao H.V.N. : Air Pollution.
- 7) Stern, Wohlers, Boobel, Lowry : Fundamentals of Air Pollution, Academic Press, 1973.

8CE03 PROJECT PLANNING & MANAGEMENT

SECTION-A

Unit-I: Project, Project Stakeholders, Project life cycle - Conceptual Phase, Planning Phase, Execution Phase, Termination phase. Conceptual Phase - Concept of feasibility study, Budgeting, Cash Flow, Risk assessment plan. Project planning- Steps, work break down structure, Scheduling, Project Monitoring & Controlling- Concept of Tracking, Reviewing and Rescheduling. Planning Tools: Basic concept of Gantt Chart, Bar Chart, Mile stone chart ,their advantage , limitations and overcoming measures ,

Unit II: Networking & Activity ,Event, dummy Activity, Fulerson's numbering rule, Geometrical consideration. Critical Path Method: Concept, technique , Critical path , Numerical on Time and Floats computation , concept of Updating Network and its numerical for computation.

Unit III: PERT: Concept, technique, three time estimates, average time, Critical path, slack computation, S.D, Variance, Probability factor, , crash programme , normal and crash cost, normal and crash time, cost slope, Numerical on Probability computation, crashing .

SECTION – B

Unit–IV: Concept of resource smoothening and leveling ,Cost Curves, Numerical of it.

Introduction to MicroSoft Project Planner software .Various stages and process for Work Breakdown structure, planning, scheduling and resource allocation for project in MSP. One Compulsory assignment for planning, scheduling and resource allocation for construction project using Microsoft Project Planner.

Unit-V: Management- Feyol's Principal of Management, Functions of management, organization definition, type line, line and staff, functional organization ,quality control, ISO. Safety management ,construction hazards in multistage building, method of prevention of accident, injury rate, injury severity rate, injury index, National safety council, its role, recommendation, Material management , Objective ,Functions, Inventory, Need for inventory, ABC,EOQ analysis.

Unit VI: Equipment Management :

- a) Power shovel: Construction, working, Output, factors affecting, cycle time , Problem on Output.
- b) Dragline: Construction, working, output, factor affecting output, cycle time ,Problem on output .
- c) Concrete mixer, Tilting and non-tilting type construction working.

BOOKS RECOMMENDED:

- 1) Pourifoy R.L. : Construction Planning, Equipment & Method.
- 2) Srinath L.S. : PERT & CPM.
- 3) Punmia & Khandelwal : PERT & CPM.
- 4) Khanna S.K. : Industrial Organization & Management.
- 5) Satyanarayan : Operations Reserach.

8CE04 PROFESSIONAL ELECTIVE –II (i) ADVANCED DESIGN OF STEEL STRUCTURES

SECTION - A

- Unit-I:** (a) Design of foot bridge(N-Truss or Pratt)
(b) Analysis and design for transmission tower lines

- Unit-II:** (a) Design of self supporting steel chimney and its foundation.
(b) Design of through type truss bridge member for dead load and equivalent live load including top, bottom bracings and portal bracing.

SECTION - B

Unit-III: Design of industrial buildings including gantry grider, gantry column, Design of knee braces.

- Unit-IV:** a) Design of north light trusses and latic girder.
b) Design of elevated rectangular, square pressed steel tanks and staging

BOOKS RECOMMENDED:

1. Ramchandra, Design of Steel Structure, Volume 6 I and II
2. Arya, Ajmani, Design of Steel Structures
3. Duggal, Design of Steel Structures
4. N. Subramanyam, Design of Steel Structures, Oxford University Press, 2008.

8CE04 PROFESSIONAL ELECTIVE – II

(ii) ADVANCED WASTE WATER & INDUSTRIAL WASTE TREATMENT

SECTION - A

- Unit-I:** 1. Physical unit process: screening, mixing, flocculation, sedimentation, floatation.
2. Design of Grit Chambers and Screens.
3. Chemical Unit Processes: precipitation, gas transfer, adsorption

Unit-II: Biological Unit Process: fundamentals of biological treatment. Design of trickling filter & activated sludge process.

- Unit-III:** 1. Low cost waste water treatment: design of oxidation pond and aerated lagoon
2. Oxidation ditch. Design of Secondary Settling Tank.
3. Methods of disposal of industrial wastes. Equalization tank, Neutralization.

SECTION – B

Unit-IV : General : Effect of discharge of industrial wastewaters on streams, land and environment. Importance and scope. Problems involved in treatment. Variation in quality and quantity of industrial wastewaters. Standards & Criteria
Indian standards for discharge of treated waste water on land, into municipal sewers and natural water courses.
Sampling of Waste Water : Representative sampling. Grab and composite samples.

Unit-V: General Approaches to Planning of Industrial Wastewater Treatment and disposal. Equalization and proportioning Neutralization.
Treating different effluent streams separately. Including/excluding domestic wastewater along with the industrial waste.
Treating industrial wastewater along with town waste.

Unit-VI: Process flow diagram, characteristics and treatment of various industrial wastes.
Industrial wastes of pulp and paper, textiles, tannery, food, canning, sugar mills, distillery, dairy, Pharmaceutical, Electroplating etc. Case study of any one industry.

BOOKS RECOMMENDED:

- 1) Matcalf and Eddy : Waste Water Treatment, Disposal and Reuse, McGraw Hill Pub. Co., New Delhi.
- 2) Rao and Datta : Waste Water Treatment, Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi.

**8CE04 PROFESSIONAL ELECTIVE – II
(iii) FINITE ELEMENT METHOD**

SECTION - A

Unit-I : Continuum structures, discretisation, finite elements, nodes, variational principle, minimum potential theorem, relation to Rayleigh-Ritz method.

Unit-II : Interpolation, Lagrangian, Hermitian shape functions, natural coordinates, area and volume coordinates, coordinate and derivative transformations.

Unit-III: 2-D plane stress and plane strain analysis, constant strain triangle, rectangle. 3D analysis, tetrahedron & parallelepiped elements.

SECTION - B

Unit-IV : Isoparametric elements, plane stress, plane strain and solids, numerical integration.

Unit-V : Beam straight with C and C continuity, numerical integration to cater for membranes, bending and torsion combination.

Unit-VI: Programming aspects, geometry, connectivity, code numbers alternate data types, half band data preparation, flow charts, typical subroutine for assembly, shape functions, solution of equations, stiffness matrix.

BOOKS RECOMMENDED:

1. Desai, C. S., Abel, Introduction to Finite Element Method
2. Cook, Concept and application of Finite Element Method
3. Patwardhan, N. R. Illustrated Finite Element Method
4. Krishnamurthi, C. S., Finite Element Analysis 6 Theory and Programming

8CE04 PROFESSIONAL ELECTIVE – II
(iv) DAM ENGINEERING
SECTION - A

- Unit-I :** Introduction to Dam Engineering : Different classification for dams, relative advantages and disadvantages of various dam selection or types of dam, Investigation of dam sites, Engineering surveys, geological investigation, subsurface exploration programme, economic height of dam, Construction machinery, material, money, inventory.
- Unit-II :** Rockfill dam : Introduction, general characteristics, materials and testing of rockfill material, foundation of rockfill dam, design, rockfill placement, examples.
- Unit-III :** Arch dam :- components, types, methods for design.
 Buttress dam : components, types, forces acting, Buttress spacing, Master curve for economic spacing, preliminary design
 Solid Gravity dams : Analysis & Design of gravity dam.

SECTION –B

- Unit-IV :** Spillways: choice of types, crest gates, hydraulic design, comparison, approach and tail channel, J.H.C. & tail water rating curve Energy Dissipaters: types, components, design of hydraulic jump type, basins, ski-bucket type, roller bucket.
- Unit-V :** Head Regulators : requirements, types, foundation treatment including uplift consideration, Bank connection, energy dissipation, hydraulic design of opening and barrel, ventilation, types of gates.
 Approach Channel, case study for one on rock foundation and one on permeable foundation.
 Model Studies: scales design principles, materials, scale effects for model of dams spillways.
- Unit-VI :** Instrumentation : In earth dam and solid gravity dams, piezo meters, settlement, gauges, (surface monuments, base plate, cross arm) strain meters joint meters, thermometers, stress meters, pore pressure cells, plumb-bob Seismograph. Water level gauges (description, object, location, working, installation of each, design not expected)
 Special problems: increasing height of masonry and concrete dams, strengthening, repairs and maintenance, leakage, evaporation controls. evaporation controls.

BOOKS RECOMMENDED:

- 1) Sharma H.D : Concrete Dams, Metropolitan Book Co, Delhi.
- 2) Varshney R.S. : Concrete Dam, Ox IBH, Mumbai.

- 3) Sherard et al : Earth and Rockfill Dam, John Wiley, New York.
- 4) USBR : Design of Small Dams.
- 5) USBR : Design of Large Dams.
- 6) Peurifoy R.L. : Construction, Planning and Equipments, McGraw Hill Book Co.
- 7) Satyanarayanan : Construction, Planning & Equipment, Standard Pub.
- 8) USBR : Design of Gravity Dam.

8CE04 PROFESSIONAL ELECTIVE – II
(v) ADVANCED ENGINEERING GEOLOGY
SECTION - A

- Unit I :** A) Geology & engineering characters of Basalts & other rock formations : study of rock formations of Maharashtra older than Deccantrap from Civil engineering point of view, field characters of basalt flows and older formations which are significant from dam foundation, tunnelling work, watershed development including percolation tanks and construction material.
- (B) Geology of dam & reservoirs : bearing capacity & water tightness of different types of rocks occurring in Maharashtra from construction of gravity dam with important case histories of different dam sites in Maharashtra whose geological problems were encountered and remedial measures were adopted. Set of geological conditions which lead to tail channel erosion with case histories of different dam sites.
- (C) Geology of tunnel alignment : geological factors responsible for overbreaks & percolation of water, various geological structures which affects the tunnelling works. Case histories of tunnels & hydro-electric projects, roads, railways & canals driven through different types of Basalts & other rocks occur in Maharashtra.
- Unit II :** (A) Seismological studies : factors to be to safeguard gravity dams. Detailed studies of active & dead faults. Type & design aspect of the dam to be constructed in seismic zone with case histories.
- (B) Percolation tanks : importance of geological studies for the selection of sites for percolation tanks, geological studies of watershed development projects in Maharashtra including Raleganshindi & Vidarbha region.

- (C) Ground water studies : water bearing characters of different types of Basalts. Soil & water preservation techniques of civil engineering significance and under ground bandhara. Exploration of tubewells in alluvium and sandy & alluvium substrata for drinking water uses procedures and need thereof. Deciding aquifers for tubewell exploration & development of tubewells conducting yield tests of tubewell.

- Unit III:** (A) eology of soil formation : geological factors which govern the engineering characters of soils. Soil derived from different types of rocks which can be used for casing & hearting of earthen dams. Nature of river alluvium in Maharashtra. Problem water logging & its remedial measures.
- (B) Construction material : properties of different types of rocks that can be used as rubble for masonry, road metal, railway ballast, concrete aggregates etc. Problem of alkali aggregate reaction. Scaricity of sand in Deccan trap region, suitability of compact & gdlaloidal basalt as a substitute of sand after crushing.
- (C) Geology of cut-off trench : geological logging and mapping of cut off trench of irrigation projects. Applicability of grouting in irrigation projects & different grouting techniques.

SECTION - B

- Unit IV :** (A) Drilling and logging : different methods of drilling. Precautions to be taken during drilling, preservation of cores. Recording of drilling data. Geological logging of the drill & its interpretation. Methods of water intake tests.
- (B) Aerial photo interpretation : interpretation of aerial photos from the point of view of rock types, geological structures, selection of dam sites and alignment of roads, railways & ghat interpretation of lineaments for groundwater.
- (C) Town planning : role of geology in town planning. Important case histories of the old town planning.

- Unit V:** **Geophysical** principle of electrical resistivity survey, its utility in determining the depth of overburden, foundation grade rocks, gullies & other geological structures by having case histories of dams & tunnels, significance of electrical resistivity survey in ground water studies, brief introductory ideas regarding seismic, magnetic and gravity surveys and their applications in various fields.

- Unit VI:** (A) Rock Mechanics : Engineering properties of rocks, general properties, strength of rocks, elasticity of rocks. Residual stresses in rock masses, classification system in rock engineering - Terzaghi's load classification, Lauffer-Pacher classification. Rock quality gnation (RQD), rock structure rating (RSR), concept of Wickham et.al (1972)
- (B) Environmental Geology : role of geology in environmental engineering, geo-environmental : soils as resources, wind erosion, erosion by moving water, predicting & controlling erosion, soil erosion & land use decisions, problem soils. Reactivation of pre faults, earthquakes in Peninsular India, intensity & magnitude, assessment, Himalayan earthquakes, landslides - characterisation, landslide analysis, dimensions of landslide hazard, landslide potential, case histories, subsidence, response to subsidence prediction, costs of subsidence, case histories.

BOOKS RECOMMENDED :

- 1) P.W.D. Hand Book, Chapter No. 6.
- 2) Geological Survey of India - Engineering Geology Case Histories, Parts I & II.
- 3) Auden J.B. : Indian Society of Engineering Geology, Commemoration Volume.
- 4) Wahlstrom E.E. : Tunnelling in Rocks.
- 5) Wahlstrom E.E. : Dams, Dam Foundations and Reservoir Sites.
- 6) Goodman R.E. : Introduction to Rock Mechanics.
- 7) Bieniawski Z.T. : Rock Mechanics Design in Minning and Tunnelling.
- 8) Lama R.D. & Vutukuri V.S. : Hand Book of Mechanical Properties.
- 9) Gupte R.B. : AText Book of Engineernig Geology, Pune Griha Prakashan.
- 10) Miller : Principles of Remote Sensing.
- 11) Pandey S.N. : Text Book of Photo Geology.
- 12) Lundgren L. : Environmental Geology, Prentice Hall Pvt. Ltd.
- 13) Patwardhan A.M. : The Dynamic Earth System, Prentice Hall Pvt. Ltd.

8CE04 PROFESSIONAL ELECTIVE –II

(vi) MATRIX COMPUTER ANALYSIS OF STRUCTURES

SECTION - A

- Unit- I:** Solution of simultaneous algebraic equations, Gaussian elimination method, Half-band matrices, computer programme.

Unit-II: Finite difference method, application to plate deflection problems for fixed and simply support conditions.

Unit-III: Flexibility method, static redundancy, flexibility coefficients, compatibility conditions, application to continuous beams, single-bay single story portals, pin joined plane trusses.

SECTION-B

Unit-IV: Stiffness method, kinematic redundancy, equilibrium equations, member stiffness matrix and structure stiffness matrix, assembly procedure, application to continuous beams, pin jointed plane truss, numerical examples upto three unknowns.

Unit- V : Stiffness matrix of plane frame member with axial deformation (6x6), Grid member (6x6), transformation of forces and displacements, member and global coordinate system.

Unit-VI: Data and program organization for stiffness method, various coding systems, member-joint and joint-coordinate relations, member-displacement relations, code number approach, methods of introducing boundary conditions for restrained displacements.

BOOKS RECOMMENDED:

1. Gere, Weaver, Analysis of framed structures
2. Rubinstein, M. F., Matrix computer analysis of structures
3. Matrin, M. C., Introduction to matrix methods of structural analysis

8CE04 PROFESSIONAL ELECTIVE–II (vii) ADVANCED STRUCTURAL ANALYSIS

SECTION –A

Unit– I: 1. Approximate methods of analysis of multi-bay multi-storey Frames by (a) Cantilever method, (b) Portal method & (c) Factor method.
2. Shear centre for thin walled beam section.

Unit– II : 1. Infinite & semi-infinite beams resting on elastic foundations.
2. Analysis of beams circular in plan.

Unit–III: 1. Cantilever moment distribution method, application to rigid jointed plane frames.
2. Vierndeel girders - analysis for vertical sway cases only.

SECTION - B

Unit-IV : 1. Finite difference method, application to beam deflection problems
2. Minimum potential principle, Rayleigh & Rayleigh-Ritz approach to continuous problems, application to simply

supported and cantilever beams using power series and trigonometric series.

Unit – V: Introduction to theory of elasticity - (treatment in Cartesian coordinates), state of stress at a point, stress equilibrium equations, strain-components, stress-strain relations, generalized Hooke's law, strain plane stress and plane conditions, stress and compatibility for 2D.

Unit-VI: 1. Analysis of columns loaded laterally.
2. Structural response to earthquake, analysis of multistoried frames by I.S. code provisions.

BOOKS RECOMMENDED:

1. Norris, Wilbur, Elementary Structural Analysis
2. Timoshenko & Goodier, Theory of Elasticity
3. Jaikrishna, Chandrashekharan, Element of Earthquake Engineering, Sarita Publication, Meerut (U.P.)
4. Vazirani & Ratwani : Advanced Theory of Structures.
5. Ross C.T.F.: Advanced Stress Analysis.

8CE04 PROFESSIONAL ELECTIVE –II (viii) ROCK MECHANICS

SECTION -A

Unit I: Introduction, properties and testing. Introduction to Rock Mechanics and its field applications, identification of common rocks, physical & mechanical characteristics of rock material. Field & Laboratory testing of rocks. Classification of rock masses for engineering purpose.

Unit II: Rock excavation : Blasting - objectives, blasting materials, blasting methods, open cut blasting. control blasting operation, precautions. Drilling, braking & cutting. Machines used for rock excavation.

Unit III: Rock reinforcement & Grouting : Rock bolting & bolting methods & materials.
High capacity of rock anchors - types of rock anchors, anchor grouting, civil engineering applications. Bolted & anchor supports. Rock grouting - objectives, types of treatment, grouting material, grouting methods, quality control & monitoring of grouting.

SECTION-B

Unit IV: Rock strength & deformability : modes of rock failure, stress-strain behaviour in compression, Mohr- Coloumb failure criteria, Griffiths crack theory, empirical criteria for failure, effect of size

on strength. Plane of weakness in rocks, joint orientation & roughness. Deformability of rocks - elastic & non- elastic behaviour, influence of time on rock deformation, viscous behaviour & creep.

Unit V: Rock foundation & slope stability : rock foundation & allowable bearing pressures, stress & deflection in rock under footing, failure mechanisms, subsiding & swelling rocks, base heave & remedies, foundation anchoring. Rock slopes - modes of failure, factors affecting, analysis of slopes.

Unit VI: Underground opening : types of boring machine, cutting tools, muck handling. Opening in competent rock, horizontally layered rocks & rock with inclined layers, plastic behavior around tunnels, time dependent behaviour of tunnels, underground opening in blocky rocks - Block theory. Review of design methods of tunnels - Empirical & semi-empirical methods. Support & stabilisation.

BOOKS RECOMMENDED:

- 1) Goodman R.E. : Introduction to Rock Mechanics.
- 2) Franklin J.A., Dusseault M.B. : Rock Engineering.
- 3) Franklin J.A., Dusseault M.B. : Rock Engineering Applications.
- 4) Stagg K.G., Zienkiewicz O.C. : Rock Mechanics in Engineering Practice.

8CE04 PROFESSIONAL ELECTIVE-II (ix) ADVANCED DESIGN OF R. C. C. STRUCTURES

SECTION - A

[BY LIMIT STATE METHOD]

Unit-I: 1) Design of Portal frame up to two bay two storied symmetrical frame for symmetrical loading.
2) Design of circular slab for uniformly distributed load only, Introduction to grid floor slab.

Unit-II: 1) Design of a footbridge and simply supported slab deck bridge for I.R.C.class A loading.
2) Design of RCC girder (T beam) bridge for I.R.C.class A loading.

SECTION - B

Unit-III: 1) Structural response to earth quake, Analysis of multistoried frame by seismic coefficient method.
2) Design of square bunkers using Rankine theory. Design of Silos.

Unit-IV: 1) Design of R.C.C. Intze tanks.
2) Design of staging for Intze tanks with raft foundation.

BOOKS RECOMMENDED:

1. Suhil Kumar, Treasure of R. C. C. Design
2. Jain, A. K., Reinforced Concrete (Limit State Method)
3. Shah, Karve, Design of R. C. C. Structures
4. N. Krishna Raju, Advanced R. C. C. Design
5. Rajgopalan, K., Storage Structures.

8CE 05 WATER RESOURCES ENGINEERING-II-Lab

TERM WORK : Five problems from the following to be worked out by the students whenever necessary scale drawing on half empirical size must be drawn : Practical examination shall consist of viva & voce.

1. Fixing control levels of Reservoir from given data.
2. Cross section, plan, L-section of Earth dam showing all components; details of drainage of downstream casing.
3. Design and Drawing of elementary and practical profile of gravity dam.
4. Design and drawing of diversion weir on permeable foundation.
5. Design and Drawing of ogee spillway with energy dissipaters.
6. Computer Aided design of unlined and lined canal.
7. Drawing of any Four canal structure (No design)
8. Field visit

8CE06 ENVIRONMENTAL ENGINEERING-II-Lab

- 1) Analysis of waste water (any four) & BOD (for domestic waste), COD (for industrial waste), Solids (Volatile), SVI, Nitrogen, Chlorides
- 2) Air sampling & Analysis of SPM.
- 3) Physical characteristic of solid waste
- 4) Sketches of sewers appurtenances & Manholes & different types storm water inlets, overflows, inverted siphons, automatic flushing tanks, ventilation in sewers.
- 5) Report of Field visit to Municipal wastewater treatment plant/Industrial Effluent treatment

8CE07 PROJECT & SEMINAR

Complete Project Report in a group of Maximum 9 students shall be submitted.

Out of 75 internal marks, 25 marks shall be given through the internal viva by three member committee one of them will be guide.

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
MECHANICAL ENGINEERING
SEMESTER PATTERN (CREDIT GRADE SYSTEM)
SEMESTER: SEVEN**

7ME01 MACHINE DESIGN AND DRAWING – II

- Unit I :**
- Design of Shaft: Material, Design on the basis of strength considering shaft subjected to
 - Twisting moment only
 - Bending moment only
 - Combine twisting and bending moment
 - Design on the basis of rigidity.
 - Design of Key** ó types, strength of key
 - Design of Coupling** ó types, requirements of good couplings, design of sleeve coupling, clamp or compression coupling, rigid flange coupling, flexible flange coupling.
 - Design of fly-wheel :** Puck, coefficients of fluctuation of speed and energy, energy stored in fly wheel, construction, stresses in fly wheel arms and rim, Design of fly wheel based on T-M diagram, fly wheel for Otto cycle engines and punching machines. (12 Hrs)
- Unit II:**
- Antifriction Bearings :** Types of bearing, construction, designations, standard load ratings by AFBMA for static and dynamic loads, life of bearings, selection of bearings, lubrication, mounting and enclosure,
 - Journal bearings :** lubrication of bearings, stable lubrication, Thick film lubrication, pressure distribution, minimum film thickness, relations of variables-viscosity, coefficient of friction, speed, pressure, length and diameter, bearing modules, viscosity-Temperature chart, Sommerfeld number, selection of lubricant, design procedure and numericals.
 - Design of belts :-**
Flat belts ó types, material and construction of belt, type of drives, slip, creep, Design of belt.
V-Belts- Construction and types, design of V Belts.
 - Wire Rope-** Selection, Construction, classification, designations, stresses in wire rope, selection of wire rope for given loads.

Unit III :- Design of Gear Classification, law of gearing, forms and system of teeth, interference. Beam strength of teeth, dynamic tooth load, wear tooth load, tooth failure.

- Spur gear - Design of gear
- Helical gear ó Classification face width, formative teeth number, strength of gear Design of gear
- Bevel gear ó Classification, pitch angles, strength of gear, Design of gear
- Worm gear ó Types, efficiency of gear, Design of gear.

- Unit IV :**
- Design of I.C. Engine parts : Design of Cylinder, Piston, Piston rings, Piston pin, connecting rod and crank .
 - Design and drawing of Governor (Parts and Assembly)
Types of Governors, Design procedure and problems, Hartnell Governor (including design of Spring, spindle, lever and bells).

BOOKS RECOMMENDED:

TEXT BOOKS-

- Machine Design fundamentals- Mechanical designer workbook, J.E. Shigley, published by McGraw Hill .
- Machine Design, R.S.Khurmi and Gupta J.K. published by Eurasia Publishers- New Delhi.
- Machine Drawing, N.D.Bhat, Charotar Publication

REFERENCE BOOKS:

- Machine Design, Maleev and Hartman, published by C.B.S. Publication New Delhi.
- Machine Component Design, William Orhwein, published by Jaico Publishing House- N.Delhi
- Machine Elements in Mechanical M.F. Spotts
- Machine Design, Black P.H. Published by McGraw Hill,
- CAD CAM Concepts & applications, Chenna Kesava, PHI Publications
- Design Data Book by- P.S.G. Koimbatore
- Design Data Book by Mahadevan
(Use of any data book from the above will be permitted during the examination).

**7ME02 ENERGY CONVERSION – II
SECTION – A**

UNIT I: Reciprocating, Air Compressions :- Industrial uses of compressed air, Methods of compression and efficiencies of compression, Methods of reducing losses during compression

single and multistaging of compressions, clearance volume and its effect on work done and volumetric efficiency, condition for minimum work in two stage compression, intercooling and its effects, Overall, isothermal and adiabatic efficiencies, IHP, BHP, requirements and after cooler. (7 Hours)

UNIT II: Rotary Compressors :- Comparison between reciprocating and rotary compressors, difference between fans, blowers and compressors, general equations for rotary machines, Vane, Roots blower, construction, working and velocity diagrams of centrifugal and axial flow compressors, performance characteristics of blowers and compressors. (8 Hours)

UNIT III: Definitions, classifications of refrigeration systems : Air refrigeration, Bell-column cycle, reversed Carnot cycle, reversed Bryton cycle, vapour compression refrigeration, vapour absorption refrigeration based on solar and waste gear recovery. Analysis of simple saturated vapour compression cycle, representation on T-s, P-h diagrams, Problem on simple saturation cycle, Need for CFC free refrigerants.
Air conditioning :- Definitions, classification and applications. Psychrometric properties, psychrometric charts. (8 Hours)

SECTION – B

UNIT IV: Classification of gas turbines, construction and working Gas turbine ideal and actual cycles constant volume, constant pressure, (Open and Closed) cycle analysis, Inter cooling, Regeneration and reheating application, optimum and maximum pressure ratios, work ratios, Performance characteristics. Fields of application of gas turbine power plant, Introduction to Jet Propulsion, Ram jet, turbo jet. (No numerical treatment for Jet Propulsion). (8 Hours)

UNIT V: NUCLEAR POWER:- Fusion, fission, Chain reaction, conversion and breeding in nuclear fission, components of water, gas cooled, liquidized metal cooled thermal reactors.

UNIT VI: Introduction to renewable energy, Wind Energy, solar, fuel cell, bio-gas, MHD, basic requirements, Advantages, Disadvantages and applications. (7 Hours)

RECOMMENDED BOOKS:-

TEXT BOOKS:

1. Steam and gas turbines R, Yadav; Central Publication Allahabad.
2. Thermal Engineering, Domkundwar, Kothandaram, Dhanpat Rai & Co.
3. Power Plant Engineering; R.K.Rajput; Laxmi publication

4. Solar Energy by S.P.Sukhatme; Tata McGraw-Hill in New Delhi

REFERENCE BOOKS:

1. Thermal engineering by Mahesh M.Rathore; Tata McGraw-Hill in New Delhi
2. Gas Turbines Theory- By Cohen and C.F.Rogers, P.H.I.H. Saravanamuttoo Heritage Publishers,
3. Gas Turbines and Rotary compressors, Khajuria and Dubey, Dhanpat Rai & Co.
4. Thermal Engineering : R.K.Rajput, Laxmi Publication.
5. Renewable Energy; Godfrey Boyle, Oxford University Press.

7ME03

INDUSTRIAL MANAGEMENT & COSTING

UNIT I: Concept, Principles and Techniques of Management; Evolution of management thoughts, functions of management, organization structure & relationship.

UNIT II: Marketing and Management : Marketing strategy market research, buying, motives, types of market, new product development, Product life cycle, Sales Organization, advertising, methods of selling, consumer behaviour.

UNIT III: a) Functions of personnel management, Human resource planning, Recruitment, training and development, workers participation in management, joint consultation, collective bargaining.
b) Materials management, classes of materials, scope of material control, scope and function of purchasing department, purchasing procedure, inventory control, ordering procedure, material identification, store function.

SECTION - B

UNIT IV : Objectives, functions, principle factors of estimating and estimating procedure, Estimation of weights & materials, Estimation of machining time, estimation of fabrication cost, forging cost, foundry cost.

UNIT V: a) Introduction to costing and costing Techniques: Definitions, objectives, elements of costs, components of cost, job costing, simple process costing, normal and subnormal losses in process, waste, scrap. (8 Hours)

UNIT VI: a) Financing of business :- Basis of business finance, need of finance, Kinds of capital, sources of fixed & working capital.
b) Financial statements :- Profit and loss statement, balance sheet

- c) Depreciation Analysis :- Causes and significance, methods of calculation of depreciation. (7 Hrs)

TEXT BOOKS:

1. Management-principles, processes and practicals, Anil Bhat, Aryakumar; Oxford University Press
2. Management Accounting; Pares Shah; Oxford University Press
3. Estimating and costing; TTTI Madras.

REFERENCE BOOKS:

1. Essentials of Management; Koontz, Harold; Mcgraw-Hill Education(India)
2. Cost Accounting; Jawahar Lal; Tata Mcgraw Hill Publishing
3. Cost Accounting by Bhar.

7ME04 AUTOMATION ENGINEERING SECTION - A

UNIT I: Automation & Types, Automation for mass manufacturing and assembly, Automation of continuous processing systems, Detroit type automation, Automated flow lines. Methods of work part transport, transfer mechanisms, control function. General terminology and analysis of automated flow line, partial automation, assembly, systems and Line balancing.

UNIT II: NC/CNC :- Basic concept, N.C. controls- point to point, straight-cut and continuous path control, machine control units, closed system, NC machine components, tooling, CNC & DNCs, Manual part programming formats, programming languages, -APT, ADAPT, EXAPT etc. NC/CNC Programming- Various Programming codes, Manual part programming for drilling, Milling and turning operations, Examples of APT, Sensors and adaptive control in machining, Applications and economics of CNC. (12 Hrs.)

UNIT III: ROBOTICS :- Introduction to cybernetics, Evolution of industrial robots, Robots anatomy, Arm geometry, drive system and end efforts, sensors, Evolution of geometrical configurations for robots Programming techniques of Robots. Application of Robots in manufacturing, casting, welding, painting, m/c loading, handling, heat treatment, assembly, inspection, etc. Technical Specifications of a Robot, Robot economics. (9 Hrs)

SECTION - B

UNIT IV : GROUP TECHNOLOGY AND PROCESS PLANNING : Introduction-Part families, part classification and coding systems, Group technology machine cells, advantage of group technology

The planning function, retrieval type process planning system, Generative process planning systems Benefits of CAPP, Expert systems and expert system approach to CAPP. (09 Hrs)

UNIT V: FMS : Introduction, schematic of FMS, FMS cells, Components of FMS, Relation of Group Technology, with FMS, Planning, Simulation and analysis of FMS, Applications of FMS. Material handling : Automated storage and Retrieval system (ASRS), Automated Guided Vehicle (AGV) etc. (08 Hrs)

UNIT VI: Computer Integrated Manufacturing; Introduction, Sequence of functions in CIM, elements of CIM system, CIM Wheel, structure of CIM database system. Guidelines for CIM development, benefits of CIM shop floor control and process monitoring. Automated inspection and testing : Introduction to automated inspection, Advantages over traditional method. On-line & off-line inspection, CMM construction, types & working. (09 Hrs)

TEXT BOOKS:

1. Production system, Automation and CIM, Mikhal Groover, Pearson Publications.
2. CNC Machines; M. Adithan & B.S. Pabla; New Age International.

REFERENCE BOOKS:

1. Robotics; Yarem Koren, Mcgraw Hill.
2. Computer aided Manufacturing; P.N. Rao, N.K. Tiwari and T.K. Kundra; Tata Mcgraw Hill.
3. Machine Tool Design; N.K. Mehta, Tata Mcgraw Hill.
4. Computer Control of Manufacturing; Yarem Koren, Tata Mcgraw Hill.
5. CAD/CAM/CIM ; Radhakrishnan & Subramaniam; New age International.

PROFESSIONAL ELECTIVE – I

7ME05 (1) NON-CONVENTIONAL ENERGY SYSTEMS

SECTION – A

Unit I :- Introduction :- Renewable & Non-renewable resources. Solar Radiation- Solar Constant basic earth-sun angles spectrum distribution of extra terrestrial radiations and its variation, Solar time, Direction of beam radiation, computation of radiation inclined surfaces, solar charts, measurements of diffuse & global & direct radiations, duration of sunshine hours, computation of radiation data, Alteration of solar radiation by the atmosphere.

Unit II : Radiation transmission through covers :- Reflection and absorption of radiation, optical properties of cover systems in transmittance effects of surface layers on transmittance,

transmittance absorptance product. Solar Energy collections;- Heat transfer for solar energy utilization, flat plate collections such as liquid & air collector, collector overall heat transfer coefficient, temperature distribution between the tubes & the collector efficiency factor useful heat gain, heat removal and flow factor, Testing of collectors & effects of various parameters on the performance. Introduction to various systems of concentrating collectors

Unit III: Solar energy Utilisation :- Application of solar energy in heating, cooling, pumping, power production, distillation, drying, solar cookers, solar pond, solar furnaces, Solar Energy Storage:- Methods of storage such as sensible, latent heat & thermochemical storage, selection of method of storage, properties of storage materials and different arrangements of storages. (No alphabetical treatment)

SECTION - B

Unit IV: Energy from Ocean : Tidal Power :- Types of tidal plants such as single and two basin plants, power developed and operation of tidal power plant. Ocean thermal energy conversion system. Ocean temp. profile, OTE Power plant development, controlled flash evaporation, indirect vapour cycle, Salinity differences conversion of salinity gradient resources, osmotic pump, dytanic battery, etc.

Wind power :- Wind speed data, power in the wind, wind power development, types of wind mills, application for pumping and power generation. (8 Hours)

Unit V: Biomass Energy Resources; Mechanism of green plant photosynthesis, efficiency of conversion, solar energy plantation, Biogas- Types of Biogas plants, factors affecting production rates, Pyrolysis, Gasification Types & Classification of vegetable oils as a liquid fuel and their properties, esterification process, formation of Biodiesel, Biodiesel & its properties, suitable species for Biodiesel formation and its cultivation, byproduct formation during esterification, Biodiesel economics. (8 Hours)

Unit VI: Direct Energy Conversion :- Photo voltage cells: Principle, concept of energy conversion, conversion efficiency, power output and performance, storage, Fuel Cells : Principles types of fuel cells, conversion efficiency, Geothermal energy resources, power generation methods like vapour dominated, water dominated, flash steam, binary fluid and total flow concept of power generation. (7 Hours)

TEXT BOOKS :-

1. Solar Energy, S.P. Sukhatme, TMH
2. Non-Conventional Energy Sources, G.D. Rai, Khanna Publications

REFERENCE BOOKS :-

1. Treatise on Solar Energy : H.P. Garg; John Wiley & Sons
2. Renewable Energy Conversion, Transmission and Storage, Bent Siresen; Elsevier Publication
3. Renewable Energy; Godfrey Boyle, Oxford University Press, Mumbai.

7ME05

PROFESSIONAL ELECTIVE – I

(2) TOOL ENGINEERING

SECTION – A

Unit I : Theory of metal cutting : Chip formation, shear angle, shear strain-velocity relations, undeformed chip thickness, Force relations, Merchant circle, energy consideration in metal cutting, Tool wear tool life, tool life criterion, machinability, tool materials, properties & types, Newly invented tool material and their types, cutting fluids. (08 Hours)

Unit II : Single point cutting tools-classification and nomenclature, various systems of nomenclature, single point cutting tool design, recommended speed, feed and tool angles determination, clamping arrangements and form tools. Twist drills & Reamers & Geometry types, cutting forces, Numerical on Power & torque. (09 Hours)

Unit III : i) Broaches & Geometric elements of broach teeth, classification of broaches, design of broaches, cutting forces.
ii) Milling cutters- Geometry elements of broach teeth, classification of broaches, design of broaches, cutting forces.
iii) Thread cutting tools:- Geometry of taps and dies.
iv) Gear cutting tools :- Geometry of gear shaper cutter, gear hobs. (09 Hours)

SECTION - B

Unit IV : Jigs & Fixtures : Design economics, principles of locations, types of locations, prevention of jamming, problems of chip & dust in location, use of dowel, Reducant location, Principles of clamping, types of clamps, power clamping, Tool guiding & tool setting, types of drill bushes, types of drill jigs & their designs, Turning, Milling, Grinding, Broaching and Assembly fixtures, Indexing devices in jigs & fixtures. (10 Hours)

Unit V: Press tools, Classification of presses, Theory of sheet metal cutting, clearance, cutting force calculations, Methods of reducing cutting forces, centre of pressure & its significance, classification of press working operations, Theory of bending, spring back action in metals, drawing fundamentals, calculation of drawing & bending forces, planning for cupping operation, stock layout. (09 Hours)

Unit VI: Design of press working tools, Types of die construction, function & nomenclature of die components Cutting Dies- Blanking & Punching, Forming Dies-Forming, Drawing and Bending etc. Design of Compound, Combination and progressive dies. Miscellaneous dies- Horn die, cam-action die, rubber & bulding die, sub-press die. (9 Hours)

TEXT BOOKS:

1. Fundamentals of Tool Design, -A.Kumar (Dhanpatrai & Sons)
2. A text book of Production Engineering -P.C.sharma (S.Chand Publication)

REFERENCE BOOKS:

1. Tool Design - Cyril Donaldson (Tata Mcgram Hill)
2. Jigs & Fixtures - P.H.Joshi (Tata Mcgram Hill)
3. Metal Cutting Theory & Cutting Tool Design- Arshinov (Mir Publications)
4. Tool Design - ASTM (ASTME)
5. Fundamentals of Metal Cutting & M/c Tools - Juneja (Age Internatioal).

PROFESSIONAL ELECTIVE-I

7ME05 (3)ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

SECTION – A

Unit-I: **Introduction to Artificial Intelligence (AI)** – Overview of AI, definition and importance of knowledge based systems, representation of knowledge, knowledge organization, knowledge manipulation, acquisition of knowledge. (6 Hours)

Unit II: Introduction to Expert Systems - Features of expert systems, knowledge engineering, basis expert system terminology, human experts and artificial experts, algorithmic and heuristic methods, difference between conventional programmes and expert systems, Architecture of expert systems. (8)

Unit III : Knowledge Representation & Rule based methods, rule execution, forward chaining and backward chaining, knowledge representation using semantic nets, structure of semantic nets, Frame-based methods . (8 Hours)

SECTION – B

Unit IV : Expert system Tools – Types of tools for expert system building, system building aids, support facilities, debugging aids, I/O facilities, explanation facilities, knowledge base editors, stages in the development of expert system tools, procedure oriented methods, object-oriented methods, logic-based methods, access-oriented methods. (7)

Unit V: Building an expert system & Development phased in expert system building, development constraints, reliability, maintainability, examples of expert systems, difficulties in development of expert systems (7)

Unit VI: Fuzzy Engineering- Fuzzy logic, fuzzy expert systems, fuzzy sets, membership functions, fuzzy rules for approximate reasoning, fuzzy inference generation, defuzzification, development of rules matrix, applications of fuzzy expert systems for design of industrial controllers,

RECOMMENDED BOOKS :

TEXT BOOKS:

1. A guide to Expert Systems by Donald a. Waterman, Pearson
2. Introduction to Artificial intelligence & Expert Systems by Dan W. Peterson, PHI
3. Fuzzy Logic by John Yen, Reza Langari, Pearson

REFERENCE BOOKS:

- 1) Expert Systems & Theory & Practice, By Ermine, Jean Louis, PHI
- 2) Expert systems in Engineering , By D.T. Pham. JFS Pub.
- 3) Expert system application by Sumit Vadera, Sigma press
- 4) Artificial Intelligence by Winston P.H., Pearson

7ME05

PROFESSIONAL ELECTIVE – I

(4) MECHATRONICS

SECTION - A

Unit I : Introduction to Mechatronics – Definition, Block diagram & Example, Basics of Sensors, Position & Speed Sensors, Proximity Sensors & Switches, LVDT, Digital optical encoder, Temperature Sensors Actuators-Functions, Electromagnetic Principles, Solenoids and Relays, working of DC motors and stepper motors, hydraulic and pneumatic actuators, (6 Hrs.)

Unit II: Data Acquisition: Analog signal processing using operational amplifier- Introduction, types of amplifiers, sample and hold circuits, introduction to data acquisition, sampling theorem, Quantizing theory, Analog to digital conversion, Analog to digital converter, Digital to analog conversion, Multiplexer. (6)

Unit III: Mechatronic Systems – control architecture Introduction, Control architecture, Analog circuits, digital circuits, Design of logic networks, sequential logic, flip-flops, application of flip-flops, micro-controllers, Programmable logic controller. (6 Hrs)

SECTION - B

Unit IV: Control Valves –

Study of different control components and pneumatic & Hydraulic system- Construction, working and function of Directional control valve, Flow control valves, Pressure relief valve, pressure reducing valve, sequence valve with symbols.

Unit V : Pneumatic System –

Design and analysis of pneumatic circuits, Synchronizing, Power chucking operations, controlling the rate of speed of piston, circuit to move with piece around a corner, circuit to move a work piece at a constant speed . (6 Hrs)

Unit VI: Hydraulic System –

Design and analysis of Hydraulic systems-Sequencing, pneumohydraulic, regeneration circuit, circuit to control tool movement on lathes, grinders, etc.

TEXT BOOKS:

1. Introduction to Mechatronics and Measurement systems- 2/e by Aciatore and M.B.Histant, Tata McGraw Hill edition.
2. Pneumatics and Hydraulics by H.L.Stewart.

REFERENCE BOOKS:

- 1) Introduction to Mechatronics by Appus Kuttan K.K.- Oxford University Press.
- 2) Mechatronics ó A multidisciplinary approach 4/e by W.Bolton- Pearson Publication,
- 3) Automation, Production systems and CIM by M.PGroover- Pearson Publication.

7ME06 PROJECT & SEMINAR

7ME07 MACHINE DESIGN AND DRAWING-II –LAB.

List of Exercises for Term Work :

- 1) Sheet 1 : Design of shaft
- 2) Sheet 2 : Design of coupling or any one type of gears.
- 3) Sheet 3 : Design of I.C. Engine Part (any one based on syllabus)
- 4) Sheet 4 : Preparation of detail drawing of simple machine assembly (Pedestal bearing, Plummer block, simple eccentric, stuffing box, Cross head, Tail stock, Tool post, C-clamp, Screw jack, Boiler safety valve ó Any 1 of these)
- 5) Sheet 5 : Preparation of assembly drawing of simple machine assembly (Any 1 machine from Practical 4)

Note :- Any one from the above list should be done using Computer Programming/software.

7ME08 ENERGY CONVERSION II –LAB.

List of Experiments :

Any six of the following :-

1. Trial on reciprocating compressor.
2. Trial on centrifugal blower.
3. Studies of domestic refrigerator.
4. COP calculation of vapour compression system.
5. Study of room air conditioner.
6. Study of gas turbine with the help of models.
7. Study of Pyrheliometer and measurement of direct radiation.
8. Study of testing of a flat plate collector
9. Study of Solar still and trial on it.
10. Study of a photovoltaic system.

Practical Examination shall consist of viva voce based on above term work.

7ME09 AUTOMATION ENGINEERING – LAB.

PRACTICALS :-

At least six practicals will be based on the following topics.

1. Preparation of Manual part program for Point-to-Point control. Ex; Drilling Operation.
2. Preparation of Manual part program for two-axis CNC turning operation.
3. Study of working & Programming of XY plotter.
4. Programming Examples on APT.
5. Study of performance of Robots.
6. Simulation of CNC Machining.
7. Case study of CAPP.
8. Case study on GT.
9. Performance on NC and CNC m/c.
10. Study of computer aided quantity control (CAQC).

PRACTICAL EXAMINATION :-

Practical Examination shall consist of viva voce based on above term work and syllabus.

7ME10 PROFESSIONAL ELECTIVE –I

(1)NON-CONVENTIONAL ENERGY SYSTEMS –LAB.

List of practicals :

Any six practicals will be based on the following topics :-

1. Study of Pyrheliometer and measurement of direct radiation.
2. Study of pyranometer and measurement of global and diffuse radiation.
3. Study of sunshine recorder and measurement of sunshine hours.
4. Study and testing of a flat plate recorder.

5. Study of various concentrating collectors..
6. Study of a solar absorption of refrigerating system.
7. Study of a solar dryer.
8. Study of wind mill and trial on it.
9. Study of a bio-gas plant.
10. Study of sterling cycle engine and a trial on it.
11. Study of a Solar Still and trial on it.
12. Study of a gasifier and trial on it.
13. Study of a Photovoltaic system & trial on it.

Practical Examination :

Practical Examination shall consist of viva voce based on the term work and syllabus.

7ME10 PROFESSIONAL ELECTIVE – I TOOL ENGINEERING – LAB.

TERM WORK : ANY EIGHT OF THE FOLLOWING .

1. Design & drawing of single point cutting tool.
2. Design & drawing of form tools.
3. Design & drawing of drill.
4. Design & drawing of broach.
5. Design & drawing of milling cutter.
6. Study of geometry of reamer.
7. Study of gear cutting tools.
8. Measurement of forces in Orthogonal cutting by Dynamometer.
9. Study of Geometry of taps and dies.
10. Design & Drawing of press tools.
11. Design & drawing of jigs.
12. Design & drawing of fixtures.

Practical Examination :

Practical Examination shall consist of viva voce based on the term work and syllabus.

7ME10 PROFESSIONAL ELECTIVE – I (1) ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS - LAB

Practical : The students are expected to perform five practicals based on the above syllabus.

7ME10 PROFESSIONAL ELECTIVE – I (2) MECHATRONICS – LAB.

PRACTICALS : At least six practicals will be based on the above syllabus.

Practical Examination :

Practical Examination shall consist of viva voce based on the term work and syllabus.

SEMESTER: EIGHTH

8ME01 PROFESSIONAL ELECTIVE – II (1) AUTOMOBILE ENGINEERING

SECTION – A

Unit I :- Classification of automobiles, chassis types, Power Unit- Functions and locations power for propulsion, engine mounting, engine parts- types, construction and functions, Multiple cylinder engines, General considerations of engine balancing, firing order.. (7 Hrs)

Unit II : Fuel feed systems - fuel feed systems for petrol engines. Fuel pumps, fuel filters, Air filters, Basic principles of MPFI and CRDI. Multipoint fuel injection Systems (MPFI) Common Rail Diesel Injection Systems (CRDI) Controlling system : purpose, types of cooling systems, liquid cooling system-water jacket ports, water pump and radiators, by pass recirculator system, temperature indicator, antifreeze, mixtures, troubles and remedies of cooling system.

Unit III: The electrical system, Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive, over running clutch, solenoid switch and shift, Ignition system;- Battery coil ignition system, Ignition timing and its effect on engine performance, Ignition advance mechanisms, Electronic Ignition system.

SECTION – B

Unit IV : Transmission system : Layout, types of clutches, single plate friction clutch and multiple clutch, clutch adjustments, clutch troubles and remedies, Gear Boxes :- Sliding mesh, constant mesh and synchromesh gear box, function of over drive, trouble shooting and remedies, torque converter, automatic transmission, Propeller shaft, hotchkiss drive, torque tube drive, differential. (8 Hrs)

Unit V: Braking system:- Mechanical, hydraulic brakes, power brakes, and vacuum brakes Fault finding and maintenance of brakes, Steering system :- Function, types of linkages. steering gears, steering gear ratio, wheel balancing, wheel alignment caster, king pin inclination, toe-in & toe-out & their effect, introduction to power steering.

Unit VI : Suspensions:- Rigid axle and independent suspension system, shock absorbers. Auto lubrication :- Types of lubrication, their tests and ratings, multi-viscosity oils, chassis lubrication, Engine lubrication :- types of lubricating system, full pressure system, dry sump system, oil pump, oil filters system- by pass system, full

flow system, oil breather, crankcase ventimeter, Engine lubrication troubles and remedies.

TEXT BOOKS :

1. Automobile Engineering- Vol.I & II, Kirpal Singh, Standard Publishers Distributors
2. Automobile Engineering ó R.K.Rajput; Laxmi publications, New Delhi.

REFERENCE BOOKS :

1. Automotive Mechanics; Crouse & Anglin, TMH.
2. Automotive Mechanics ; J Heitner; East West Press
3. Automotive Mechanics ; S.Srinivisan; TMH.

8ME01 PROFESSIONAL ELECTIVE –II (2) PRODUCTION PLANNING AND CONTROL

SECTION –A

Unit I :- INTRODUCTION

Objectives and Advantages of PPC, Production procedure, functions of PPC, production consumptions cycle, centralised & decentralised PPC, Pre-requisite of PPC.

Unit II :- PRODUCTION FORECASTING :-

Introduction, definition and importance of forecasts, Qualitative model: Delphi techniques, Quantitative models :- Simple moving average, weighted moving average, simple experimental smoothing.

Forecasting error and selection of forecasting model. Types of forecaste: Constant, linear cycle forecaster, Verification and controlling, The moving range chart, Average MR, out of control conditions.

UNIT III: PRODUCTION PLANNING :- The production order, Procedure for formulating Production order, masier Program, Basic problems in production planning, Quantities in batch production, criteria for batch, size determination, minimum cost batch size, production range, Maximum profit Batch size, Maximum return, Rate of return, Economic Batch size.

SECTION – B

Unit IV : MACHINE OUTPUT :

Machine output, multi machine supervision by one operator, Machine interforcence, Ashcroft lalbles, average number of consecutive servicing task, the Ashcraft Number.

Unit V: ANALYTICAL STRUCTURE OF INVENTORY :- Definition of inventory, Types of inventory and the classification, structure of inventory problems and its analysis, the relevent cost, objectives of carrying inventories, selective inventory analysis. Static Model :- General characteristic, incremental analysis, opportunity cost, cost of risk, decision criteria under uncertainty.

Unit VI: A) DYNAMIC MODEL :- CERTAINTY CASE ;- General characteristic, optimum lot size model win constant demand, quntity discounts.

Risk Case :- General characteritics, P-system and Q-system.

B) Material Requirment planning (MRP) :- Introduction to MRP, Manufacturing Resource Planning (MRP-IT), just in time (JIT), comparasion of MRP, MRP-II, Enterprenureship Resource Planning (ERP) (8 Hrs.)

TEXT BOOKS :

1. Elements of Production Planning and Control by Simuel Eilon ó Universal Publishing Corporation Ltd.Mumbai
2. Production Control ó John E.Biegal- Prentice Hall of India.
3. Inventory control, Theory & Practice- Start & Miller

REFERENCE BOOKS :

1. Production Planning and control and Management:- K.C.Jain & L.N.Agrawal.
2. Production & Operation Mgmt.- E.E.Adam, Jr.R.J.Ether, Prentics Hall of India.
3. Industrial Engineering and Production Management- M.Mahajan-Dhanpat Rai.

8ME01 PROFESSIONAL ELECTIVE –II (3) MANAGEMENT INFORMATION SYSTEM

SECTION - A

Unit I : Basis of MIS :

What is a system, what is information and data, necessity of prompt, accurate & relevent information for effective decision making, decision tables, Types of information, organisational structure and types of information within them, Fact gathering techniques. (8 Hrs.)

Unit II : System of Anaylsis & Design :

Phases of system development procedure, project request form system proposal, cost/benefit analysis functional specifications, detailed system descriptio, system acceptance criteria, audit and control requirments, structured system development, data flow diagram, context analysis diagram, exploding a process,

structured analysis, structured design, structure charts, coding schemes, input form design, system protection . (8 Hrs.)

Unit III : A) Development of MIS

Long Range plans of MIS, Class of Information, information requirement, implementation of MIS, Management of Quality in the MIS, Organisation for the development of MIS, Factors of success & failure of MIS.

B) Choice of Information Technology :

Nature of IT decision, Strategic decision, Configuration decision, Evaluation, IT implementation plan. (8 Hrs.)

SECTION – B

Unit IV : Introduction of MIS :

Prerequisites of Information System Technology Data base Management System : Concepts, Models, design, Performance monitoring & Turning, Security in the database environment MIS & RDBMS. DBMS Software ORACLE (8 Hrs)

Unit V : a) Decision Support Systems (DSS) :

Concept & Philosophy AI, Knowledge based expert system, MIS & Role of DSS.

b) Enterprise Management System (EMS) :

Introduction to ERP, basic feature, benefits, selection and implementation EMS & MIS.

c) Business process Re-engineering (BPR) ; Introduction, Business process, Process Models of Organisation and value stream model of organization, MIS & BPR. (8 Hrs)

Unit VI ; Application of MIS

A) Application in Manufacturing Sector:- Personal Management, Materials Management, Marketing Management.

B) Application in Service Sector like Hospitals, Airlines, Hotels, Banks, Insurance. (8 Hrs)

TEXT BOOKS :

- 1) Management Information System - W.S.Jawadekar (TMH, 2010)
- 2) Information Systems for operation & Mgmt.-Voichdan, Homer.
- 3) Management Information Systems - Ross.

8ME01

PROFESSIONAL ELECTIVE – II

(4) ADVANCED MANUFACTURING SYSTEMS

SECTION – A

Unit I: Total Quality Management(TQM) : Understanding quality, commitment & leadership Customer satisfaction involvement

Performance measures- Case Study Implementation of TQM Case Study (10)

Unit II : Total Productive Maintenance (TPM) Introduction outline of TPM Concepts of ōKobetsu-Kaizenō, ōJishu-Hozenō Planned Maintenance Systems Operation & Maintenance skill upgrade training initial control, ōHinshitu-Hozenō concept. (10)

Unit III : Business Process Re-Engineering (BPR) : Introduction, Reengineering. Rethinking The new world of work who will Re-Engineer? Succeeding at Re-Engg.-case study. (10)

SECTION – B

Unit IV : Value Engineering (VE) Introduction Value Orientation The various phases of VE like orientation phase Information phase, function phase etc. How to manage the VE programme case study (10)

Unit V : Concurrent Engineering (CE) Introduction to CE & need of CE CE tools Advances in design & manufacturing Engineering Design for manufacture, design for assembly Rapid prototyping Concurrent approaches in design, manufacturing and aspects of engg.

Unit VI : Just in Time (JIT) Introduction to JIT What is Toyota Production Systems Design, Development & Management of JIT Manufacturing systems, Implementation of JIT.

BOOKS RECOMMENDED:

TEXT BOOKS :

- 1) Besterfield D.H. et al ōTotal Quality Management, ō PHI New Jersey, 1995.
- 2) Johan S. Okland, ōTQMō: Text with Cases, Butterworth einemann, Oxford, 1995.
- 3) ōTPM edited notesō by Japan Institute of Plant Management.
- 4) Michel Hammer & Jones Champy, ōRe-Engineering the Corporation, Nicholas Brealey, London, 1994.
- 5) G.Joganathan, ōGetting MORE at Less Cost : The Value Engineering Wayō, Tata McGraw Hill, 1992.

REFERENCE BOOKS:

- 1) Andrew Kausik, :Concurrent Engineering : Automation, Tools & Techniquesō, John Wiley & Sons.
- 2) Chanan S. Syan & Unny Menon, ōConcurrent Engineering: Concept, Implementation & Practice, Chapman & Hall.
- 3) M.G.Korgaonkar, ōJust in Time Manufacturingō, Macmillan India Ltd. New Delhi, 1992.

PROFESSIONAL ELECTIVE – III
(1) REFRIGERATION & AIR CONDITIONING

SECTION – A

- Unit I:** Introduction to automotive air conditioning- Vapour compression system:- Analysis of simple vapour compression system. Use of pressure enthalpy. Temperature entropy charts. Effect of operating conditions such as evaporation and condensation pressure, superheating and sub cooling Actual vapour compression system, Refrigerants :- classification: primary & secondary refrigerants, desirable properties of refrigerants; merits & demerits of commonly used refrigerants such as Ammonia R-12, R-22 and their selections and eco friendly refrigeration 134 a, HFC.
- Unit II:** Multi stage pressure systems;- multistage compression: choice of intermediate pressure, complete multi-stage compressions. Multi evaporator systems; single compression individual expansion valve, single compression multi expansion valve, individual compressor multi expansion valves, cascade systems, its applications to cryogenics Air liquefaction processes- Linde-Hampson (No numerical treatment to air liquefaction system)
 (10 Hours)
- Unit III :** Refrigeration systems components & controls:- brief study of refrigerants compressor, condensers, evaporators, expansion valves, drier, fillers, selection criteria for the components of vapours compression systems Flow controls, temperature controls, pressure controls and safety devices. Defrosting systems, testing & charging of refrigeration systems, leak detection. (No analytical treatment is expected)
 (8 Hours)

SECTION – B

- Unit IV :** Psychrometric properties of moist air psychrometric chart, concept of thermodynamic wet bulb temperature, representations of Psychrometric process on Psychrometric charts, mixing of air, evaporating cooling, air washers. Human comfort:- metabolism of human body, factors influencing comfort, concept of effective temperature, optimum effective temperature & comfort charts.
 (7 Hours)
- Unit V :** Classification of air conditioning systems & applications. Unitary system package, window type & split type air conditioning. Central system:-System components, types:- direct expansion system, all water system & all air system. Water, summers & year

round air conditioning. Transmission & distribution. Types of supply air ducts, consideration for selection & location of outlet, distribution patterns of outlet, location of return air opening & introduction to duct design.

(No numerical treatment is expected) (9 Hours)

- Unit VI:** Load calculation & applied Psychrometry-basic consideration at heat gains/losses sensible & latent, heat due to occupancy lighting, appliances, products, process, air conditioning systems, safety factor cooling load estimates, heating load estimates. Sensible heat factor by pass factor, apparatus dew point, effective sensible heat factor
 (8 Hours)

BOOKS RECOMMENDED:

TEXT BOOKS:

1. Refrigeration & air conditioning; C.P.Arora; Tata Mcgraw Hill Publication.
2. Refrigeration & air conditioning; Arora, Domkundwar; Dhanpat Rai Publication.

REFERENCE BOOKS:

1. Principles of Refrigeration; J.Dossat; Pearson Education, Asia publication
2. Refrigeration & air conditioning- P.L.Balaney
3. Refrigeration & air conditioning- Manohar Prasad.

8ME02 PROFESSIONAL ELECTIVE – III
(2) MACHINE TOOL DESIGN

SECTION – A

- Unit I :** General requirement of machine tool design kinematics of m/c tool :- Various driving systems used in machine tools, basic design consideration in the design of variable speed range in the machine tools, layout of speed in geometric, logarithmic & earthmatic progression saw diagrams, range ratio, graphical representation of speed on structural and ray diagrams, design of speed & feed boxes and their classification. (8 Hours)
- Unit II :** a) Mechanical, electrical, Hydraulic stepless regulation of speeds.\
- b) Machine tool structure (bed, column, cross-rail) functions & their requirements design criteria for machine tool structure design procedure factors effecting stiffness for machine tool structure & their profile. (8 Hours)
- Unit III :** Static & dynamic rigidity, methods of increasing rigidity of structure, machine tool clastic system, procedure for assessing dynamic stability, dynamic characteristics, single degree &

multidegree of freedom systems, Experimental determination of dynamic characteristics of m/c tool, dynamic characteristics of cutting process, stability analysis, single degree, multidegree (8 Hrs)

SECTION – B

Unit IV: Vibrations of machine tools :- Effects vibration on m/c tool on cutting conditions, workpiece, Sources of vibrations, types of vibrations (forced, chatter, stickup vibrations) and its minimization.

Shock absorber, isolated tool holder, chatter in milling lathe, grinding, reduction of chatter in design & production stages. (8 Hrs)

Unit V : a) Machine tool guideways & slideways :- Functions, shapes of guideway, materials, methods of adjusting clearance in guideways, design of slideways for wear resistance, determination of maximum and average pressure, on slide way, Hydraulic guideway, antifriction guideway, protecting devices for slideway. (8 Hrs)

Unit VI: machine tool spindle and bearings :- Functions, requirement, types and materials of spindle, machine tool compliance, design of spindle, antifriction bearing, performance indices, Hydrostatic journal bearing, hydrodynamic bearing. (8 Hrs)

BOOKS RECOMMENDED:

TEXT BOOKS:

1. Principles of Machine Tools ó Base & Pal
2. M/c Tool Design ó N.K.Mishra.

REFERENCE BOOKS:

1. Machine Tool Design Vol. I,II,III,IV, N. Acherkar (Mir Pub.)
2. Principles of Machine Tools ó Sen & Bhattacharya
3. Design Principles of Metal ó Kongsberger Cutting Machine Tools
4. Machine Tool Design Vol. I to VI ó CMIT, Bangalore.

8ME02

PROFESSIONAL ELECTIVE-III (3) FINITE ELEMENT METHOD

SECTION - A

Unit I: Introduction : Application, Advantages, Steps of FEM, Stress and Equilibrium, Boundary conditions, Strain Displacement Relations, Stress-strain Relations, Von mises stress, Temperature effect, Potential Energy & Equilibrium, Galerkin's Method, stiffness (Displacement) Method. (7 Hrs)

Unit II: Matrix Algebra & Gaussian Elimination : Matrix Multiplication, Transposition, Diagonal Matrix, Symmetric Matrix, Upper Triangular Matrix, Determinant of Matrix, Matrix Inversion Eigen values & Eigenvectors, Gaussian elimination. (7 Hrs)

Unit III: ID Problems : Finite Element modeling, coordinate Shape function, The potential Energy approach, The Galerkin's Approach, assemblies of the global stiffness matrix and load vectors, Properties of stiffness Matrix, Treatment of boundary conditions, quadratic Shape Functions, Temperature Effects. (7 Hrs)

SECTION – B

Unit IV : 2D Problems for CST : Constant strain triangle, isoperimetric Representation , potential Energy approach, element stiffness, Galerkin's approach, temperature effects, problem modeling and boundary conditions. (7 Hrs)

Unit V: Development of equations: Truss equations, derivation of the stiffness, matrix for a bar element in local coordinate, global stiffness matrix, beam equation. Beam stiffness, example assemblage of beam stiffness matrix, plain stress & plain stress stiffness equations, basic concept of plain stress and plain strain, derivation of the CST stiffness matrix and equations Treatment of body and surface forces. (7 Hrs)

Unit VI: Heat Transfer : Derivation of the basic differential equations, Heat transfer with conduction, radiation, ID Formulation using variational method.

Fluid Flow : Derivation of the basic differential equations, ID Finite Element formulation, Computer Implementation (preprocessing, post processing, input data file, mesh generation)

BOOKS RECOMMENDED:

TEXT BOOKS:

1. Introduction to Finite Element Engineering ó T.R.Chandrupatla, Belegunda; PHI
2. A First course in Finite Element Method- Darya Logon, Thompson Learning (TL Publisher)

REFERENCE BOOKS:

1. The Finite Element Method in Engineering- S.S.Rao, Elsevier Pub., 4th Edition.
2. Fundamentals of Finite Element Method analysis ó D.V.Hutton, Tata McGraw Hill

3. Concept & Applications of Finite Element Analysis ó Robert D.Cook
4. Finite & Boundary Element Method in Engineering ó O.P.Gupta
5. An Introduction to Finite Element Method- J.N.Reddy, Tata McGraw Hill, 2nd Edition, 2005.

8ME02 PROFESSIONAL ELECTIVE - III

(4) ROBOTICS

SECTION – A

Unit I: Fundamentals of Robotics- Introduction, Automation & Robotics-robot applications robotic systems, robot anatomy and robot configurations, Joint types used in robots, robot wrists, joint notation schemes, work value for various robot anatomies, robot Specifications. (8 Hrs.)

Unit II: Robots end-effectors-classification of end-effectors, mechanical grippers, hooking or Lifting grippers, grippers for molten metals, plastics, vacuum cups, magnetic grippers Electrostatic grippers, multiple grippers, internal & external grippers, drive systems for grippers, active & passive grippers. (7 Hrs.)

Unit III: Robot drives & control-pneumatic power drives, hydraulic systems, electric drives, robot controllers-servo and non servo systems, motion control of robots, point to point and continuous path control, teaching of robots, robot programming methods. (7 Hrs.)

SECTION – B

Unit IV: Robot Sensors : Scheme of robotic sensors, contact type sensors, force, torque, touch, position, velocity sensors, non-contact type sensors, electro-optical imaging sensors, proximity sensors, range imaging sensors, robot environment and robot input/output interfaces, machine intelligence, safety measures in robots. (7 Hrs.)

Unit V: Robot Kinematics- Forward & reverse kinematics, forward and reverse transformation of two DOF & three DOF 2-D manipulator, homogeneous transformations.

Unit VI: Quantitative Techniques for economic performance of robots- Robot investment costs, robot operating expenses. methods of economic evaluation, method of pay-back period, return on investment method, discounted cash flow method. (7 Hrs.)

RECOMMENDED BOOKS:

TEXT BOOKS:

- 1) Robotics Technology & Flexible Automation by S.RDeb, Tata McGraw Hill.

- 2) Industrial Robotics by M.P.Groover, McGraw Hill.

REFERENCE BOOKS:

1. Robotics for Engineering, Korean Yoram, McGraw Hill.
2. Robots & Manufacturing automation by Asfahal, C.Ray, John Wiley.
3. Robotic Engineering by Richard D.Klafter, PHI.

8ME03

I. C. ENGINES

SECTION – A

UNIT I: Introduction to IC Engines and cycle analysis: Basic of I.C. Engines , Details of two stroke and four stroke engines, Air standard cycles, Fuel air cycle and actual cycle. Variation in specific heat, Dissociation and their effect on engine performance. Review of other losses in IC engines. (7 Hrs)

UNIT II: Fuels and alternative fuels : Conventional fuels for IC engines, requirement, properties, fuel additive, limitations of fossil fuels. Review of various alternative/non-conventional fuels . Studies of fuel injection systems : Fuel pump and their working, different types of fuel feed systems, studies of injectors nozzles, Bosch type fuel pump. (8 Hrs)

UNIT III: Combustion SI Engine:- Stages of combustion, factors influencing various stages, Normal and abnormal combustion, Detonation, Factors responsible for detonation. Effect of detonation. Octane rating of fuel, Requirement of combustion chambers for SI engines, important types, relative advantages and disadvantages and application. (8 Hrs.)

SECTION - B

UNIT IV: Combustion in CI. Engines:- Stages of combustion in CI Engines, Delay period, factor affecting delay period, diesel knock, cetane rating, Requirements of combustion chamber for CI Engines. Methods of generating turbulence in combustion chamber. Types of combustion chambers for CI Engines. (8 Hours)

UNIT V: Performance testing of IC Engines: Evaluation of various performance parameters of IC Engines including heat balance, sheet and excess air calculation. Methods of determination of friction power. Supercharging : Basic principles, objectives, arrangements for super charging, advantages and limitations of super charging (8 Hours)

UNIT VI: Emission from IC Engines : review, their effect on human health, cause of formation and approaches to control this pollutants. Study of BIS, EURO emission norms, IC Engines: Recent trends: Microprocessor based engines, management multi-point fuel

injection engines, common rail direct injections engines, variable valve timing engines. (8 Hours)

TEXT BOOKS:

1. Internal combustion Engines - M.L.Mathur & Sharma Dhanpatrai & Sons.
2. Internal combustion Engines ó V.Ganeshan, Tata Mcgraw Hills.

REFERENCE BOOKS:

1. Internal combustion Engines Fundaments- John B. Heywood, Mcgraw Hills
2. Internal combustion Engines & Air Pollution- Obert E.F.Intext Educational.

8ME04 OPERATION RESEARCH TECHNIQUES

SECTION-A

UNIT I: Operations Research : Introduction, characteristics, Phases, Limitations, Models and classification of O.R.Models.

Linear Programming : Formulation, Standard Form, Graphical and simplex methods, Primal-Dual relationship. (8 Hrs)

UNIT II: Transportation Models : Introduction, LP Formulation of transportation problems, Methods for finding initial solution, MODI method.

Assignment Models : Introduction, Mathematical statement and solution methods of assignm. Problems, variations of assignment Problems. (6 Hrs)

UNIT III: Network Models : Network construction, PERT analysis, CPM analysis, cost analysis & Crashing the network, Updating resources smoothing and leveling. (6 Hrs)

SECTION-B

UNIT IV: Waiting line models : Introduction, characteristics, classification, analysis of M/M/1 and M/M/s models.

Sequencing : processing of n jobs through two machines, n jobs through m machines, two jobs through m machines. (7 Hrs)

UNIT V: Replacement models : introduction, value of money, individual and group replacement policies.

Simulation : introduction, Monte Carlo simulation, advantages and limitations, applications of simulation to queuing models, inventory models, maintenance models , etc. (7 Hrs)

UNIT VI: Dynamic programming: introduction, characteristics, applications of dynamic programming to capital budgeting, production

scheduling, travelling sales men, cargo loading problems, etc. (6 Hrs)

RECOMMENDED BOOKS:

TEXT BOOKS:

1. Operations Research and Theory applications- II ed.J.K.Sharma; Macmilan Business Books
2. Operations Research; Prem kumar Gupta, D.S.Hira; S.Chand & Co. Ltd.

REFERENCE BOOKS:

1. Inroduction to Research Operation, 7th Edition; Hiller/Lieberman; Tata Macgraw Hills.
2. Operations Research : An Introduction, 7th Edition, H.A.Taha; PHI.
3. Operations Research: Principles and practices; 2nd Edition, Ravindran, Philips, Solberg, John Willey & Sons.
4. Operations Research: Kapoor .

8 ME05 PROJECT & SEMINAR

8ME06 PROFESSIONAL ELECTIVE-III

(1) REFRIGERATION & AIR CONDITIONING-LAB.

List of Practicals :-

Any six of the following should be conducted and a report there of should be submitted

1. Trial on Vapour compression system.
2. Trial on Air-conditioning system.
3. Study of Electrolux system.
4. Study of Water cooler.
5. Study of window Air conditioner.
6. Study of household refrigerator.
7. Study of desert cooler.
8. Study of cold storage plant.
9. Testing and changing of refrigeration system.
10. Study of defrosting system.
11. Study/trial of ice plant.
12. Study of various refrigeration and air-conditioning controls.

Practical Examination:

It shall consists of viva-voce based on term work and syllabus.

8ME06 PROFESSIONAL ELECTIVE-III

(2) MACHINE TOOL DESIGN -LAB.

PRACTICALS :-

- (1) Design of speed box.
- (2) Design of feed box.
- (3) Design of combination guide way.

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ARCHITECTURE
SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

SEMESTER: SEVENTH

07AR01 ADVANCE CONSTRUCTION-I

Objective : The course will enable the learning in progression , starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization.

Unit I: Analysis of different type of foundation as per load bearing capacity of soils, types of soil and building loading conditions. Caisson foundation its types and purposes. Combined foundation its purposes types.

Unit II: Earthquake resistant structure.

- a) Introduction of earthquake, types of earthquake, origin and causes of earthquake.
- b) Failure mechanism of structures due to earthquake. Analysis of earthquake affected load bearing masonry and framed structures

Unit III: a) Remedial measures in terms of planning , designing , materials and techniques for earthquake resistant structure.
b) Retrofitting of earthquake affected buildings.

Unit IV: a) General study of standardisation of building elements its uses for various construction.
b) Study of Modular co-ordination and its multipurpose functional application.

Unit V: Concept of curtain wall and structural glazing material and construction techniques, fixing details of various metal casements.

Unit VI: Architectural glass system.

Sessional work: Assignments, test, site visit and drawing on the above topics.

REFERENCE BOOKS:

1. S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand, 1997
2. HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.
3. W.B. McKay Building Construction, vol. 1,2,3, Longmans, U.K. 1981.
4. Don A Watson, Construction Materials and Processes, McGraw Hill Co., 1972.

5. R. Chudley, Construction technology, Richard Clay (Chaucer Press) Ltd., Suffolk, 1978.
6. J.H. Callender, Time saver standard for Architectural Design Data, McGraw-Hill, 1994.

07AR02 ENVIRONMENTAL SERVICES –I

Objective: To impart knowledge of various aspects of city level water supply systems, drainage and solid waste disposal.

Unit I: Sources of water supply their types, water collection, water treatment, distribution of water from various sources.

Unit II: Rain water disposal and roof drain and rain water harvesting system.

Unit III: Water pollution and preventive measures.

Unit IV: Sewage treatment plant and its locational factor..

Unit V: Garbage disposal and recycling methods. Concept of recycling of solid and liquid waste in building. Vermicomposition, Biogas production.

Unit VI: Sewage disposal systems in unsewered location viz. septic tank, soak pit, aqua privy.

Sessional work: Assignments, test, site visit and drawings on the above topics.

REFERENCE BOOKS:

1. Manual of Water supply and treatment , second edition, CPHEEO, Ministry of Works and housing, New Delhi, 1977.
2. Manual of Sewerage and sewage treatment, CPHEEO Ministry of Works and housing, New Delhi, 1980.
3. S.C. Rangwala, water supply and sanitary Engineering, Charotar publishing House , Anand 1989.
4. Bureau of Indian Standards.
5. Pachauri, A.K., Water Supply and Sanitary Installations, Design, Construction and Maintenance, New Age International Ltd.
6. Manas Handbook of Plumbing, Manas Publishers

07AR03 PROFESSIONAL PRACTICE

Objective: The objective of the course is to expose the students to the present trends of architectural practice and valuation.

Unit I: Role of professional bodies such as The Indian Institute of Architects, working, byelaws, categories of membership, election procedure and code of conduct; The Architects Act of 1972 and the Council of Architecture.

- Unit II:** Professional responsibilities of the architect, copyrights, scale of charges, variation of charges, mode of payment, termination of services, specialized building services.
- Unit III:** Techniques of valuation, elements of valuation and factors affecting valuation. Methods, valuation of landed and building property, comparable cost of sale, purchase and mortgage.
- Unit IV:** Valuation for compensation on acquisition, compensation under central and state legislation, relevance of the Town Planning Act.
- Unit V:** Valuation for renewal or lease/extension of lease, standard rent, easement rights, dilapidation, insurance, estate development and advice on investment policy.
- Unit VI:** Arbitration, arbitrators, umpire and nature of arbitration.
Sessional work: Assignments, test, site visit and drawings on the above topics.

REFERENCE BOOKS:

1. Rangwala, S C , "Valuation of Real Properties", Charotar Book Stall.
2. Piotrowski, A. and Williams, Julia, "The Discipline of Architecture", University of Minnesota Press.
3. Eldred, G.W., "The Beginners Guide to Real Estate Investing", John Wiley & Sons
4. Publications of COA, IIA Hand Book on Professional Practice, The Architects publishing Corporation of India, and Bombay 1987.

07AR04 : URBAN PLANNING

- Objective:** The objective of the course to develop the understanding of urban planning process through surveys, analysis, alternative planning strategies and urban planning issue.
- Unit I:** Need and study of Urban planning interrelationship between urban planning, urban design, urban landscape design and Architecture planning as a team work and role of urban planner in planning team. Hierarchical levels of planning.
- Unit II:** Planning during Medieval and renaissance period in western and Indian context.
- Unit III:** Evolution of modern planning concepts. Impact of industrial revolution on planning process. Planning theories developed by Patric Geddis, Ebenezer Howard, Lewis Mumford, C. L. Doxiadis, Patric Abercrombie.

- Unit IV:** Introduction to TPS, master plans, structure plan, regional plans, land use planning , Neighbourhood Planning, zoning.
- Unit V:** Recent trends in urban planning, New towns development, SEZ, JNNURM, Green cities, ISHDP, Urban renewal process.
- Unit VI:** National habitat and housing policy. Slum improvement scheme, ISHDP, DCR relevant to housing.
Sessional work: Assignments, test, site visit and drawings on the above topics.

REFERENCE BOOKS :

1. Gallion Arthur B & Eisna Simon, The Urban Pattern, City Planning and Housing.
2. C. L. Doxiadis, Ekistics, An introduction to the Science of Human Settlements, Hutchinson, London, 1968
3. John Ratchiffe, An Introduction to Town and Country Planning.
4. Gupta, V., "Energy and Habitat: Town Planning and Building Design for Energy Conservation", Wiley Eastern.
5. Rangwala, S.C., "Town Planning", Charotar Publishing House.
6. Eleanor, S.M., "British Town Planning and Urban Design: Principles and Policies", Longman.
7. Randall, A., "Crossroads, Hamlet, Village, Town: Design Characteristics of Traditional Neighbourhoods, Old and New", American Planning Association.

07AR05 ARCHITECTURAL STRUCTURE-VI

Objective: Understanding of Basic Theory and principles of structural analysis and structural properties of elements.

- Unit I:** Design and detailing of simple G + 1 structure.
- Unit II:** Walls and chimneys subjected to kind pressure.
- Unit III:** Introduction to flat slabs, combined and eccentric footings selection criteria for above structures. (only Theory no Design)
- Unit IV:** Failure of structured
- a. Types of failure in various structure.
 - b. Causes of failure.
 - c. Evaluation of damage
 - d. Non destructive testing techniques .
 - e. Techniques to prevent collapse failure of structures.
 - f. Repaired and rehabilitation of structures.
- Unit V:** Simple welded and riveted connection (without moments) only axial loads .

Unit VI: Design of simple tension and compression member of trusses.

Sessional work:

Visit to construction sites to study R.C.C. Structures and steel fabrication work and preparing report.

REFERENCE BOOKS:

1. P.C.Punmia, Strength of Materials and Theory of Structures; vol I, Laxmi Publications, Delhi 1994.
2. S.Ramanmurtham, Strength of Materials ó Dhanpatrai & Sons, Delhi 1990
3. W.A.Nash, Strength of Materials ó Schaums Series ó McGraw Hill Book Company, 1989
4. R.K.Bansal ó engineering Mechanics and Strength of Materials ó Lakshmi Publications, Delhi, 1990

07AR06 ARCHITECTURAL DESIGN STUDIO-VII

Objective: To enable the student to design the large scale housing and housing project in an urban environment with emphasis on advanced building services and systems, urban development regulations, building byelaws.

BASIC CONTENTS:

- 1) Introduction to the designing of multifunctional community housing project on an appropriate scale.
- 2) Importance of case studies, data collection, area analysis, evolution of plan forms, climatic oriented planning and design features, space utilization, building & site services, site analysis and site planning ,etc; in the Architectural design process.
- 3) Importance of culture, tradition, topography, climate and building bye laws in generating built form.
- 4) Planning and designing of large scale housing and building projects in an urban environment, advance building services, energy conservations, cost effective techniques and materials, building bye laws, housing schemes etc.
- 5) Architectural study tour relevant to design project.

Sessional work: One major design project and one time project with other task and assignments.

Viva Voce by external examiner at the end of Semester.

Suggested text books:

1. Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)

3. Scott: Design Fundamentals ,Edward d Mills- Planning the Architects Hand Book ó Bitterworth, London, 1985.
4. Watson,D (editor) Time ósaver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.
5. Neufert,P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G, õForm defining strategis: experimental architectural designö. Wasmuth, 2007.

07AR07 ADVANCE CONSTRUCTION STUDIO -I

Sessional work;

Assignments and drawing on the above topics given in the subject 07AR01 Advance construction ó I.

Viva Voce by external examiner at the end of Semester.

07AR08 URBAN PLANNING STUDIO

Sessional work;

Assignments and drawing on the above topics given in the subject 07AR04 Urban Planning.

Viva Voce by external examiner at the end of Semester.

SEMESTER: EIGHTH

08AR01 ARCHITECTURAL DESIGN -VIII

Objective : To expose students for designing of large scale urban design projects with emphasis on modern material, techniques , architectural styles advanced services, sustainable architecture, green architecture, climate responsive architecture etc.

Basic contents:

- 1) Introduction to urban design project planning and design consideration.
- 2) Importance of case studies, data collection, area analysis, evolution of plan forms, climatic oriented planning and design features, space utilization, building & site services, site analysis and site planning ,etc; in the Architectural design process.
- 3) Importance of culture, tradition, topography, climate and building bye laws in generating built form.
- 4) Major design project may include high rise/tall buildings viz. apartment and commercial mixed used complexes, five star Hotel, multifunctional complex, community centers, super specialty hospital, institutions etc.
- 5) Architectural study tour relevant to design project.

Sessional work:

One major design project and one time project with other task and assignments.

SUGGESTED TEXT BOOKS:

1. Ching, F.D.R.: Form, Space and Order, Van Nostrand Rheinhold, New York (1979).
2. Parmar V.S.: Design Fundamentals in Architecture, Somoiya Publications, Bombay (1973)
3. Scott: Design Fundamentals Edward d Mills- Planning the Architects Hand Book ó Bitterworth, London, 1985.
4. Watson, D (editor) Time ósaver standards for Architectural Design: Technical data for professional practice, McGraw-Hill, 2005.
5. Neufert, P; Architects Data; Blackwell Science, 2000.
6. Agkathidis, A, Hudert, M and Schiling, G, óForm defining strategis: experimental architectural designö. Wasmuth, 2007.

08AR02 ADVANCE CONSTRUCTION - II

Objective: The course will enable the learning in progression , starting from simple building elements, components, materials and construction techniques to develop strong sense of visualization.

Unit I: General introduction to large span structures and high rise structures, planning features and its construction aspects. Chronological development of large span structural framework such as lamella, laminated portal frame , R.C.C. & steel portal frames.

Unit II: A) R.C.C. and steel space frame structures. B) Study of shell structures and its construction techniques from historical perspective. C) Shell structures such as Geodesic Schwedeler and Gitter Kuppel and its construction aspect.

Unit III: Constructions aspect consider in temporary structures which are in portable nature for various short terms events. Use of modular techniques and materials.

Unit IV: Ferrow cement techniques and its appropriate various uses for building construction elements.

Unit V: Introduction to prestressed concrete, principle and method of prestressing, advantages and disadvantages.

Unit VI: Types of elevators ó Electric, hydraulic, passenger, hospital, capsule, freight etc., details of lift shaft and other mechanism

escalators and conveyors. Parallel and criss cross escalators, horizontal belt conveyors , horizontal moving walkwayø.

Sessional work:

Assignments, test, site visit and drawing on the above topics.

REFERENCE BOOKS:

1. S.C. Rangwala, Engineering Materials, Charotar Publishing House, Anand, 1997
2. HUDCO - All you want to know about soil stabilized mud blocks, HUDCO Pub, New, Delhi, 1989.
3. W.B. McKay Building Construction, vol. 1,2,3, Longmans, U.K. 1981.
4. Don A Watson, Construction Materials and Processes, McGraw Hill Co., 1972.
5. R. Chudley, Construction technology, Richard Clay (Chaucer Press) Ltd., Suffolk, 1978.
6. J.H. callender, Time saver standard for Architectural Design Data, McGraw-Hill, 1994.

08AR03 ENVIRONMENTAL SERVICES – II

Objective: To expose the students specialized services in buildings.

Unit I: Natural and artificial ventilation system in buildings. Air conditioning methods equipments and ducting.

Unit II: Refuse disposal system in high-rise buildings, viz. ó refuse chute, purpose of service floor and other services.

Unit III: Lift , escalator, different type and use their lay out , lighting conductors, building automation system.

Unit IV: Energy construction, low energy systems, hybrid systems, integration and P. V. and wind system in the building, wind , solar and other non-conventional energy systems, solar thermal application for heating and cooling, electricity generation in building.

Unit V: Fire safety ó general provisions. Causes of fire in buildings, Fire protection standards ó safety regulation ó NBC ó planning consideration in building like non- combustible material, construction , stair cases and lift lobbies , fire escapes and A.C. system. Special features required for physically handicraft and elderly in building types.

Unit VI: Fire detectors and fighting installation. Type of detectors and usage. Alarm system, Fire fighting pumps , fire tank , dry and wet risers, automatic sprinkler, fire drill , refuge areas.

Sessional work:

Assignments, test, site visit and drawings on the above topics.

REFERENCE BOOKS:

1. Manual of Water supply and treatment , second edition, CPHEEO, Ministry of Works and housing, New Delhi, 1977.
2. Manual of Sewerage and sewage treatment, CPHEEO Ministry of Works and housing, New Delhi, 1980.
3. S.C.Rangwala, water supply and sanitary Engineering, Charotar publishing House , Anand 1989.
4. Bureau of Indian Standards.
5. Pachauri, A.K., Water Supply and Sanitary Installations, Design, Construction and Maintenance, New Age International Ltd.
6. Manas Handbook of Plumbing, Manas Publishers

08AR04 SUSTAINABLE ARCHITECTURE

Objective: To sensitize students about the importance and need for Sustainable Planning concept and appropriate Architectural design concept as an emerging thrust area.

UNIT-I: Introduction : Planning concept & Environmental Impact Analysis & Ecological foot prints & Essential ingredients of sustainable development apart from social and economical & environment , stake holder, participation , institutional mechanism.

UNIT-II: Development in Historical Context - Early settlement pattern & Climate Responsive Planned Layouts & orientation of Streets and Buildings, Creation of Habitable Environment , Early Planning Methods.

UNIT-III: Resource Efficiency & Land , Water, Energy, Human Resource, Biodiversity & Suitable practices at settlement, Campus and Building Level.

UNIT-IV: Sustainable Architecture & Appropriate materials and construction & review of their properties workability, Eco Friendly construction practices & sustainable campuses and case studies..

UNIT-V: Sustainable Planning and Policies & Awareness programme at National, International levels Rio de Janeiro agenda & Earth summits & agenda involved & their realization.

Sessional work: Assignments and test on the above topics.

REFERENCE BOOKS:

1. O.H.keonigsberger; T.G. Ingersoll and others; Manual of tropical housing and building- Part-I; Longmans,London-1980
2. M. Evans; Housing, climate and comfort; Architectural press London- 1980
3. B.G.Givoni; Man,climate,and architecture; Applied science, banking, Essex, 1982

4. N.K Bansal and others; Passive building design; Elsevier science-1994.
5. S.Drake; The third skin architecture,technology and environment;UNSWpress-2007.
6. Manik & Girish Komisva, IIPA, keeping Cities Clean and Green, Uppal Publishing House, 1997.
7. Beer, Environment Planning for Site Development.

08AR05 LANDSCAPE DESIGN

Objective: To enable students realize that architectural design could enhance and enrich built environment through a study and understanding of plants and vegetation historical achievements and techniques of application in the overall context of ecology.

UNIT-I: Introduction : Landscape Architecture. Understanding man and nature land and landscape. Relationship of architecture and Landscape Architecture.

UNIT-II: History of the art of garden design of India, China, Persia, Japan, Italy, France and England.

UNIT-III: Garden Design of the modern world.

UNIT-IV: Basic Principles of landscape design and element. Types of landscape elements and its various uses.

UNIT-V: Plant classification and nomenclature, plant identification. Characteristics of various types of plants and their suitability of landscaping, plant selection criteria, planting design and visual aspects of plant form.

UNIT-VI: Methodology and process of site analysis, data collection, compilation , Presentation and analysis techniques. Preparation, interpretation and evolution of landscape plans site planning.

Sessional work:

Assignments, tests, and tutorials on the above topics

REFERENCE BOOKS:

1. Sylvia Crowe Sheila Haywood, The Gardens of Mughal India , Vikas Publishing House, Pvt. Ltd, India, Delhi,1973.
2. Garrett Eckbo, The Art the Home Landscaping, McGraw-hill Book Co., London, 1956.
3. Testsuro Yoshida, Gardens of Japan, Jr. Marcus G. Sims, 1963.
4. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone press, 1986.

5. Percy Brown, Indian Architecture (Islamic period), Taraporevala and Sons, Bombay, 1983
6. Satish Grover, The Architecture of India (Buddhist and Hindu Period), Vikas Publishing Housing Pvt. Ltd., New Delhi, 1981
7. Christopher Tadgelli, The History of Architecture in India from the Dawn of Civilization to the end of Raj, Longman group, U.K.Ltd., London, 1990

08AR06 PROFESSIONAL ELECTIVE – I (1) HOUSING

Objective: To sensitize students about the need for , demand and supply of housing in India, to expose the role or function of various housing agencies, the typologies of housing with basic environmental issues.

UNIT-I: Housing Issues ó Indian Context. Housing as Architecture ó basic need ó demand and supply of housing ó Housing Agencies and their role in housing development.

UNIT-II: Social factors influencing housing design, affordability , economic factors and influence of traditional housing and planning features.

UNIT-III: Housing surveys and standards. Sources of Data and information, methods and techniques of housing survey, housing standards etc.

UNIT-IV: Housing Design ó Traditional Patterns ó Row housing and cluster housing ó layout concepts ó use of open spaces ó utilities and common facilities.

UNIT-V: Case studies of housing schemes designed by eminent architects. High Rise Housing.

UNIT-VI: National habitat and housing policy slum improvement scheme, ISHDP, DCR relevant to housing.

Sessional work :

Assignment and case studies of above topics.

TEXT BOOKS :

1. Joseph de chiara and others ó Time Saver Standards for Housing and Residential Development McGraw-Hill Co., New York, 1995
2. Karnataka state Housing Board ó MANE ó Publication - 1980

08AR06 PROFESSIONAL ELECTIVE – I (2) ENVIRONMENTAL PLANNING

Objective: To Provide advanced knowledge on how all issues and concerns of environment can integrate to architectural design process.

UNIT-I: Introduction to the ideas, issues and concepts of sustainable Architecture, Global Environment , Principles of environmentally and ecologically supportive Architecture.

UNIT-II: Early Settlement Patter ó Climate Responsive Planned Layouts ó Orientation of streets and buildings. Creation of Habitable Environment, Early Planning Methods.

UNIT-III: Quality of Urban Environment and Living ó Past , Present and Future Trends role of Urban Design in Urban Environment, Planning for Quality Living in Urban Areas.

UNIT-IV: Conservation of Water, Land, Energy its methods. Environmental impact assessment.

UNIT-V: Solid & Liquid Waste from residential & Commercial Buildings ó Environmental significance ó Segregation and treatment of waste-degradation of environment due to wast .

UNIT-VI: Salient Features of environmental laws ó Rain Water Harvesting Techniques. Biological and Thermal Energy Options ó Biogas Production ó Liquid Waste, Recycling Methods & Practices.

Sessional work :

Assignment and case studies of above topics.

TEXT BOOK :

1. Gosling and Maitland ó Environmental Planning ó St. Martin's Press, 1984

08AR06 PROFESSIONAL ELECTIVE – I (3) CONSTRUCTION MANAGEMENT

Objective: To establish and develop construction management skills network techniques, construction equipments and methods along with quality control in construction.

UNIT-I: Introduction to project management concepts ó background of management, purpose, goal and objectives. Traditional management system, Gantt's approaches, load chart, progress chart, bar charts, merits and limitation schedule time estimates units.

UNIT-II: Project management, resources balancing, phasing of activities, programmes, scheduling project control, reviewing, updating and monitoring.

UNIT-III: Introduction to modern management concepts. Introduction to PERT and CPM network concepts, inter relationship, information, data sheets and development of network. CPM for management, CPM network analysis, identification of critical path floats computation result sheets.

UNIT-IV: PERT Network, introduction to the theory of probability and statistics, probabilistic aim estimates for the activities of PERT Network.

UNIT-V: Financial management. Introduction to two dimensional network analysis activity cost information. Cost time relationship, crashed estimates for the activities, project direct cost and indirect cost.

UNIT-VI: Construction quality control and inspection, significance of variability and estimation of risks, construction cost control, crashing of networks.

Sessional work :

Assignment and case studies of above topics.

TEXT BOOKS :

1. Dr. B. C. Punmiya and K. K. Khandelwal ó Project Planning and Control with PERT/CPM Laxmi Publications, New Delhi, 1987.
2. S. P. Mukhopadhyay, Project Management for Architects and Civil Engineers, IIT, Kharapur.
3. Ahuja H. N. óConstruction Performance Control by Networksö, Wiley Inter science Publication.
4. Peurifoy, R. I. óConstruction Planning Equipments and Methodsö McGraw Hill Book Co. Inc.
5. Srivastva, U. K. óConstruction Planning Managementö Galgotia Publisher.

08AR07 ARCHITECTURAL DESIGN STUDIO -VIII

Sessional work:

Assignments and drawing on the above topics given in the subject 08AR01 Architectural Design Studio ó VIII.

Viva Voce by external examiner at the end of Semester.

08AR08 ADVANCE CONSTRUCTION STUDIO -II

Sessional work:

Assignments and drawing on the above topics given in the subject 08AR08 Advance construction Studio ó II.

Viva Voce by external examiner at the end of Semester.

08AR09 LANDSCAPE DESIGN STUDIO -II

Sessional work:

Assignments and Sketches, Case Studies of contemporary period, Landscape Proposals for Residential, Public, Institutional Buildings on the above topics given in the subject 08AR09 Landscape Design Studio ó II.

Viva Voce by external examiner at the end of Semester.

SEMESTER: NINTH

09AR01

PRACTICAL TRAINING

Each candidate shall have to prepare a detail report along with necessary drawing, sketches, measurement, record, reading, observations, survey analysis, log sheets and modes, if necessary on the following six aspects which are concerned with the practical training. This report shall be submitted for the Viva-Voce examination duly certified by the Principal of the College.

1. Critical appraisal - of any building that he/she or his/her employer has designed and executed. The building shall be used and the students may record the reactions of the users to support his/her appraisal in addition to photographs, drawing etc.
Marks (Sessional)- 25
2. Site Supervision and Practice-A detail report of any major part of a small building that has been personally supervised by the candidate. It may include checking site measurement preparation of a bill, site instructions and checking of the executed work.
Marks(Sessional)- 25
3. Field Observation - A report on architectural use of the site conditions. For example, Electric poles, Water tanks, slope of the site etc.
Marks (Sessional)- 25
4. Log sheet and office certificate - A student shall fill the log sheets as a record of his every day work and shall submit the same along with the certificate from his/her employer.
Marks (Sessional)- 25
5. Working drawing and complete estimate of small project - A student shall submit all the working details prepared by him/her during his/her practical training along with estimate of small project.
Marks (Sessional)- 100
6. Viva-Voce Each candidate shall be individually interviewed and questioned on any of the sublet mentioned above by a Principal,

Head of Department of Architecture and Two external examiner appointed by the University.

Marks(Viva-Voce)-100

Total Marks - 300

Pass Marks - 150

SEMESTER: TENTH

**10AR01 PROFESSIONAL ELECTIVE – II
(1) INDUSTRIAL ARCHITECTURE**

Objective: To impart knowledge of planning and design features, materials and techniques useful in industrial structures.

UNIT -I : Meaning of industrial architecture, scope , context. Impact of industrial revolution ó origin in the context of Britain and the United States ó Impact of materials and technology.

UNIT-II : Automation techniques & its impact, circulation and area requirement, influence on design ó Internal & External Environment Control ó Precaution at site.

UNIT-III : Pioneers and Architects role in industrial design. Study of examples of pioneer to include Peter Behrens, Max Berg, Hans Poelzig and P. L. Nervi ó impact of expressionism and international style.

UNIT-IV : Responsibilities of architect in innovative corporate image, understanding industrial environments through Indian case studies.

UNIT-V : Zoning principle, Factories Act and Rules (1948) in India ó Role of Pollution Control Boards, organizing principles. Environmental Control & Waste Management.

Sessional work :

Assignments and drawing on the above topics given in the subject 10AR01 Climate Responsive Architecture .

**10AR01 PROFESSIONAL ELECTIVE – II
(2) CLIMATE RESPONSIVE ARCHITECTURE**

Objective: To sensitize students about the importance and need for Climate Responsive Architecture Design concept.

UNIT-I: Introduction to the ideas, issues and concepts of sustainable Architecture, related to types of climates. Global Environment & Principles of Environmentally and supportive Architecture.

UNIT-II: Non- conventional Energy Systems, Solar Thermal Application for heating and cooling.

UNIT-III: Low Energy design Hybrid Systems, Integration of PV and wind systems in the buildings.

UNIT-IV: Day Light principles , Glare amount of daylight, daylight factor, orientations and sizes of opening to achieve diffused lights.

UNIT-V: Application of Climatic Principles ó Evolution of Plan Form to minimize Heat Gain in Tropical Climates, Orientation of Building with respect to sun , wind, sizes of fenestration & its orientation, Use of evaporative cooling, ground coiling, cavity walls, topography , water bodies, vegetation. Landscape elements, cross ventilation system to achieve natural comfort level in indoor & outdoor spaces.

UNIT-VI: Planning and Design features to be considered with respect to various Climate.

Sessional work :

Assignments and drawing on the above topics given in the subject 10AR01 Climate Responsive Architecture .

**10AR01 PROFESSIONAL ELECTIVE – II
(3) VERNACULAR ARCHITECTURE**

Objective: To impart knowledge about various manmade and natural forces behind the evolution of traditional architecture.

UNIT -I : Approaches and Concepts to the study of vernacular architecture ó Aesthetics ó Anthropological ó Architectural ó Developmental ó Geographical ó Historical ó Spatial ó Folkloristic.

UNIT-II : Traditional Principles of Planning in Western & Northern India ó Primitive Forms, Symbolism, Colour, Folk Art etc. in the Architecture of the Deserts of Kutch and Gujrat State ó Wooden Houses & Mansions (Havelis) Gujrat & Rajsthan ó House boats (Dhugas) Kashmir ó Material of Construction & Construction details.

UNIT-III: Vernacular Architectural of South India ó Wooden Houses, Palaces & Theatres in Kerala, Palaces in Tamilnadu, Principles of Planning, Proportions, Elements, Beliefs & Culture, Material of construction and construction detail.

UNIT-IV : Western influences on Vernacular Architecture ó Colonial influence on the traditional House, Bangla & Bungalow, House typologies, settlement planning, Pondicherry & Cochin.

UNIT-V: Secular Architecture ó Medieval Period ó Citadel, Palaces, Towers, Gateways, Public Buildings etc. in the medieval towns of Jodhpur, Jaipur, Jaisalmer, Gwalior etc.

Sessional work;

Assignments and drawing on the above topics given in the subject 10AR01 Climate Responsive Architecture .

10AR02 ARCHITECTURAL PROJECT / THESIS

Objective: Develop any chosen architectural design project, emphasis being on integration of all technical, human & aesthetic aspect in the Architectural design solution.

The topic would be selected by students, subject to approval by the department. The topic selected may be a live design project or research oriented but essentially concluding in its application in architectural design project. The work progress evaluation would also be based on intermediate reviews of the study in presence of panel of teachers and experts from professional field.

The Viva-voce would be in the form of final Review on the basis of sessional submission in presence of two External Examiners. The H.O.D. Department of Architecture and student's teacher Guide would act as Internal Examiners.

The students would be required to explain and defend their study and design. The submission would consist of proper Presentation of Drawings, Thesis Report and Model.

The candidate shall carry out thesis considering the following aspect ó Research analysis and data collection, site selection & justification, user requirements & justification, climatic conditions, socio-economic problems, communication, Transportation, Landscape & Urban Planning.

10AR03 SEMINAR

Objective: Seminar is intended to evaluate the student's ability to explore in the field of architecture and make in depth investigation in the chosen area.

The students are expected to choose topics which are of special interest to them and prepare a Report and Drawings to show analysis of investigation. The Review of work would be done in presence of H.O.D. Department of Architecture, and nominated teacher guide, and other teachers.

The Viva-voce would be in the form of proper presentation of the Drawings, Information/ Data and Report. The Viva-voce would be in

presence of External Examiner. The H.O.D. Department of Architecture, and student's teacher Guide would act as internal examiners.

The Seminar topic can be related to any of the following subject ó Architectural theory, history, design determinates, design language, design evaluation, building types, urban planning and design, housing, interior design, landscape design, building technology and environmental sciences, professional practice and any other related field, accepted and approved by the Department.

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
INFORMATION TECHNOLOGY
SEMESTER PATTERN (CREDIT GRADE SYSTEM)**

SEMESTER: SEVENTH

7IT 01 DIGITAL SIGNAL PROCESSING

- Unit I:** Discrete Time Signals and Systems: Introduction to DSP, Advantages, basic elements of DSP system, sampling theorem, A/D, D/A conversion, quantization. Elementary discrete-time sequences. Discrete-time systems: description, representation, classification (linear, time-invariant, static, causal, stable)
- Unit II:** Analysis of DT LTI systems: The convolution sum, properties of convolution, Analysis of causal LTI systems, stability of LTI systems, step response of LTI systems, difference equation, recursive & non recursive discrete-time systems, solution of difference equations, Impulse response of LTI recursive system. Correlation of discrete time signals.
- Unit III:** z- Transform and Analysis of LTI Systems: Definition of z- Transform, properties, rational z-Transforms, evaluation of the inverse z- Transforms, analysis of linear time invariant systems in z-domain, transient and steady-state responses, causality, stability, pole-zero cancellation, the Schur-Cohn stability test
- Unit IV:** Fourier Transforms, the DFT and FFT: Definition & properties of Fourier transform, relation with z-transform. Finite duration sequences and the discrete Fourier transform (DFT), properties, circular convolution, Fast algorithms for the computation of DFT: radix-2 and radix-4 FFT algorithms
- Unit V:** Design of Digital Filters: Classification of filters: LP, HP, BP, FIR and IIR filters, filter specifications. Design of FIR filters using Windows and by Frequency sampling methods. Design of IIR filters from Analog filters using approximation of derivatives, Impulse invariant transformation, Bilinear transformation and Matched z-Transformation, Commonly used Analog filters and IIR Filter design example
- Unit VI:** Realization of Discrete-Time systems: Structures for realization of Discrete-Time systems, realization of FIR systems: Direct Form, Cascade Form, Frequency sampling and Lattice structures. Realization of IIR filters: Direct Form, Signal flow graph and Transposed structures, Cascade form, Lattice and Lattice-ladder. Realization for IIR systems.

TEXT BOOK :

J G Proakis and D G Manolakis, *Digital Signal Processing: Principles Algorithms and Applications* (Pearson Education)

REFERENCE BOOKS:

1. S. Salivahanan, A Vallavaraj, C Gnanapriya *Digital Signal Processing* (TaTa McGraw Hill)
1. S K Mitra: *Digital Signal Processing: A Computer-Based Approach* (TaTa McGraw Hill)
2. E C Ifeachor and B W Jervis *Digital Signal Processing A Practical Approach* (Pearson Education)
3. A V Oppenheim, R W Schaffer with J R Buck *Discrete Time Signal Processing* (PHI)

7IT02 OBJECT ORIENTED ANALYSIS AND DESIGN

- UNIT-I:** Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle.
- UNIT-II:** Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams.
- UNIT-III:** Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Instances, Object Diagram
- UNIT-IV:** Basic Behavioral Modeling-I: Interactions, Use cases, Use case Diagrams, Interaction diagrams, Activity Diagrams.
- UNIT-V:** Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.
- UNIT-VI:** Architectural Modeling: Component, Deployment, Collaborations, Component diagrams and Deployment diagrams.

TEXT BOOK:

1. Grady Booch, James Rumbaugh, Ivar Jacobson : *The Unified Modeling Language User Guide*, Pearson Education.

REFERENCE BOOKS:

1. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: *UML 2 Toolkit*, WILEY-Dreamtech India Pvt. Ltd.
2. Meilir Page-Jones: *Fundamentals of Object Oriented Design in UML*, Pearson Education.
3. Pascal Roques: *Modeling Software Systems Using UML2*, WILEY-Dreamtech India Pvt. Ltd.
4. Atul Kahate: *Object Oriented Analysis & Design*, The McGraw-Hill Companies.

**SYLLABUS PRESCRIBED FOR
BACHELOR OF ENGINEERING
COMPUTER SCIENCE & ENGINEERING
SEMESTER PATTERN (C. G. S.)**

SEVENTH SEMESTER

7KS01 DIGITAL SIGNAL PROCESSING

Unit I: Discrete Time Signals and Systems: Introduction to DSP, Advantages, basic elements of DSP system, sampling theorem, A/D, D/A conversion, quantization. Elementary discrete-time sequences. Discrete-time systems: description, representation, classification (linear, time-invariant, static, causal, stable)

(08Hrs)

Unit II: Analysis of DTLTI systems: The convolution sum, properties of convolution, Analysis of causal LTI systems, stability of LTI systems, step response of LTI systems, difference equation, recursive & non recursive discrete time systems, solution of difference equations, Impulse response of LTI recursive system. Correlation of discrete time signals.

(08Hrs)

Unit III: z- Transform and Analysis of LTI Systems: Definition of z- Transform, properties, rational z-Transforms, evaluation of the inverse z- Transforms, analysis of linear time invariant systems in z-domain, transient and steady-state responses, causality, stability, pole-zero cancellation, the Schur-Cohn stability test.

(08Hrs)

Unit IV: Fourier Transforms, the DFT and FFT: Definition & properties of Fourier transform, relation with z-transform. Finite duration sequences and the discrete Fourier transform(DFT), properties, circular convolution, Fast algorithms for the computation of DFT: radix-2 and radix-4 FFT algorithms

(08 Hrs)

Unit V: Design of Digital Filters: Classification of filters: LP, HP, BP, FIR and IIR filters, filter specifications. Design of FIR filters using Windows and by Frequency sampling methods. Design of IIR filters from Analog filters using approximation of derivatives, Impulse invariant transformation, Bilinear transformation and Matched z-Transformation, Commonly used Analog filters and IIR Filter design example.

(08Hrs)

Unit VI: Realization of Discrete-Time systems: Structures for realization of Discrete-Time systems, realization of FIR systems: Direct Form, Cascade Form, Frequency sampling and Lattice structures. Realization of IIR filters: Direct Form, Signal flow graph and Transposed structures, Cascade form, Lattice and Lattice ladder. Realization for IIR systems.

(08Hrs)

TEXT BOOK :

J G Prokis and D G Manolokis, Digital Signal Processing: Principles Algorithms and applications (Pearson Education)

REFERENCE BOOKS:

1. S K Mitra: Digital Signal Processing: A Computer-Based Approach (McGraw Hill)
2. E C Ifeachor and B W Jervis Digital Signal Processing A Practical Approach (Pearson)
3. A V Oppenheim, R W Schaffer with J R Buck Discrete Time Signal Processing (PHI)
4. P Ramesh Babu: Digital Signal Processing Scitech Publications.

7KS02/7KE02

COMPUTER NETWORKS

UNIT I: Introduction: Brief history of computer networks & Internet, Layered architecture, Internet protocol stack, Network entities & layers, Application layer: Principles of protocols, HTTP, FTP, SMTP and DNS protocols.

(08Hrs)

UNIT II: Transport layer: services & principles, multiplexing & demultiplexing applications, UDP, principles of reliable data transfer, TCP details, principles of congestion control, TCP congestion control.

(08Hrs)

UNIT III: Network layer: network service model, routing principles, hierarchical routing, Internet Protocol (IP) & ICMP details, routing in the Internet, router internals, IPV6.

08Hrs

UNIT IV: Link layer: Introduction, services, multiple access protocol, LAN addresses & ARP, CSMA / CD, PPP details.

(08 Hrs)

UNIT V: Network security: Basic issues, principles of cryptography, authentication and authentication protocol, version, integrity: digital signatures, message digests, hash function algorithm, key distribution & certification, secure e- mail, E-Commerce: SSL & SET, IP Sec details.

(08 Hrs)

UNIT VI: Firewalls: Packet filtering and Application gateway, Network Management: Basic principles, infrastructure for network management, The Internet Network management framework: SMI, MIB, SNMP details, security and administration, ASN.1

(08 Hrs)

TEXT BOOK:

James F. Kurose & K W Ross: Computer Networking, Pearson Education (LPE)

Reference Books:

1. Douglas E. Comer: Computer Network & Internet, Addison Wesley.
2. Andrew S. Tanenbaum: Computer Networks, PHI (5E)
3. Leon Garcia & Widjaja: Communication Networks, TMH
4. William Stallings: Data & Computer Communication, Pearson Education.

7KS03 DESIGN AND ANALYSIS OF ALGORITHMS

- Unit I:** Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.
- Unit II:** Divide And Conquer: Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Convex Hulls, Drawbacks of D & C & Timing Analysis.
- Unit III:** Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstra's Shortest Path Algorithm.
- Unit IV:** Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.
- Unit V:** Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.
- Unit VI:** Efficiency of Algorithm: Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

TEXT BOOK:

Dave and Dave: "Design and Analysis of Algorithms" Pearson Education

REFERENCE BOOKS:

1. Aho, Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
2. G. Brassard, P. Bratley: "Fundamentals of Algorithms", PHI
3. Horowitz & Sahani: "Fundamental Algorithms", Galgotia.
4. Cormen, T.H, Lierson & Rivest: "Introduction to Algorithms", McGraw-Hill

7KS04**OBJECT ORIENTED ANALYSIS AND DESIGN**

- UNIT-I:** Modeling Concept: Introduction, Object orientation, OO Development, OO themes, Modeling as a design technique, Class Modeling. Abstraction, The three models, Object and class concepts, Link and association concepts, Generalization & Inheritance, Navigation of class models. (08Hrs)
- UNIT II:** Advanced object and class concepts, Association Ends, N-ary association, Aggregation, Abstract classes, Multiple inheritance, Metadata, Reification, Constraints, Derived data, Packages, State Modeling: Events, States, Transitions and Conditions, State diagrams, State diagram behavior. (08Hrs)
- UNIT III:** Nested state diagram, Signal Generalization, Nested states, Concurrency, Relation of class and state models, Use case model, Sequence models, Activity models, Use case relationships, Procedural sequence model, Special constructs for activity models. (08 Hrs)
- Unit IV:** Development stages, Development life cycle, Devising a system concepts, Elaborating a concepts, Preparing a problem statements, Overview of analysis, Domain class models, Domain state model, Domain Interaction model. (08 Hrs)
- Unit V:** Application Analysis. Overview of System Design, Estimating Performance, Making a reuse plan, Breaking a system into subsystems, Identifying Concurrency, Allocation of subsystems, Management of data storage, Handling global resources, Choosing a software control strategy, Handling boundary conditions, Setting trade-off priorities, Architecture of the ATM system. (08 Hrs)
- Unit VI:** Overview of class design, Realizing the use cases, Designing algorithm, Recursing Downwards, Refactoring, Design Optimization, Reification of behavior, Adjustment of Inheritance, Organizing a class design, ATM examples (08 Hrs)

TEXT BOOK :

Blaha, Rumbaugh: "Object Oriented Modeling and Design with UML" (2/e) Pearson Education.

REFERENCE BOOKS:

1. Dathan, Ramnath: "Object Oriented Analysis, Design & Implementation", OUP.
2. McRobb & Farmer: "Object Oriented System Analysis & Design" McGraw Hill.
3. Booch, Rumbaugh & Jacobson: "The UML User guide" Pearson Education.

4. Whitten & Bentley: *System Analysis & Design Methods* Tata McGraw Hill.
5. Booch: *Object Oriented Analysis & Design with Applications*, Pearson Education.

7KS05 PROFESSIONAL ELECTIVE -I
(I) COMPUTER GRAPHICS

- Unit I:** An overview of Computer Graphics and Graphics System: video display devices, Raster-Scan systems, Random-Scan systems, Graphics monitors and workstations, input devices, hard copy devices, Graphics software. (08 Hrs)
- Unit II:** Output primitives : Point and Lines, Line drawing algorithms, loading the frame buffer, line function, circle and ellipse generating algorithms, curves, parallel curves algorithms, Pixel addressing, filled-area primitives, functions, Cell array, character generation. (08 Hrs)
- Unit III:** Attributes of output primitives : Line and curve attributes, color and grayscale levels, area fill attributes. Character attributes, bundled attributes, antialiasing. (08 Hrs)
- Unit IV:** 2-D geometric transformations : basic transformations, matrix representations, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations. Two- Dimensional viewing : viewing coordinates, Window-to viewport coordinate transformation, viewing functions, clipping : point, line, polygon, curve, text, exterior. (08Hrs)
- Unit V:** Structures and hierarchical modeling : concepts, editing structures, basic modeling concepts, hierarchical modeling, GUI and interactive input methods : the user dialogue, input of graphical data, functions, initial values for input device parameters, interactive picture - construction techniques, virtual reality environments. (08Hrs)
- Unit VI:** Three dimensional concepts : display methods, graphics, Bezier curves and surfaces, B-spline curves and surfaces, Beta-splines, three dimensional geometric and modeling transformations : translation, rotation, scaling, three dimensional viewing : viewing pipeline, viewing coordinates, projections. (08Hrs)

TEXT BOOK:

D. Hearn, M.P.Baker : *Computer Graphics*, Second Edition, Pearson Education.

REFERENCES:

1. F.S.Hill: *Computer Graphics Using Open GL*, II edition, Pearson Education.
2. W.M.Newman & R.F.Sproul: *Principles of Interactive Computer Graphics*, 2/e, McGraw Hill.
3. F.S.Hill : *Computer Graphics*, McMillan.
4. D.Hearn & M.P.Baker : *Computer Graphics*, Prentice Hall.
5. Hamington : *Computer Graphics*, McGraw Hill.

7KS05 PROFESSIONAL ELECTIVE -I
(II) MULTIMEDIA TECHNOLOGIES

- Unit I:** Multimedia Authoring and Data Representations: Introduction, Components of Multimedia, Hypermedia and Multimedia, Overview of Multimedia Software Tools, Multimedia Authoring and Tools: Multimedia Authoring, VRML. Graphics and Image Data Representations: Graphics/Image Data Types, 1-Bit Images, 8-Bit Gray-Level, Images, Image Data Types, Popular File, Formats, GIF, JPEG, PNG, TIFF, EXIF, Graphics Animation Files, PS and PDF, Windows WMF, Windows BMP, Macintosh PAINT and PICT, X Windows PPM. (08Hrs)
- Unit II:** Color in Image and Video: Color Science, Color Models in Images, and Color Models in Video. Fundamental Concepts in Video: Types of Video Signals, Component Video, Composite Video, S-Video, Analog Video, NTSC Video, PAL Video, SECAM Video, Digital Video, Chroma Sub sampling CCIR Standards for Digital Video, High Definition TV. (08Hrs)
- Unit III:** Basics of Digital Audio: Digitization of Sound, Digitization, Nyquist Theorem, Signal-to-Noise Ratio (SNR), Signal-to-Quantization-Noise Ratio (SQNR), MIDI: Musical Instrument Digital Interface, Hardware Aspects of MIDI, Structure of MIDI Messages, General MIDI, MIDI-to-WAV Conversion, Quantization and Transmission of Audio, Coding of Audio, Pulse Code Modulation, Differential Coding of Audio, Lossless Predictive Coding, DPCM, DM, ADPCM. (08Hrs)
- Unit IV:** Multimedia Data Compression: Lossless Compression Algorithms: Basics of Information Theory, Run-Length Coding, Variable-Length Coding (VLC), Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. The JPEG Standard. (08Hrs)
- Unit V:** Basic Video Compression Techniques: Introduction, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261, Intra-Frame (I-Frame) Coding, Inter-

Frame (P-Frame) Predictive Coding, Quantization in H.261, H.261 Encoder and Decoder, H.261 Video Bitstream Syntax, MPEG-1, Motion Compensation in MPEG-1, Major Differences from H.261 (08Hrs)

Unit VI: Basic Audio Compression Techniques: ADPCM, Vocoders, Phase Insensitivity, Channel Vocoder, Formant Vocoder, Linear Predictive Coding, CELP. MPEG Audio Compression: Psychoacoustics, Equal-Loudness Relations, Frequency Masking, Temporal Masking, MPEG Audio, MPEG Layers, MPEG Audio Strategy, MPEG Audio Compression Algorithm, MPEG-2 AAC (Advanced Audio Coding). (08Hrs)

TEXT BOOK:

Ze-Nian, Li, Mark S. Drew "Fundamentals of Multimedia" (Pearson Education)

REFERENCE BOOKS:

1. Rajan Parekh "Principles of Multimedia" (Tata McGraw-Hill)
2. S.J.Gibbs & D.C.Tsichritzis "Multimedia Programming", Addison Wesley 1995
3. P.W.Agnew & A.S.Kellerman "Distributed Multimedia", Addison-Wesley 1996
4. C.A.Poynton, "A Technical Introduction to Digital Video" Wiley 1996
5. F.Fluckiger, "Understanding Networked Multimedia", Prentice-Hall 1995

7KS05

PROFESSIONAL ELECTIVE - I (III) WEB ENGINEERING

UNIT I: Introduction to the Web: History of web, Protocol governing the web, Web architecture, Major issues in Web solution development, Web servers, Web browsers, Internet Standards, TCP/IP protocol suites, IP Address, MIME, Cyber laws. Hypertext Transfer Protocol (HTTP): Introduction, web server and client, Resources, URL and its Anatomy, Message Format, Examples, Persistent and non persistent Connections, Web caching, Proxy. (08Hrs)

Unit II: Hypertext Markup language (HTML): History of HTML, HTML basics, Elements, attributes and tags of HTML, Basic Tags, Advanced Tags, Frames, Images, Meta Tag, Planning of web page, Model and Structure of web site, Designing web pages, Multimedia content. Cascading Style Sheet (CSS): Introduction, advantages, Adding CSS, Browser compatibility, CSS and page layout, Selectors, Grouping, Type Selectors. (08Hrs)

Unit III: Extensible Markup Language (XML): Common Usage, Role of XML, Prolog, Body, Elements, Attributes, Validation, Displaying XML, Namespaces. XML DTD, Introduction to DTD, Purpose of DTD, DTD in XML document, element type declaration, Attribute declaration, Entity declaration, DTD validation. 08 Hrs

Unit IV: W3C XML Schema: Introduction, limitation of DTD, strengths of schema, schema structure, schema element, element declaration, schema validation, Built in data types, declaring simple elements. (08Hrs)

Unit V: Java Script: Introduction, variables, literals, operators, control structure, conditional statements, Arrays, Functions, Parameter Passing, Function Pointer, Inner/Nested Functions, Objects. (08Hrs)

Unit VI: Common Gateway Interface (CGI): Internet programming paradigm, Server side programming, Language for CGI, Applications, Server environment, Environment variables, CGI building blocks, CGI scripting using C, shell script, writing CGI program, CGI security, Alternatives and enhancement in CGI. (08 Hrs)

TEXT BOOK:

Roy Uttam K: Web Technologies, Oxford University Press, 2010.

REFERENCES:

1. Dr. Raja Subramanian: Creating Web Sites in Engineering, University Science Press.
2. Mohler J.L. & Duff J.M.: Designing Interactive Web Sites, CENGAGE Learning.
3. Joel Sklar: Text Book of Web Design, CENGAGE Learning.
4. Meenakshi G.M.: Web Graphics, Scitech Publications (India) Pvt. Ltd.

7KS05

PROFESSIONAL ELECTIVE - I (IV) HUMAN COMPUTER INTERFACE

UNIT I: Human factors of interactive software: Goals of system engineering & User-interface design, motivation for human factors, accommodation of human diversity, High level theories, Object-Action interface model, Recognition of the diversity, Eight golden rules of interface design, Preventing errors, Guidelines for data display and data entry, Balance of automation and human control. (08 Hrs)

UNIT II: Managing design process, Organizational design to support usability, the three pillars of design, Development methodologies, ethnographic observation, Participatory Design,

Scenario Development, Social impact statement for early design review, legal issues, Software tools: specification methods, Interface-Building tools, Evaluation and Critiquing tools.

(08 Hrs)

UNIT III: Direct manipulation and virtual environments, example of direct manipulation system, Explan ations of direct manipulation, OAI model, Visual thinking and icons, direct manipulation programming, home automation, Remote Direct manipulation, Virtual environments.

(08 Hrs)

UNIT IV: Interaction devices: Keyboards and function keys, Pointing devices, Speech recognition , digitization and generation, Image and Video Displays, Printers. Response time and Display rate: Theoretical foundations, Expectations and attitudes, User Productivity, Variability.

(08 Hrs)

UNIT V: Multiple window strategies, Individual windows design, Multiple window design, Coordination by tightly coupled windows, Image browsing and tightly coupled windows, Personal role management and elastic windows. Computer supported cooperative work: Goals of cooperation , Asynchronous interaction, Synchronous distributed and face-to-face, Applying CSCW to education.

(08 Hrs)

UNIT VI: Information search and visualization, Database Query and phrase search in textual documents, multimedia documents searches, Information visualization, advanced filtering. Hypermedia and the World Wide Web, Genres and goals and designers, Users and their tasks, Object action interface model for web site design.

(08 Hrs)

TEXT BOOK:

Ben Shneiderman:öDesigning the User Interfaceö, Pearson Education.

REFERENCE BOOKS:

1. R. Beale, A.J. Dix, J. E. Finlay, G. D. Abowd öHuman-Computer Interactionö, Prentice-Hall.
2. Joann Hackos, Janice Redish, öUser and Task Analysis for Interface Designö, Wiley.
3. Jeff Raskin, öThe Humane Interfaceö, Pearson Education.
4. Jesse James Garrett, -The Elements of User Experienceö, New Riders.

7KS06 DIGITAL SIGNAL PROCESSING - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

7KS07 DESIGN & ANALYSIS OF ALGORITHMS - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

7KS08 OBJECT ORIENTED ANALYSIS & DESIGN - LAB.:

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units along with one mini project.

7KS09 PROJECT AND SEMINAR

Seminar should be preferably based on the proposed project to be completed in final year. The seminar should be conducted in seventh semester and evaluated. Each candidate shall submit a seminar report, deliver the seminar and face the viva-voce. The distribution of internal 50 marks shall be as follows.

- | | |
|---|----------|
| 1. Seminar report preparation and submission :- | 10 marks |
| 2. Seminar delivery/ presentation:- | 20 marks |
| 3. Seminar viva-voce:- | 10 marks |
| 4. Attendance in all seminar sessions:- | 10 marks |

SEMESTER : EIGHT

8KS01 ARTIFICIAL INTELLIGENCE

Unit I : Introduction: Definition of AI, AI Techniques, Tic-Tac-Toe, Pattern Recognition, Level of the model, Critical for Success, Problems and Problem Specifications, Defining the Problems, Production Systems, Control Strategies, Futuristic Search, Problem Characteristics, Decomposition of Problems, Solution steps, Predictability, Absolute & Relative Solutions.

Unit II: Basic Problem Solving methods: Reasoning, Problem trees and graphs, Knowledge Representation, Matching indexing with variables, Heuristic Functions, Weak Methods, Problem reduction, Constraints Satisfaction, Means-ends analysis, Analysis of Search Algorithms.

Unit III: Games Playing, Minimax Search Procedure, adding alpha beta cutoffs, additional refinements, waiting for quiescence, Secondary Search, Using Book moves limitations.

Unit IV : Knowledge Representation using Predicate Logic: Representing simple facts in logic, augmenting the representation, resolution, conversion to clause form, Resolution in Propositional Logic and Predicate Logic, Unification Algorithms, Question Answering and Natural Deduction.

Unit V : Structural representation of knowledge: Some common known structures, choosing the level of representation, finding the right structure as needed, declarative representation, semantic nets, Conceptual Dependency, Frames, Scripts, Semantic- Semantic, Spectrum and procedural representation.

Unit VI : Natural Language Understanding: Concepts of Understanding, Keyword matching, Syntactic and Semantic analysis, Understanding single and multiple sentences, Using Four, Cover structures, Schemes and Scripts in Understanding, Dialogue Understanding.

TEXT BOOK:

Elaine Rich & Knight: "Artificial Intelligence", McGraw Hill.

REFERENCE BOOKS:

1. Nils Nilson: "Principles of Artificial Intelligence". (Addison-Wesley)
2. R. J. Winston: "Artificial Intelligence". (Wiley)
3. Patternson "Introduction to Artificial Intelligence and Expert Systems" (PHI).
4. Rolston "Principles of Artificial Intelligence and Expert Systems", McGraw Hill.

8KS02/8KE02

EMBEDDED SYSTEMS

Unit-I Introduction to Embedded System: Embedded Systems Vs General Computing Systems. History, classification, major application areas and purpose of Embedded Systems. Components of Embedded system: General Purpose and Domain Specific Processors, Memories for embedded systems.

Unit-II Components of Embedded system: Sensors & Actuators, Communication Interface, Embedded Firmware and other components. Characteristics of Embedded System, Quality Attributes of Embedded System. Embedded Systems Examples: Washing machine. Automotive application.

Unit-III Introduction to 8051 Microcontroller: 8051 Architecture, 8051 Memory Organization, Registers, Oscillator Unit, Ports, 8051 Interrupt System, Timer units, the Serial Port, 8051 Power Saving Modes.

Unit-IV: Programming the 8051 Microcontroller: Addressing modes. 8051 Instruction Set: Data transfer instructions, Arithmetic instructions, Logical instructions, Boolean instructions, and Program Control Transfer instructions. Assembly Language based Embedded Firmware development.

Unit-V : Programming in Embedded C: Review of various constructs in C. Constant declarations, `volatile` type qualifier, Delay generation and Infinite loops in Embedded C. Coding Interrupt Service Routines, Recursive and Re-entrant Functions, Dynamic memory allocation.

Unit-VI : VxWorks Real Time Operating System (RTOS): Characteristics, Real Time Kernel, Hard/Soft Real time. VxWorks Task Creation, Management and Task Scheduling, Kernel Services, Inter Task Communication, VxWorks Task Synchronization and Mutual Exclusion, Interrupt Handling, Watchdog for task Execution monitoring, Timing and Reference in VxWorks.

TEXTBOOK:

Shibu K V "Introduction to Embedded Systems" McGraw-Hill.

REFERENCES:

1. Rajkamal , "Embedded Systems, Architecture, Programming & Design" TMH.
2. Tammy Noergaard "Embedded Systems Architecture" Elsevier Newness Publication.
3. Vahid and Givargis "Embedded System Design" John Wiley & Sons P Ltd.
4. Peter Marwedel "Embedded Systems Design" Springer, Netherland.

8KS03/8KE03

SOFTWARE ENGINEERING

Unit I : Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. W5HH principles, critical practice. (08 Hrs)

Unit II: Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan. (08 Hrs)

Unit III: Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard. (08 Hrs)

Unit IV: System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation. (08 Hrs)

Unit V: Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User-interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation. (08 Hrs)

Unit VI: Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software. (08 Hrs)

TEXTBOOK:

Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

REFERENCE BOOKS:

1. Somerville: Software Engineering (Addison-Wesley) (5/e)
2. Fairly R: Software Engineering (McGraw Hill)
3. Davis A: Principles of Software Development (McGraw Hill)
4. Shooman, M.L: Software Engineering (McGraw-Hill)

8KS04 PROFESSIONAL ELECTIVE -II (I) DISTRIBUTED COMPUTING

UNIT-I: Basic distributed system: Introduction, Distributed computing models, Software concepts, Issues in designing distributed system, Client Server model, Case studies. (08 Hrs)

UNIT II: Inter process Communication: Message passing Group Communication, Remote Communication: Introduction, Remote procedural call basics, RPC Implementation, RPC Communication, Other RPC Issues, Remote method, Invocation basics, RMI Implementation. (08 Hrs)

UNIT III: Synchronization: Introduction, Clock Synchronization, Logical clocks, Global state, Mutual Exclusion, Election algorithms, Deadlock in Distributed systems. (08 Hrs)

UNIT IV: Distributed system management: Introduction Research management, Task assignment approach, Load balancing

approach, Load sharing approach, Process management in a distributed environment, Process migration, Threads, Fault tolerance. (08 Hrs)

UNIT V: Distributed shared memory: Introduction, Basic concepts of DSM, Hardware DSM, Design Issues in DSM, Issues in implementing DSM systems, Heterogeneous and other DSM systems. (08 Hrs)

UNIT VI: Distributed File System: Introduction to DFS, File models, DFS design, Semantics of file sharing, DFS Implementation, File catching in DFS, Replication in DFS. (08 Hrs)

TEXT BOOK :

Sunita Mahajan & Seema Shah: Distributed Computing Oxford University Press

REFERENCE BOOKS:

1. Tanenbaum: Distributed Operating Systems Oxford University Press.
2. Sinha: Distributed Operating Systems Concepts & Design PHI.
3. Tanenbaum & Van Steen: Distributed Systems Principles & Paradigms PHI, Second Edition.
4. Crichlow: Distributed Systems- Computing Over Networks PHI.

8KS04 PROFESSIONAL ELECTIVE -II (II) MOBILE COMPUTING

Unit I : Introduction: Applications, History of wireless communication, A simplified reference model, Wireless Transmissions: Frequencies for Radio Transmissions, Signals, Antennas, Signal Propagations, Multiplexing, Modulation, Spread Spectrum, Cellular System. (08 Hrs)

Unit II: Medium Access Control: Motivations for a specialized MAC, SDMA, FDMA, TDMA, CDMA, Comparison of S/T/F/CDMA, Telecommunications System: GSM, DECT, TETRA, UMTS and IMT-2000. (08 Hrs)

Unit III: Satellite Systems: History, Applications, Basics, Routing, Localizations, Handover, Examples, Broadcast Systems: Cyclical Repetition of Data, Digital Audio Broadcasting, Digital video Broadcasting, Convergence of Broadcasting and mobile communications. (08 Hrs)

Unit IV: Wireless LAN: Infra Red Vs Radio Transmission, Infrastructure and Ad-hoc Network, IEEE 802.11, HIPERLAN, Bluetooth. (08 Hrs)

Unit V: Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile Ad-hoc Networks, Mobile Transport Layer:

Traditional TCP, Classical TCP improvements, TCP over 2.5/3G Wireless Networks. (08 Hrs)

Unit VI: Support for Mobility: File Systems, World Wide Web, Wireless Application Protocol (version 1.X) Architecture, i-mode, SyncML, WAP2.0. (08 Hrs)

TEXT BOOK :

ochen Schiller: "Mobile Communication" Pearson Education, Second Edition.

REFERENCE BOOKS:

1. Mazliza Othman: "Principles of Mobile Computing and Communications", Auerbach.
2. Agrawal and Zeng: "Introduction to Wireless and Mobile Systems", Cengage Learning.
3. Upena Dalal: "Wireless Communication", Oxford University Press.
4. Raj Kamal: "Mobile Computing", Oxford University Press.

**8KS04 PROFESSIONAL ELECTIVE -II
(III) SOFT COMPUTING**

Unit-I: Fundamental of Neural Network: Basic concepts of Neural Network, Human Brain, Model of artificial neurons, Neural Network architecture, Characteristics of Neural Network, Learning methods, Taxonomy of Neural Network architecture, Early Neural Network architecture. (08 Hrs)

Unit-II: Architecture of a Backpropagation Network, The Perceptron Model, The solution, Single Layer Artificial Neural Network, Model for Multi-layer Perceptron, Back propagation learning, Input Layer, Hidden Layer and Output Layer Computation, Calculation of error, Training of Neural Network, Method of Steepest Descent, Effect of Learning rate, Adding a momentum Term, Backpropagation Algorithm. (08Hrs)

Unit-III: Fuzzy Set Theory: Fuzzy versus Crisp, Crisp sets, Operations and Properties of Crisp Sets, Partition and Covering, Fuzzy sets, Membership Function, Basic Fuzzy Set Operation, Properties of Fuzzy Sets, Crisp Relations, Cartesian product, other relations, Operations on Relations, Fuzzy Relations, Fuzzy Cartesian Product, Operations on Fuzzy Relations. (08Hrs)

Unit IV: Fuzzy Systems: Crisp logic, Laws of Propositional logic, Inference in Propositional logic, Predicate logic, Interpretations of Predicate Logic Formula, Inference in Predicate Logic, Fuzzy logic, Fuzzy Quantifiers and Inference, Fuzzy rule based system, Defuzzification methods, applications. (08 Hrs)

Unit V: Fundamental of Genetic Algorithm: Genetic Algorithms, Basic Concepts, Creation of offspring, Working Principle, Encoding, Binary, Octal, Hexadecimal, Permutation, Value, Tree, Fitness function, Reproduction. (08 Hrs)

Unit VI: Genetic Modeling: Inheritance Operators, Cross over, Inversion & Deletion, Mutation Operator, Bit wise operator, Bit wise operator used in GA, Generational cycle, Convergence of genetic algorithm, Application, Multilevel Optimization, Real life problem, Differences and similarities between GA and other traditional methods, Advances in GA. (08 Hrs)

TEXT BOOK:

S. Rajesekaran, G. A. Vijayalakshmi Pai: "Neural Network, Fuzzy logic, and Genetic algorithms Synthesis and Applications", PHI.

REFERENCE BOOKS:

1. S. Haykin: "Neural Networks", Pearson Education.
2. Jang, Sun and Mezutani: "Neuro Fuzzy and Soft Computing", McGraw-Hill.
3. J. Yen, R. Langari: "Fuzzy Logic: Intelligence, Control & Information", Pearson Education.
4. N.P. Pahey: "Artificial Intelligence and Intelligent Systems", Oxford University Press.

**8KS04 PROFESSIONAL ELECTIVE -II
(IV) NETWORK SECURITY**

Unit I: Introduction: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Internetwork Security, Internet Standards and the Internet Society. Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. (08 Hrs)

Unit II: Public-Key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public Key Cryptography Principles, Public Key Cryptography Algorithms, Digital Signatures, Key Management. (08 Hrs)

Unit III: Authentication Applications: Kerberos, X.509 Authentication Service, Public-Key Infrastructure, Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME, (08 hrs)

Unit IV: IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management, Web Security: Web Security Considerations, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). (08 Hrs)

Unit V: Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3, Intruders: Intruders, Intrusion Detection, Password Management. (08 Hrs)

Unit VI: Malicious Software: Viruses and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks, Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation. (08 Hrs)

TEXT BOOK:

William Stallings: Network Security Essentials Applications and Standards Pearson Education, Third Edition.

REFERENCE BOOKS:

1. Atul Kahate: Cryptography and Network Security Mc Graw Hill.
2. Forouzan and Mukhopadhyay: Cryptography and Network Security Mc Graw Hill.
3. Matt Bishop: Computer Security: Art & Science Pearson Education.
4. Brijendra Singh: Network Security & Management PHI.

8KS05 ARTIFICIAL INTELLIGENCE -LAB.

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

8KS06 EMBEDDED SYSTEMS -LAB.

Minimum Eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units.

8KS07 PROJECT & SEMINAR

The project shall be internally evaluated (for 75 Internal Marks) in three phases based on the progress of the project work. Each phase shall be internally evaluated for 25 marks as follows:

Phase I: - Problem Definition and Design

Phase II: - Problem Implementation and Testing

Phase III: - Project Demonstration & Report submission.

The external evaluation of the project shall be based on demonstration of the project and viva-voce

SYLLABUS PRESCRIBED FOR BACHELOR OF ENGINEERING COMPUTER ENGINEERING SEMESTER PATTERN (C. G. S.)

SEVENTH SEMESTER

7KE01

SIGNALS AND SYSTEMS

Unit I: Continuous time and discrete time signals, transformation of the independent variable, exponential and sinusoidal signals, unit impulse and unit step functions, operations on signals like folding, time-shifting, amplitude scaling and time-scaling, mixing of signals and modulation. (08Hrs)

Unit-II: Continuous time and discrete time systems, basic system properties, discrete time LTI systems, Continuous time LTI systems, Properties of linear time invariant systems, Causal LTI systems described by differential and difference equations, Singularity functions. (08 Hrs)

Unit III: Fourier Series representation of periodic signals: Response of LTI systems to complex exponentials, Fourier representation of continuous time periodic signals, convergence of the Fourier series, Properties of continuous time Fourier series, Fourier series representation of discrete time periodic signals, properties of discrete time Fourier series, Fourier series and LTI systems, filtering. (08 Hrs)

Unit IV: Continuous Time Fourier Transform: Development of the Fourier transform representation of an aperiodic signal, the Fourier transform for periodic signals, properties of the continuous time Fourier transform, the convolution property, multiplication property, Linear constant coefficient differential equations. (08 Hrs)

Unit V: Sampling: Representation of continuous time signals by its samples, reconstruction of a signal from its samples, aliasing, discrete time processing of continuous time signals, sampling of discrete time signals. (08 Hrs)

Unit VI: Z- Transform: Z- transform, the region of convergence for the z-transform, Inverse z- transform, properties of Z transform, analysis and characterization of LTI systems using z transforms, System function algebra and block diagram representations, the unilateral z transform. (08 Hrs)

TEXT-BOOK:

Oppenheim, Willsky, Nawab -Signals and Systems Pearson Education.

8CH02 CHEMICAL REACTION ENGINEERING-II

SECTION - A

- UNIT I:** Residence time distribution. Models for non-ideal flow. (7)
- UNIT II:** Mixing concept and models: Rate equation for Heterogeneous reactions, fluid particle Reactions. Determination of rate controlling step. Application to Design. (8)
- UNIT III:** Fluid-Fluid reaction: The rate equation for different cases and application to design. (7)

SECTION - B

- UNIT IV:** Heterogeneous processes, catalysis and adsorptional determination of surface area, void volume. Pore volume distribution catalyst preparation, promoters and inhabitation catalyst reactivation. (8)
- UNIT V:** Rate equation for third solid catalytic, reactions. Internal External transport process in Heterogeneous Reactions. (7)
- UNIT VI:** Design of Heterogeneous catalytic reactors, fixed broad reactors, isothermal and adiabatic fixed bed reactor, non-isothermal & non-adiabatic fixed bed reactor. Fluidized bed, Drickle bed, slurry reactor. (8)

TEXT BOOKS:

1. Chemical Reaction Engineering, Octave Levenspil, Wiley Eastern Ltd.
2. Chemical Engineering Kinetics, Smith J.M., McGraw Hill

REFERENCE BOOKS:

1. Elements of Chemical Reaction Engineering - H. Scott Fogler, Prentice Hall
2. Chemical Reactor Analysis & Design, Gilberth F. Froment & Kenneth B. Bischoof, John Wiley & Sons
3. Chemical Reactor Design, Vol. I & II, M. W. Rase

8CH03 SYSTEM MODELLING

SECTION - A

- UNIT I:** Introduction - models and model building, principles of model formulation, fundamental laws - continuity equation, energy equation, equations of motion, transport equations, equations of state, equilibrium and kinetics, classification of mathematical models. Numerical solutions of model equations ó Linear and non linear algebraic equations in one and more than one variables, ordinary differential equations in one and more than one variables. (8)

UNIT II: Lumped Parameter Models:

Formulation and solution techniques to be discussed for Vapour liquid equilibrium models, dew point and flash calculations for multicomponent systems, boiling operations, batch and continuous distillation models, tank models, mixing tank, stirred tank with heating. (7)

- UNIT III:** CSTR with multiple reactions. Non-isothermal CSTR - mutiplicity and stability, control at the unsteady state. Non-ideal CSTR models - multi-parameter models with dead space and bypassing, staged operations. (7)

SECTION - B

UNIT IV: Distributed Parameter Models (Steady State):

Formulation and solution of split boundary value problems - shooting technique, quasilinearization techniques, counter current heat exchanger, tubular reactor with axial dispersion, counter current gas absorber, pipe line gas flow, tubular permeation process, pipe line flasher. (8)

UNIT V: Unsteady State Distributed Parameter Models:

Solution of partial differential equations using finite difference method, convective problems, diffusive problems, combined convective and diffusive problems. Unsteady state conduction and diffusion, unsteady state heat exchangers, dynamics of tubular reactor with dispersion. Transfer function models for distributed parameter systems. (8)

UNIT VI: Model Parameters Estimation:

Introduction, method of least squares, curve fitting, parameter estimation of dynamic transfer function models ó step and impulse response models, Auto regressive Moving Average models, least square and recursive least square methods, parameter estimation of RTD models - moments method. (7)

TEXT BOOKS:

1. Roger E. Franks, òModelling and Simulation in Chemical Engineeringö, John Wiley and Sons, 1972
2. W.F. Ramirez, òComputational Methods in Process Simulationö, Butterworth Publishers, 1989

REFERENCE BOOKS:

1. Seinfeld and Lapidus, òMathematical Methods in Chemical Engineeringö, Prentice Hall, 1974
2. W.L. Luyben, òProcess Modelling, simulation and Control for Chemical Engineersö, 1990
3. Santosh Kumar Gupta, òNumerical Methods for Engineersö, Tata McGraw Hill, 1995

8CH04 PROFESSIONAL ELECTIVE - II
(1) PETROLEUM PROCESSING TECHNOLOGY
SECTION - A

UNIT I: Petroleum Exploration Production and Refining of Crude oils
 Crude oils: Chemistry and composition (Characteristics and constituents of crude oils, Classification of crude oils). (7)

UNIT II: Quality Control of Petroleum Products Classification of laboratory tests, distillation, vapour pressure, flash and fire points, octane number, performance number, cetane number, aniline point, viscosity index, calorific value, smoke point, char value, viscosity, viscosity index, penetration tests, cloud and pour points, drop point of grease, melting and settling points of wax, softening point of Bitumen, induction period of gasoline, thermal stability of jet fuels, gum content, Total Sulphur, Acidity and Alkalinity, Copper Strip Corrosion Test, Silver 6 Strip Corrosion Test for ATF, Ash, Carbon Residue (Conradson method, Ramsbottom method) Colour, Density and Specific gravity, Refractive index of hydrocarbon liquids, water separation index (modified) (WSIM), ductility. (8)

UNIT III: Petroleum Products: Composition, Properties & Specification of LPG, Naphthas, motor spirit, Kerosine, Aviation Turbine Fuels, Diesel Fuels, Fuel Oils, Petroleum Hydrocarbon Solvents, Lubricating oils (automotive engine oils, industrial lubricating oils electrical insulating oils, Jute Batching oils, white oils, steam turbine oils, metal working oils, etc.) Petroleum Waxes Bitumens, Petroleum coke.
 Crude Oil Distillation: Desalting of crude oils, Atmospheric distillation of crude oil, Vacuum distillation of atmospheric residue.
 Thermal Conversion Process: Thermal Cracking Reactions, Thermal Cracking, Visbreaking, (Conventional Visbreaking and Soaker Visbreaking) Coking (Delayed Coking, Fluid Coking, Flexicoking), Calcination of Green Coke. (8)

SECTION - B

UNIT IV: Catalytic Conversion Process Fluid catalytic cracking; Catalytic reforming; Hydrocracking Catalytic Alkylation, Catalytic Isomerization; Catalytic Polymerization. (7)

UNIT V: Finishing Process Hydrogen sulphide removal processes; Sulphur conversion processes; Sweetening processes (Caustic treatment, Solutizer process; Doctor treating process; Copper chloride sweetening; Hypochlorite sweetening ;Air and inhibitor treating process; Merox processes; Sulphuric acid treatment;

Clay treatment); Solvent extraction processes (Edeleanu process, Udex process, Sulfolane process), Hydrotreating processes. (7)

UNIT VI: Lube Oil Manufacturing Process Evaluation of crude oils for lube oil base stocks, Vacuum distillation, Solvent deasphalting Solvent extraction of lube oil fractions (Furfural, NMP and Phenol), Solvent dewaxing, Hydrofinishing, Manufacture of petroleum waxes (Wax sweating, Solvent deoiling) Manufacture of Bitumens Selection of crude oil, Methods of manufacture of bitumens, (Distillation, Solvent precipitation, Air blowing). (8)

TEXT BOOKS:

1. Nelson, W.L., Petroleum Refining Engineering, McGraw Hill
2. Mall, I D ,Petrochemical Process Technology, McMillan India

REFERENCE BOOK:

1. Sarkar, G.N., Advance Petroleum Refining, Oscar Publication

8CH04 PROFESSIONAL ELECTIVE - II
(2) CORROSION ENGINEERING
SECTION - A

UNIT I: Basic aspects, introduction, classification, economics and cost of corrosion, emf series, Galvanic series, corrosion theories derivation of potential- current relationship of activation controlled and diffusion corrosion processes. Potential- pH diagrams Fe-H₂O system, application and limitations. Passivation, definition, anodic passivation, theory of passivation, oxidation laws, effects of oxygen and alloying on oxidation rates. (8)

UNIT II: Forms of corrosion-definition, factors and control methods of various forms of corrosion such as pitting, inter granular, crevice, stress corrosion, corrosion fatigue, hydrogen embrittlement, corrosion processes and control methods in fertilizers, petrochemical and petroleum refineries. (7)

UNIT III: Environmental aspects: Atmospheric corrosion- classification, factors influencing atmospheric corrosion, temporary corrosion preventive methods, corrosion in immersed condition, effect of dissolved gases, salts, pH, temperature and flow rates on corrosion, Underground corrosioncorrosion process in the soil, factors influencing soil corrosion. (8)

SECTION - B

UNIT IV: Corrosion control aspects: Electrochemical methods of protection-theory of cathodic protection, design of cathodic protection, sacrificial anodes, anodic protection. Corrosion

inhibitors for acidic, neutral and alkaline media, cooling water system-boiler water system. Organic coatings surface preparation, natural synthetic resin, paint formulation and applications. Design aspects in corrosion prevention, corrosion resistant materials. (8)

UNITV: Corrosion Testing, monitoring and inspection, laboratory corrosion tests, accelerated chemical tests for studying different forms of corrosion. (7)

UNITVI: Electrochemical methods of corrosion rate measurements by DC and AC methods, corrosion monitoring methods, chemical and electrochemical removal of corrosion products. (7)

TEXT BOOKS:

1. S.N. Banerjee, An Introduction to Corrosion and Corrosion Inhibition, Oxonian Press Ltd., New Delhi.
2. L.L Shrier Corrosion Vol. I & II, George Nownons Ltd., London Edition II

REFERENCE BOOKS:

1. M.G Fontana & N.D. Greene, Corrosion Engineering, McGraw Hill, New York, Edition III
2. H.H. Uhlig, Corrosion and Corrosion Control. A Wiley- Inter Science. Publication John Wiley & Sons, New York
3. C.T.Munger- Organic Coatings
4. Jain & Jain, Engineering Chemistry, Dhanpat Rai & Sons, New Delhi

8CH04 PROFESSIONAL ELECTIVE -II (3) BIOCHEMICAL ENGINEERING

SECTION -A

UNITI: Introduction - principles of microbiology, structure of cells, microbes, bacteria, fungi, algae, chemicals of life - lipids, sugars and polysaccharides, amino acids, proteins, nucleotides, RNA and DNA, hierarchy of cellular organisation, Principles of genetic Engineering, Recombinant DNA technology, mutation. (7)

UNITII: The kinetics of enzyme catalyzed reactions - the enzyme substrate complex and enzyme action, simple enzyme kinetics with one and two substrates, determination of elementary step rate constants. Isolation and utilisation of Enzymes -production of crude enzyme extracts, enzyme purification, applications of hydrolytic enzymes, other enzyme applications, Enzyme production & intercellular and extra cellular enzymes. (8)

UNITIII: Metabolic pathways and energetic of the cell, concept of energy coupling, ATP and NAD, Photosynthesis, Carbon metabolism, EMP pathway, Tricarboxylic cycle and electron transport chain,

aerobic and anaerobic metabolic pathways, transport across cell membranes, Synthesis and regulation of biomolecules. (8)

SECTION - B

UNITIV: Typical growth characteristics of microbial cells, Factors affecting growth, Batch and Continuous cell growth, nutrient media, enrichment culture, culture production and preservation Immobilisation Technology & Techniques of immobilisation, Characteristics and applications, Reactors for immobilized enzyme systems. (8)

UNITV: Introduction to bio reactors, types, Continuously Stirred aerated tank bioreactors, Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power consumption. (7)

UNITVI: Fermentation-methods and applications, Downstream processing and product recovery in bio processes. (7)

TEXT BOOKS:

1. M.L.Shuler and F.Kargi, BioProcess Engineering : Basic concepts, 1st Edition, Prentice Hall, New Jersey, 1992
2. Mukesh Doble, Sathyanarayana N, Gummai, Biochemical Engineering, Prentice Hall, 2007

REFERENCE BOOKS:

1. Trevan, Boffey, Goulding and Stanbury, Biotechnology, Tata McGraw Hill Publishing Co., New Delhi, 1987
2. S.Aaiba, Biochemical Engineering, Academic Press, 1965
3. D.G. Rao, Introduction to Biochemical Engineering, Tata McGraw Hill, 2005
4. J.E.Bailey and D.F.Ollis, Biochemical Engineering Fundamentals, McGraw Hill, 1986

8CH04 PROFESSIONAL ELECTIVE -II (4) PETROLEUM REFINERY ENGINEERING SECTION - A

UNIT-I: Introduction & genesis, occurrence, exploration, drilling of crude oil. Composition and Evaluation of crude oil and testing of petroleum products. Refining of petroleum & Atmospheric and vacuum distillation. (8)

UNIT-II: Refining of petroleum & Atmospheric and vacuum distillation. Pretreatment of crude oil and transportation. (7)

UNIT-III: Cracking processes - Thermal cracking, Vis-breaking, Coking. Catalytic cracking (FCC), Hydro cracking, Rebuilding processes, bitumen blowing. (8)

SECTION - B

UNIT-IV: Treatment techniques for removal of sulphur compounds to improve performance, Storage and stability. Product treatment processes - various solvent treatment processes, Dewaxing, Clay treatment and Hydro fining. (8)

UNIT-V: Cracking of naphtha and gas for the production of ethylene, propylene isobutylene and butadiene. Production of acetylene from methane. (7)

UNIT-VI: Catalytic Reforming of petroleum feed stocks. Extraction of Aromatics. (7)

TEXT BOOKS:

1. B.K.Bhaskara Rao, "Modern Petroleum Refining Processes", 2nd Edn., Oxford and IBH Publishing Company, New Delhi, 1990
2. W.L.Nelson, "Petroleum Refinery Engineering", 4th Edn., McGraw Hill, New York, 1985

REFERENCE BOOKS:

1. Robert. A. Meyers, "Handbook of Petroleum Refining Processes", McGraw Hill, 1986
2. G.D.Hobson and W.Phol, "Modern Petroleum Technology", Applied Science Publishers, IV Edition, 1975

8CH04 PROFESSIONAL ELECTIVE -II (5) BIOFUELS

SECTION - A

UNIT-I: History, diesel engine, diesel fuel, alternative diesel fuels, Biodiesel, definition, sources, standards. (7)

UNIT-II: Use of straight vegetable oil, dilution with conventional diesel, blending with esters; Structure of triglycerides. (7)

UNIT-III: Transesterification of oils, alcohols and catalysts used, mechanism of reaction, reaction conditions, process, glycerine recovery, raw materials and glycerine use, fuel related properties of various fats, oils and their esters, comparison with petroleum diesel. (8)

SECTION - B

UNIT-IV: Combustion chemistry, lubricity, engine performance, engine problems and deposits using biodiesel in present engines. (7)

UNIT-V: Tailpipe emissions using vegetable oil fuel and esters, comparison with petroleum diesel. (8)

UNIT-VI: Health hazards on use of petroleum fuel and biodiesel, Safety and advantages of biodiesel. Storage conditions for biodiesel. (8)

TEXT BOOKS:

1. Biodiesel: A Realistic Fuel Alternative for Diesel Engines by Ayhan Demirbas
2. The Biodiesel Handbook by Knothe, Gerhard

8CH04 PROFESSIONAL ELECTIVE -II (6) INDUSTRIAL PIPING

SECTION - A

UNIT-I: Importance of piping in chemical industry. Classification of pipes: - Pipe codes and specification, Schedule numbers, BWG, NPS. (7)

UNIT-II: Material of construction of pipes. Pipe sizing: - Calculation of pipe diameter, thickness. Pipe fittings, advantages, calculation of frictional losses, and empirical correlations for flow of oil. Gasoline, hydrocarbons. (8)

UNIT-III: Criteria for selection of pipe joints, pipe joints for similar and dissimilar material, expansion effects and methods for reducing them. (7)

SECTION - B

UNIT-IV: Piping lay-out consideration, piping diagrams, types of pipe support, erection and maintenances of supporting, restraining and braing systems. Complex pipelines in series and in parallel. (8)

UNIT-V: Calculation of equivalent lengths. Pipeline storage capacity. Fundamental considerations in piping vibrations, types of vibrations, their prevention and control. Cryogenic piping. (8)

UNIT-VI: Single phase and two-phase flow. Piping for slurries. Insulation for piping systems. (7)

TEXT BOOKS:

1. Piping Design for Process Plants by H. F. Rase, John Wiley.
2. Process Piping Systems, D. J. Deutsch, Chemical Engineering Magazine, McGraw Hill

REFERENCE BOOK:

1. Industrial Piping, C.T. Littleton, McGraw Hill

(7) WINE MAKING

SECTION - A

- UNIT-I:** History, definition, wine and wine industry, Wine production of selected areas, grape varieties Geographic, geological, and climatic attributes regarding wine production and quality. Structure and composition of grapes: Grape structure, chemical composition of grapes, e.g. sugars, acids, an thocyanins, tannins, etc., analytical techniques, fruit ripeness. noble rot. (7)
- UNIT-II:** Processing of grapes: Grape reception, grape handling strategies, e.g. destalking, crushing, pressing and skin contact, must treatments, temperature control. Fermentation: Alcoholic fermentation, role of yeast, enzymes, temperature and fermentation Vessels, strategies for the extraction of colour, aroma, flavour and tannin Carbonic maceration, whole bunch fermentation and thermovinification, theory and practice of malolactic fermentation. (7)
- UNIT-III:** Maturation and blending: Maturation options, types of maturation vessel, inert storage, blending options, timing of bottling Stabilization, clarification, packing and labeling: Movement of wine in bulk, methods of stabilization and clarification, e.g. fitting, filtration, centrifugation, cold stabilization, etc., use of chemicals in wine making and wine handling - their function, action and application, international regulations governing the use of chemicals, packing into bottles and other containers, ingredient labeling, closures. (8)

SECTION - B

- UNIT-IV:** Production of sparkling wines: Production techniques for sparkling wines, grape selection and pressing, temperature control, selection and blending of base wines, the second fermentation, Maturation, finishing. (7)
- UNIT-V:** Production of fortified wines: Production techniques for fortified wines, selection of base wines, timing of fortification. practice and significance of blending and maturation, finishing. (8)
- UNIT-VI:** Quality assurance and quality control: Composition of wine and its faults, analysis of wine, its purpose, use and limitations, QA and QC systems and structures for wine and dry goods, practical issues of QA and QC, Effects of storage and transport on wine after packing. (8)

TEXT BOOK:

1. Exploring Wine, II Edition, by Koplan, Smith, & Weiss, Published by John Wiley & Sons, Inc. New York

(8) PETROCHEMICAL TECHNOLOGY

SECTION - A

- UNIT-I:** General Introduction - History, economics and future of petrochemicals, energy crisis and petrochemical industry, sources and classification of petrochemicals. (7)
- UNIT-II:** First generation petrochemicals - alkanes - C1, C2, C3, C4 petrochemicals, alkenes -C2, C3, C4, petrochemicals, alkynes - C2, C3, C4 petrochemicals, B-T-X aromatics, diene based petrochemicals. (7)
- UNIT-III:** Second generation petrochemicals - synthesis gas, methanol, formaldehyde chloromethanes, ethanol, acetaldehyde, acetic acid, acetic anhydride, isopropyl alcohol, ethylene oxide, propylene oxide, acetone, vinyl chloride, phenol, aniline and styrene. (8)

SECTION - B

- UNIT-IV:** Third generation petrochemicals - plastics, rubbers and fibres, olefinic polymers, polyethylene, polypropylene, polyisobutylene, diene polymers - polybutadiene, neoprene, polyisoprene, SBR, synthetic fibres. (7)
- UNIT-V:** Miscellaneous petrochemicals - petroleum proteins, synthetic detergents, resin and rubber chemicals, explosives - TNT and RDX. (8)
- UNIT-VI:** Various technological forecasting of the petroleum and petrochemicals. (8)

Text Books:

1. S.Maiti, ðIntroduction to petrochemicalsö, Oxford and IBH publishing Co.,1992
2. H.Steines, ðIntroduction to petrochemical Industryö, Pergamon, 1961

REFERENCE BOOKS:

1. G.D.Hobson and W.Pohl, ðModern Petroleum Technologyö, Applied Science Publishers, IV Edition, 1975
2. Richard frank Goldsten and A.Lawrence Waddams, ðThe Petroleum Chemical Industryö, E&FN Spon Ltd., 1967
3. G.T.Austin, ðShreves Chemical Process Industriesö, McGraw Hill, V Edition, 1986

8CH04 PROFESSIONAL ELECTIVE - II
(9) ENERGY TECHNOLOGY & MANAGEMENT
SECTION - A

- UNIT-I:** Fuels: Classification, Properties, tests and analysis. Solid Fuels: Coal, origin, classification, storage and handling, carbonization, gasification and briquetting, gasification of biomass. (7)
- UNIT-II:** Liquid fuels: Petroleum based fuels, synthetic fuels, alcohol and blended fuels, storage and handling.
 Gaseous fuels: Water gas, carburetted water gas, producer gas, coal gas and natural gas. (7)
- UNIT-III:** Combustion - Air requirement for solid, liquid and gaseous fuels, combustion equipment Solar energy, Wind energy, Tidal energy. (8)

SECTION - B

- UNIT-IV:** Geothermal energy, Magneto hydrodynamics, Nuclear energy. Energy Management-Principles need, initiating and managing an energy management program. (7)
- UNIT-V:** Energy audit: Elements, and concepts, types of energy audits, energy audit with respect to industries like sugar, paper etc. (8)
- UNIT-VI:** Energy Conservation: Thermodynamics of energy conservation, cogeneration, waste heat recovery technologies. Industrial insulation, material selection, economical thickness. (8)

TEXT BOOKS:

1. S.Sarcar, öFuels and combustionö, Orient Longman, 1990
2. G.D.Rai, öNon conventional energy sourcesö, Khanna Publishers, IV edition, New Delhi, 2004
3. S.P.Sharma and ChanderMohan, öFuels and Combustionö, Tata McGraw Hill, 2004
4. J.K.Harker and J.R.Backhurst, öFuel and energyö, Academic Press, 1981

REFERENCE BOOKS:

1. D.A.Raey, öIndustrial Energy Conservationö, Pergomon Press, 1980
2. J.D.Gilchrist, öFuels, Furnaces and Refractoriesö, Pergamon Press, 1977

8CH04 PROFESSIONAL ELECTIVE - II
(10) ENERGY & ENVIRONMENT
SECTION - A

- UNIT I:** INTRODUCTION TO ENERGY SOURCES: Global Energy, Environmental Resources, Energy necessity and energy crisis. Indian Energy Scenario: Energy Consumption, needs and crisis, energy sources and availability. (7)
- UNIT II:** RENEWABLE SOURCES OF ENERGY AND ENVIRONMENT: Biomass ö introduction, energy plantation, bio-mass conversion technologies (wet and dry process), photosynthesis, agricultural waste derived energy, urban waste derived energy. BIOGAS: Generation, factors affecting bio-digestion, advantages of anaerobic digestion, classification of bio-gas plants. (7)
- UNIT III:** HYDROPOWER: Site selection for hydroelectric power plants, classification of hydroelectric power plants, submergence, ecological imbalance, catchment area treatment, advantages and disadvantages of hydroelectric power plants. Submergence, Ecological Imbalance, Catchment Area Treatment. (8)

SECTION - B

- UNIT IV:** SOLAR ENERGY: Solar constants, solar radiation at earth surface, physical principles of conversion of solar radiation into heat. Concentrating collectors (focusing and non-focusing). (7)
- UNIT V:** TIDAL ENERGY: OTEC (Ocean Thermal Electric Conversion), methods of ocean thermal electric power generation, site selection. Energy from tides ö basic principles of tidal power, components of tidal power plant.
 WIND ENERGY: Introduction, basic principles of wind energy conversion. Site selection considerations. Basic components of wind energy conversion system. Wind energy collectors. Natural gas ö classification and comparison of different gas turbine power plants, Associated Environmental Effects. (8)
- UNIT VI:** NUCLEAR ENERGY: necessity, general components of nuclear reactors, different types of reactors, breeding reactors, location of nuclear power plants, disposal of nuclear wastes, Associated Environmental Effects.
 GEO-THERMAL ENERGY: introduction, nature of geothermal fields, geo-thermal sources, binary fluid geo-thermal power system and arrangement for hybrid plants. (8)

TEXT BOOKS:

1. Rai, G.D., *Non-conventional Energy Sources*, Khanna Publications
2. Rao and Parulekar B.B., (1977), *Energy Technology* *Non-conventional, Renewable and Conventional*, 2nd Edition, Khanna Publishers

REFERENCE BOOKS:

1. Mathur, A.N., and Rathore, N.S., *Renewable Energy and Environment* *Proceedings of the National Solar Energy*, Himanshu Publications, Udaipur
2. Saha, H., Saha, S.K., and Mukherjee, M.K., (1990), *Integrated Renewable Energy for Rural Development*, *Proceedings of the National Solar Energy Convention*, Calcutta, India,
3. Wilber, L.C., (1989), *Handbook of Energy Systems Engineering*, Wiley and Sons
4. The Energy Research Institute (TERI), New Delhi, Publications
5. Ministry of Environment and Forests, Government of India, Annual Reports

8CH05 PROFESSIONAL ELECTIVE-II LAB

Minimum EIGHT experiments based on the syllabus are to be performed by the students.

8CH06 PROJECT & SEMINAR**SEMINAR:**

The Seminar Report submitted by the student at the end of VII Semester will be evaluated by external examiner appointed by the University along with the Project - Viva Voce examination at the end of VIII Semester.

PROJECT:

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of Chemical Technology. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department.

The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks by way of oral presentations. The university examination, which carries a **total of 150 marks**, will be a Viva Voce examination conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

**FOUR YEAR DEGREE COURSE IN
B.TECH POLYMER TECHNOLOGY
CREDIT & GRADE SYSTEM**

SEMESTER: SEVEN**7PP01**

**POLYMER PROCESSING - I
SECTION - A**

Unit-I&II: Injection moulding - Principle, process, Types of injection moulding m/c, Clamping unit, injection unit, selection of injection moulding machines, materials used. M/c maintenance defects and remedies. Feed system in injection moulding, Quality in injection molding. Fundamental of injection moulding, typical injection moulding cycle, effect of materials, properties and process variables on product quality, Runners and hot runner moulding. Injection moulding of thermosets. Problems of calculation of optimum no. of cavities, Injection pressure, volumetric output, HP/KW required, Wall thickness, Shrinkage etc. Recent developments in injection molding such as Gas assist injection molding, two colour Injection moulding.

Unit III: Compression Moulding Principle, Process, types of process, materials used, properties of materials relevant to moulding process. Compression moulding cycle, equipments and auxiliary equipments, Interrelation between flow properties of the polymers, process parameters as well as moulding design on product quality. Different types of compression moulds. Molding defects and remedies.

SECTION - B

Unit IV: Transfer Moulding: Principle, process description, Transfer moulding cycle. Types of process, materials used. Types of equipment comparison with compression Moulding, limitations, Defects and remedies.

Unit V: Lamination, casting, foaming of polymers, rotational molding and reaction injection moulding.

Unit VI: Recycling Tech: Types of recycling, size and material separation, Biodegradation, Incineration.

TEXT BOOKS:

- 1) Principles of Polymer Processing: Z. Tadmor and C.G. Gogos.
- 2) S.P.I. Hand Book of Plastic Engg, Foadoes

REFERENCE BOOKS:

- 1) Injection Molding, Theory and Practice: I.I. Rubin
- 2) Injection Molding Design, 11nd Edn.,: R.C. W.Pye.

NOTIFICATION

No. 90 /2020

Date : 26/10/2020

Subject : Implementation of new Syllabi of Semester III & IV B.E. (Chemical) / B. Text. E./ B.Tech. (Chem.) (Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum ...

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester III & IV of of B.E.(Chemical)/B.Text.E./B.Tech. (Chem.) (Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2020-21 & onwards as per “**Appendix-A**” as given :

Sd/-
(Dr.T.R.Deshmukh)
Registrar

“**Appendix – A**”

SYLLABUS OF B.TEXT. ENGG. SEM. III & IV C.B.C.S.]

3 TX 01 Textile Fibre -I

Course objectives :

- 1) To gain basic knowledge about essential and desirable properties of textile fibres and their classification.
- 2) To gain the knowledge about various textile natural fibres.
- 3) To understand various methods for analyzing fibre structure.

Course outcomes :

After the completion of Textile Fibre –I course, students will able to demonstrate,

- 1) the essential and desirable properties of Textile fibre and their classification
- 2) the physical, chemical and biological properties of cotton fibre
- 3) the physical, chemical and biological properties of jute and flax
- 4) the physical, chemical and biological properties of wool
- 5) the physical, chemical and biological properties of Silk
- 6) the various methods for analyzing fibre structure

SECTION-A

Unit-I: Definition of fibre, Classification of Textile fibres, Essential and desirable properties of Textile fibres, Polymers: Definition, Types of polymers, Requirements of fibre forming polymers. Basic structure of fibre: Concept of molecular weight, Degree of polymerization, Orientation and crystallinity, effect of orientation and crystallinity on the properties of fibres.

Unit-II: Cotton: Introduction, structure of Cotton fibre, fibre morphology, cotton polymer system, Physical, chemical and biological properties, Applications. Introduction to Banana, Pineapple fibres and their distinctive features and applications.

Unit-III: Jute: Cultivation and Extraction of Jute fibre, Structure of jute fibre, physical, chemical and biological properties, Applications. Flax: Retting and extraction process, structure of flax fibre, physical, chemical and biological properties, Applications. Introduction to hemp, ramie fibres and their distinctive features and applications.

SECTION-B

Unit-IV: Wool: Types of wool, grading of wool, Structure of wool, chemical composition, polymer system of wool, Physical, chemical and biological properties, Applications. Introduction to fibres like, mohair, camel, alpaca and their distinctive features and applications.

Unit-V: Silk: Types of silk, Production of silk (life cycle, reeling), Structure of silk, chemical composition, polymer system of silk, Physical, chemical and biological properties, Applications, blending opportunities in silk.

Unit-VI: Analysis of fibre structure: Introduction, crystal structure, and polymer crystals. i) X-ray diffraction: Bragg's law, X-ray diffractometer. ii) Electron microscopy: Principle and working of Transmission and scanning electron microscope. iii) Spectroscopy: Principle and working of IR-Spectroscopy and NMR-Spectroscopy. Introduction to thermal analysis of polymers.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

4CH10 CHEMICAL ENGINEERING OPERATIONS-I LAB (MECH. OPERATIONS) -LAB

- To study the performance of Ball Mill and find out it's crushing efficiency.
- To study the performance of Jaw Crusher and find out it's crushing efficiency.
- To study the performance of Crushing Rolls and find out it's crushing efficiency.
- To study the settling characteristics (Free & Hindered settling) of a given suspension of particles.
- To study the filtration characteristics of rotary vacuum filter.
- To study the filtration characteristics of Plate and frame filter press.
- To study the filtration characteristics of Leaf and sparkle filter.
- To carry out differential and cumulative screen analysis of given sample of solid particles.
- To determine energy consumption and crushing law constants for jaw crusher.
- To determine Critical speed of Ball mill & Average particle size of the product obtained in ball mill, **OR** Average particle size of product obtained in Bhrustone mill.
- To determine area of batch thickener by conducting batch sedimentation test.
- To determine efficiency of Cyclone separator.
- To Determine Variation of size reduction in ball Mill by changing the residence time, size of grinding medium and material of grinding medium.

All above experiments are to be arranged in the laboratory. Minimum 8 experiments are required to be performed by the student to complete the term work.

SYLLABI PRESCRIBED FOR FOUR YEAR DEGREE COURSE

BACHELOR OF TECHNOLOGY CHEMICAL TECHNOLOGY

SEMESTER PATTERN (CHOICE BASED CREDIT GRADE SYSTEM)

SEMESTER : THIRD

3CT01 APPLIED ORGANIC CHEMISTRY

Course Objectives:

1. Students will get introduced to aromatic compounds, heterocyclic chemistry and natural products, properties and applications of phenols, ethers, epoxides, amines and their derivatives.
2. Student will get the knowledge about the chemistry of unit process, kinetics and mechanism of Nitration, sulphonation and sulphation.
3. Students will get introduces to polymer chemistry and technical preparation of some polymers.

Course Outcomes:

Students will be able to -

1. Analyzed aromaticity and list properties of aromatic compounds.
2. Write simple mechanisms of aromatic reactions.
3. List some of the heterocyclic chemistry and chemistry of natural products.
4. List some properties of amines and their derivatives.
5. Know the unit process like halogenation, sulfonation and nitration.
6. Synthesized some simple organic compounds, polymers and understand the kinetics and mechanism of unit processes.

SECTION-A

Unit I : 1. Aromatic hydrocarbons : Preparation, properties and applications of Benzene, and Naphthalene
2. Heterocyclic compounds: Classification of heterocyclic compounds, preparation, Properties and applications of pyrrole, thiophene, & furan (8 Hrs.)

Unit II : 1. Phenols : Basic concepts, classification, preparation, properties and applications of Phenol, resorcinols, cresols, catechol.

2. Ethers, epoxides and sulphur acids: Methods of preparation, General reaction, ethylene and propyleneoxides – their reactions and applications (8 Hrs.)

Unit III : Amines and their derivatives : Basic concepts, classification of amines, preparation, properties and applications of aniline and Benzene diazonium chloride.

Natural products: Terpenes, alkaloids, plant pigments, their applications (8 Hrs.)

SECTION-B

Unit IV : 1) Study of Chemistry of Nitration : Nitration, nitrating agents, kinetics and mechanism of aromatic nitration. Technical preparation of nitrobenzene and nitronaphthalene.

2) Study of Chemistry of Sulphonation and Sulphation : Sulphonating & Sulphating agents, kinetics of mechanism of sulphonation. Technical preparation of Sulphonation of Benzene (8 Hrs.)

Unit V : 1) Study of Chemistry of Halogenation : Halogenating agents, thermodynamics, kinetics
Technical preparation of DDT and Vinyl chlorides.

2) Principles of polymer chemistry and practices: Classification of polymerization. Types of polymers. Technical preparation of Polyvinylchloride, Bakelite. (10 Hrs.)

Unit VI: 1) Carbohydrates: Basic concepts, classification, industrial applications of glucose, sucrose and starch.

2) Chemicals in food products: Study of preservatives, sweetening agents and antioxidants. (6 Hrs.)

Books Recommended :

- 1) Organic Chemistry (Vol. I & II): I.L.Finlar, Longman Group Ltd. And the English Language Book Society, London, 6th edition.
- 2) Advance Organic Chemistry: Fieser and Fieser, Asia Pub. House, Mumbai, 1961.
- 3) Unit Process in Organic Synthesis: P.H.Groggins, McGraw Hill, 5th edition.

3CT02 APPLIED PHYSICAL CHEMISTRY

Teaching Scheme:

(Th)Lecture: 03 Hours / week

Tutorial: 01 Hour /week

Total credit: 04

Examination Scheme:

T (U) : 80 Marks T (I) : 20 Marks

Duration of Univ. Exam : 03 Hours

Learning Objectives:

- To understand the effect of structure on properties of polymer, concept of weight average and number average molecular weight of macromolecules.
- To understand the electrical properties of fluid.
- To know the rate, order, energy of activation of chemical reactions and their determination.
- To know the use of kinetics and thermodynamics to elucidate mechanisms of reactions.
- To understand the basic concepts, the Ist and IInd Laws of Thermodynamics, Thermodynamic functions and their applications.
- To predict the high and low quantum yield photochemical reactions and to know about advanced spectroscopic analysis techniques.
- To know the basic concepts and industrial examples of catalysis and adsorption on surface.

Course outcomes :

The course will enable the student to:

- Evaluate the structural properties of macromolecules, average molecular weight determination of polymers by various methods.
- Evaluate the specific rate, order and energy of activation of chemical reactions.
- Know the fundamental concepts related to homogeneous and heterogeneous catalysis, mechanisms of industrially important reactions, surface phenomenon and adsorption isotherms.
- Apply mass and energy balances to closed and open systems, Rationalize bulk properties and processes using thermodynamic considerations
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and spectroscopic methods for identification of compounds.
- Know the ion transport & electrical properties of solutions, solve problems involving transport no, electrode potential and emf of different types of cell.

Contents:

Unit- I : Ion transport and electrical phenomenon at interface: Specific, Equivalent and Molar conductivity, Kohlraush's law and its applications, Transport number and their determination, Reversible and reference electrode, Thermodynamics of reversible electrode, Relation between electrical work done and free energy, Nernst equation for electrode potential, Standard electrode potential, Electrolytic concentration cell with and without transference, Determination of pH, solubility and solubility product of sparingly soluble salts, dissociation constant by EMF measurement, Numerical. (8 Hrs.)

Unit-II : Polymer science: Number average and weight average molecular weight of macromolecule, Methods of molecular weight determination of macromolecules, Membrane osmometry, Light scattering, sedimentation and ultracentrifuge methods, Effect of polymer structure on properties of polymers. Numerical on molecular weight determination. (6 Hrs)

Unit- III : Kinetics & Reaction mechanism: Introduction, Rate of reaction, concept of molecularity and order in elementary and complex reactions, differential and integral methods to formulate rate equations of zero, first and second order reactions. experimental methods in kinetic studies, effect of temperature on reaction rate, energy of activation and its determination, steady state approximation and rate determining step, Mechanism of complex reactions, photochemical chain reactions, polymerization reactions. Fast reactions – experimental techniques. Numerical (10 Hrs.)

Unit-IV : Surface, interfacial chemistry and catalysis: Adsorption, types of adsorption, Adsorption isotherms, Langmuir theory of adsorption, BET adsorption isotherm and its application for determination of surface area of fine powder. Homogeneous and Heterogeneous catalysis, Criteria of catalyst, Theory of heterogeneous catalysis, Homogeneous, Lewis acid-base catalysts, organometallic catalysts and industrial examples, Auto and enzyme catalysis. kinetics of reactions on surfaces. (8 Hrs.)

Unit – V : Thermodynamics and Equilibrium : Statements of the second law; Heat engines, Carnot's theorem, and Carnot cycle, Mathematical statement of the second law, Introduction of Entropy under the IInd Law to define spontaneity of a process, Temperature- entropy diagram, Introduction of the state functions A & G to determine conditions of Material Equilibrium. Condition of reversibility, Transformation at constant temperature and pressure, Gibbs- Helmholtz equation, pressure – volume and volume – Temperature relationship under isothermal condition for ideal gas. Partialmolar properties, chemical potential, Numerical. (8 Hrs.)

Unit VI: Spectroscopic techniques and applications : Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules. Principle, Instrumentation and Applications of IR, UV & NMR spectroscopy

Photochemistry and Modern Analytical techniques: Laws of photochemistry, quantum efficiency and its determination, low & high quantum yield reactions, Atomic absorption spectroscopy, chromatography. (8 Hrs.)

Books Recommended :

1. Physical Chemistry, P.W. Atkins and J.D. Paula, Oxford University Press.
2. Physical Chemistry, K.J. Laidler and J.M. Meiser, CBS Publisher
3. Chemical kinetics and catalysis, R. J. Masel, John Wiley publications
4. Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
5. Fundamentals of spectroscopy, Banwell, Tata McGraw-Hill
6. Physical chemistry of surfaces, Arthur W. Adamsons, Alice P. Gast, John Wiley publications
7. Principle of Heterogeneous catalysis, J.M.Thomas, W.J. Thomas, John Wiley publications
8. Thermodynamics for students of chemistry, Dr. J. Rajaram & Dr. J. C. Kuriacose, Chand & comp.

3 CH 03 /3CT03 STRENGTH OF MATERIALS

Learning Objectives of Subject:

1. To determine the Mechanical behavior of the body and construction materials by determining the stresses, strains produced by the application of loads.
2. To apply the fundamentals of simple stresses and strains.
3. To make one understand the concept of bending and its theoretical analysis.
4. To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, principal stresses and strains, slopes and deflection.

Course outcomes:

At the end of the subject the students will be able -

1. To understand the basics of material properties, stress and strain.
2. To apply knowledge of mathematics, science, for engineering applications
3. To identify, formulate, and solve engineering & real life problems
4. To design and conduct experiments, as well as to analyze and interpret action and reaction data.
5. To understand specific requirement from the component to meet desired needs within realistic constraints of safety.

SECTION – A

Unit I: Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit II: Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.

Unit III: Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

SECTION – B

Unit IV: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

Unit V: Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains. Combined direct & bending stresses.

Unit VI: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

Books Recommended:

1. E. P. Popov, "Mechanics of Materials", Prentice Hall of India, New Delhi.
2. S. Timoshenko and O. H. Young, 'Elements of Strength of Materials', East West Press Private Ltd., New Delhi.
3. Ferdinand L. Singer, 'Strength of Materials', Harper and Row, New York.
4. Shames, I. H., 'Introduction to Solid Mechanics', Prentice Hall of India, New Delhi.
5. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.
6. Junnarkar, S. B., Mechanics of materials.
7. Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.
8. Beer and Johnston, Mechanics of materials, Mc-Graw Hill.
9. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt Ltd.

3CT04 APPLIED THERMODYNAMICS

Course Learning Objectives :

1. To study the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. To study the laws of thermodynamics and their applications
3. To study the properties of steam, work done and concept of heat transfer
4. To study the air standard cycles

Course Outcomes :

Students will be able to

1. Understand the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. Apply first law of thermodynamics and application of first law to flow and non-flow processes
3. Apply second law of thermodynamics and understand concept of entropy
4. Understand the properties of steam, work done and heat transfer during various thermodynamics processes with steam as working fluid
5. Understand the concept of air standard cycles

SECTION – A

Unit-I: Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems, Temperatures and Zeroth law of thermodynamics, Quasi-static process, Gas Laws and Ideal gas equation of states, gas constant and universal gas constant.

Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams (10 hrs)

Unit-II: First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law, Joules experiment. Energy a property of system, internal energy-a function of temperature, Enthalpy, specific heat at constant volume and constant pressure. Application of first law to non-flow processes, Change in internal energy, work done and Heat transfer during various non-flow processes. (7 hrs)

Unit-III: First Law applied to flow processes: Steady state, steady flow process, equation for work done in steady flow process and its representation on P-V diagram, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. (9 hrs)

SECTION – B

Unit-IV: Second Law of thermodynamics: Limitations of First law, Thermal energy reservoir, heat engines refrigerator and heat pumps, COP and tonne of refrigeration, COP for heat pump and refrigerator, Kelvin-Planck and Clausius statements, their equivalence, reversible and irreversible processes, Carnot cycle, Carnot theorem and its corollary, The thermodynamic temperature scale, Reverse Carnot cycle, Inequality of Clausius. Introduction to Entropy, availability and irreversibility. Principle of increase of entropy. (8Hrs)

Unit-V: Properties of Steam: Triple point and critical point, Sensible heat, latent heat, superheat and total heat of steam. Wet steam, dryness fraction, Internal energy of steam, External work of evaporation, internal latent heat, Specific volume, enthalpy, internal energy and entropy of steam. T-S diagram Mollier chart, Steam tables and their use. Work done and heat transfer during various thermodynamics processes with steam as working fluid. Throttling of steam, determination of dryness fraction using various calorimeters. (8 Hrs)

Unit VI: Air Standard Cycles: Otto, diesel, semidiesel, Brayton, Sterling and joule cycles etc., their efficiencies and mean effective pressure, comparison of Otto, diesel and dual cycles.

Vapour Cycles:- Rankine and Modified Rankine Cycle. Comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram. (No numerical on this unit) (numerical on air standard cycle) (8 Hrs)

BOOKS RECOMMENDED:

Text Books :

1. Engineering Thermodynamic - by P. K. Nag.
2. Fundamentals of Engineering Thermodynamics; R. Yadav;
3. Thermodynamics Basics and Applied: by V. Ganeshan
4. Thermal Engineering: by Mahesh M. Rathore.

Reference Books :

1. Basic Engineering Thermodynamics - by Reynier Joel
2. Thermodynamics - by C.P. Arora.
3. Fundamentals of Classical Thermodynamics - by G. J. Van Wylen.
4. Engineering Thermodynamics; P. Chattopadhyay; Oxford
5. Engineering Thermodynamics; Gordon Rogers, Yon Mayhew; Pearson.

3CT05 PROCESS CALCULATION

Course objectives :

1. Students will learn the basic and fundamentals of chemical engineering operations and processes.
2. Students will understand the material balance and energy balance of various unit operations and unit processes.
3. Students will learn how to formulate and solve the problems related to material and energy balance with or without chemical reaction.

Course Outcomes:

- After successful completion of this course student will be able to
1. Understand the concept of basic chemical calculations
 2. Understand the concept and application of theory of proportions
 3. Determine the humidity with/without using a psychrometric chart.
 4. Make the material balance over unit operations and processes.
 5. Make the energy balance over unit operations and processes.
 6. Solve the problem of fuels and combustion.

SECTION A

Unit I: Introduction to unit operations and unit processes, Units and dimensions, Atoms, moles and molecular weight, mole and mass fraction, Composition of solids, liquids and gases, Concept of Normality, Molarity and Molality, PPM (Parts Per Million), Ideal Gas Law, Dalton's Law, Partial Pressure, Amagat's Law, Average Molecular Weight, Density of Gas Mixture, Raoult's Law, Henry's Law, Vapour Pressure, Clausius Clapeyron equation, Cox Chart, Humidity and saturation, Humidity Chart, and their application.

Unit II : Material balance without chemical reaction stoichiometry and unit operations Distillation, Absorption, Extraction, Crystallization, Drying, Mixing, Evaporation. Recycle, purge and Bypass calculations.

Unit III : Material balance involves chemical reaction, Principle of stoichiometry, simple oxidation reaction, multiple chemical reaction, percentage Conversion, percentage Yield, and selectivity, calculation involving combustion of gases, liquid and solid fuel. Recycle, purge and bypass calculations.
Introduction to unsteady state material balance

SECTION B

Unit IV : Energy balance: open and closed system, heat capacity, calculations of enthalpy changes, enthalpy changes for phases transitions, evaporation, Solution and mixing, clausius clapeyron equation.

Unit V: Energy balance with chemical reaction, calculation of standard heat of reaction, heat of formation, heat of combustion, Hess law, Effect of temperature on heat of reaction; adiabatic flame temperature calculations.

Unit VI : Heating value of fuels, calculations involving theoretical and excess air, heat and material balance of combustion processes.

References :

1. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.
2. Narayanan K V and Lakshmikutty B, Stoichiometry and Process Calculations, Prentice Hall of India Pvt Ltd, New Delhi 2006.
3. Sikdar, D. C., "Chemical Process Calculations", Prentice Hall of India.
4. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.
5. Hougen. O. A, Watson K.M. and Ragatz R.A. "Chemical Process Principles, Part -I, Material and Energy Balance".

3CT06 APPLIED ORGANIC CHEMISTRY- LAB

Course objectives:

1. Students should be familiar with common organic compounds, should identify them and should know simple organic preparation and separation methods.
2. Students will get introduced to aromatic compounds, heterocyclic chemistry and natural Products.

Course outcomes:

1. Students will be able to list steps for identifying simple organic compounds
2. Students will be able to list some methods of separation of organic compounds
3. Student will be able to synthesize simple organic compounds.

Content:

1. Identification of an organic compound through elemental analysis, group detection, physical constants (m.p and b.p) and derivatisation.
2. Separation and purification of binary mixtures of the type: water soluble-water insoluble, both watersoluble, liquid-liquid by distillation, dissociation - extraction , crystallization, etc.
3. Simple organic preparations:
 - i) Acetanilide
 - ii) Nitro Acetanilide
 - iii) Aspirin

Books Recommended:

1. Practical Organic Chemistry, by I.L. Finar
2. Laboratory hand book of organic qualitative analysis and separation, by Kulkarni V. S. D. Ramchandra & co. Pune.

3CT07 APPLIED PHYSICAL CHEMISTRY- II - LAB

Total hours / week : 2
Total credit: 1

Examination Scheme: (I): 25, (Ext): 25 Marks

Course Objectives: To provide the practical knowledge of analysis techniques by classical and instrumental methods for developing experimental skill to built technical competence.

List of Experiments:

1. Determination of viscosity average molecular weight of polymer.
2. Determination of order of reaction and specific rate constant of hydrolysis of methyl acetate.
3. Study of kinetics of second order reaction.(Saponification of ethyl acetate & reaction between potassium per sulphate & potassium iodide)
4. Determination of relative strength of two acids by kinetic study of reaction
5. Determination of energy of activation of reaction
6. Determination of equivalent conductivity of strong electrolytes at infinite dilution.
7. Determination of transport number by EMF measurement.
8. Determination of equivalence point of titration by conductance measurement.
9. Potentiometric titration between strong acid and strong base.
10. Verification of Beer- Lambert's law and determination of concentration of unknown solution.
11. Verification of Freundlich and Langmuir isotherm.
12. Determination of refractive index.
13. Determination of solubility of sparingly soluble salts by EMF measurement.
14. Determination of heat of neutralization & ionization of acetic acid
15. Determination of ΔH and ΔS of monobasic acid by measuring its solubility at different temperatures.
16. Determination of specific rotation of cane sugar by polarimetry.

All above experiments are to be arranged in the laboratory. Minimum 08 experiments are required to be performed by the student to complete the term work.

Course outcomes: After completion of this course the students shall be able to :

1. Understand the objectives of their experiments.
2. Follow the proper and safe procedure to get the accurate results.
3. Record and analyze the results.
4. Interpret the results through proper writing in laboratory journal

Books Recommended :

1. Experiments in Physical Chemistry, David P. Shoemaker, Carl W. Garland, Jeffrey I. Steinfeld
2. Experiments in Chemistry, Dr. D. V. Gahagirdar, Himalaya Publishing House
3. A Text Book of on experiments and calculations- Engg. Chemistry, S.S. Dara, S. Chand & Comp. ltd.

3CT08 / 3CH08 – STRENGTH OF MATERIALS – LAB

List of Practical's in Strength of Material Lab (Minimum any eight practical from the list should be performed)

1. Tension test on metals.
2. Compression test on metals.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Buckling of columns.
10. Deflection of springs.

3CT09 APPLIED THERMODYNAMICS – lab.

Minimum 8 10 10 Practicals based on the Syllabus 3CT09 APPLIED THERMODYNAMICS.

SEMESTER - IV

4CT01 MATHEMATICS - II

Course Outcomes:

After successfully completing the course, the students will be able to

1. Demonstrate the knowledge of partial differential equations, applied to Computer technology.
2. Find roots of complex numbers, separate the complex quantity in real & imaginary parts, and find logarithms of negative numbers and complex quantities.
3. Compute different Numerical Methods
4. Analyze the Knowledge of Optimization.
5. Analyze the concept of Linear Programming Problems and Simplex Method
6. Demonstrate the basic concepts of probability and statistics

Students are expected to be aware of the statements of the relevant theorem without mastering their proofs.

Unit I :Partial Differential Equations : Basic concepts (@J 1.1), Vibrating string (@11.2), separation of variables (@11.3), one dimensional heat flow(@11.5), 11.6) (07 periods)

Unit II: Complex Numbers and Analytic functions : Complex numbers(@12.1), polar form(@12.2),Complex function limit, derivative analytic function (@12.4), Cauchy Riemann Equations, Laplace's Equation(@12.5), rational functions(@12.6), Exponential function (@12.7), Trigonometric and hyperbolic functions (@12.8), [logarithm \(@12.9\)](#) (07 periods)

Unit III : Numerical Analysis : Errors in computation (@19.1), Solution of Equations by iteration, Newton - Raphson method (@19.2) Finite differences{@19.3}, Interpolation (@19.4), Numerical integration using rectangular, trapezoidal and Simpson's rule (07 periods)

Unit IV : Optimization : Basic concepts (@22.1), Linear programming{@22.2}, Simplex method{@22.3},(@~2.4) (07 periods)

Unit V : Probability and Statistics : Sample mean and variance (@23.3), probability (@23.5),Permutations and combinations (@23.6), discrete and continuous distributions (@23.7), mean and variance of a distribution (@23.8), Binomial, Poisson distributions (@23.9),Normal distribution (@23.10) (07 periods)

Unit VI : Probability and Statistics (continued) : Random sampling (@23.12), Estimation of parameters (@23.13),confidence intervals (@23.14), Testing of hypothesis (@23.15) (07 periods)

Note : Numbers in bracket refer to section number; T1 "AdvancedEngineering Maths" by Erwin Kreyszig (Finn jdn), WileyEastern.

Books Recommended :

- 1) Elements of Applied Mathematics: P.N. Wartikar & J.N. Wartikar,
- 2) A text book of Applied Mathematics: P. N. Wartikar & J. N. Wartikar,
- 3) Advanced Engg. Mathematics - Erwin Kreyszig, Wiley Eastern (5th Edition),
- 4) Higher Engg. Mathematics . B.S. Grewal.
- 5) Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI
- 6) 4. Numerical Methods - Principles, Analysis & Algorithms Pal, Oxford.

4FT02 FOOD TECHNOLOGY-I:

CHEMISTRY OF FOODS :

Development of Food Chemistry : History of Food Chemistry. Nature and Origin of life. Basic activities of animals and plants and their relations. Water and Ice: Importance of water in foods. Structure of water and ice. Concept of bound and free water and their implications.

Carbohydrates :- Nomenclature, Classification and structure of Carbohydrates. Chemical reactions of carbohydrates. Physical and Chemical properties of sugars, starch, pectic substances, gums and other polysaccharides, Functional properties of carbohydrates in foods.

Lipids: Definition and classification of lipids, Chemistry of fatty acids and glycerides, Physical and chemical characteristics. Chemistry of processing of fats and oils, hydrogenated fats, shortening agents and confectionery fat etc. Rancidity of fats and oils, its prevention and antioxidants. Functional properties of lipids in foods.

Protein: Importance of proteins. Nomenclature, classification, structure and chemistry of amino acids, peptides and proteins Sources and distribution of proteins. Isolation identification and purity of proteins, Denaturation Functional properties of proteins in food.

Fruits and Vegetables: Plant Cells and tissues, their structure, functions and physiology, Chemical Composition of edible plant tissue. Texture of fruits and vegetables. Effects of cooking on texture and composition of fruits and vegetables.

Meat. Fish and Poultry : Animal Proteins, Structure and chemical composition of muscles, **Myoglobin and hemoglobin** - Post - Mortem changes regor mortis. Methods of cooking and processing and their influence on texture. Physical and chemical changes during cooking Palatability characters; texture and tenderness. Structure and composition of eggs. Chemistry and functional properties of eggs.

Milk and Milk Products : Composition of milk, Physical and chemical properties of milk protein and effects of processing on these. Chemistry of milk product like cheese, cream, butter, ghee etc

Miscellaneous: Sensory perception of tests and flavors. Browning reactions, Nutritive and non-nutritive sweeteners. Food dispersions and their implications on foods.

Books Recommended :

1. Food Chemistry by L.H. Meyer, Publishers, Van Nostrand Reinhold Co. New York, Latest Edition.
2. Principles of Food Science- Edited by Owen R. Fennema, Part I Food Chemistry, Publishers Marce Dekker, Inc. New York.
3. The Chemical Analysis of Foods and Food Products : Morris, B. Jacobs 3rd Edition, Publishers Van. Nostrand Company, INC. Princeton, New.
4. Introduction to the Biochemistry of Foods by J..B.S. Braverman, Publishers Elsevier Publishing Co. Amsterdam, Latest Edition.
5. The Spice Hand Book by J. W. Patty, Publishers Chemical Publishing Co. Inc. New York, Latest Edition.
6. Food Theory and Application by Paul, Pauline and Palmer, Helen H., Publishers, John Wiley and Sons. New York, Latest Edition.

4PT02 PULP AND PAPER TECHNOLOGY-I

CHEMISTRY OF WOOD AND PULP OF PAPER MATERIALS:

Species, anatomy and physical properties of Wood:-

Classification of woods, plants used in pulp and paper, gross structure of trunk, structure elements of wood, fiber dimensions water conducting system, food conducting system, reactions of wood, bark and its structural elements, decay of wood, physical properties of wood. Fiber morphology: Cell formation and growth, fiber structure, chemical composition of wood, non-wood fibers used in pulping bast, fruits, grass, leaf, animal, mineral and synthetic fibers

Cellulose: Chemistry and location in the cell, isolation molecular constitution, microfibrils, crystalline and amorphous Pulp of Paper biogenesis of the cell wall, Polysaccharides, sorption, swelling and solution of cellulose, degradation reactions of pulp of paper.

Hemicelluloses : Structure and properties of hemicelluloses.

Lignin: Lignification in wood, biological and biochemical aspects of lignin information, structure and properties of lignin, separation of lignin from woody tissues and Fiber laboratory separation, commercial separation, analysis of lignin and utilization of Lignin.

Books Recommended :

1. "The Chemistry of Cellulose" by Emil Hauser, John Wiley & Sons, New York.
2. "The Methods of Cellulose Chemistry" by Charles Dorce, Chapman & Hall, L.
3. High Polymers Vol V (Part-I to V) edited by Emil Ott & Others, Interscience Publishers.
4. Publishing Processes by S.A. Rydholm, John Wiley & Sons, Inc., New York.
5. Pulp & Paper : Chemistry & Chemical Technology by James P. Cascoy.

4OT02 OIL & PAINT TECHNOLOGY-I

(CHEMISTRY OF OIL AND FATS & INTRODUCTION OF PAINTS)

Natural Fats : Their Sources, classification and composition Constituents of natural fats : Glycerides, Phospholipids, Fatty acids, non-glycerides constituents, toxic constituents and detoxication, Nutritional functions of Fats. **Glycerides and fatty acids :** Nomenclature, Structure, occurrence in fats. Physical properties of fats and fatty acids. Elementary ideas on their liquid properties, solution properties and spectral properties.

Chemical reaction of fats and their fatty acids. Chemistry of hydrogenation, hydrogenolysis, autoxidation, polymerisation dehydration, pyrolysis, halogenation, sulphonation and sulphonation , esterification , interesterification and hydrolysis. Chemical Oxidation of fatty acids, Significance and importance of these reactions. Rancidity Of Oils & Fats, . Oils Antioxidant and Synergists.

Physical and Chemical characteristics : Indian standards for oils and fats - ISI Specifications of Oilseeds, Oils, DOC, Vegetable Ghee . Identification of fats. Detection of adulteration in fats and Indian standards for oils and fats. **Introduction of Paints,** Types Of Paints, Basic Ingredients of Paint System, Industrial Applications of Paints , Recent development in the field of Oils & Paints.

Books Recommended :

1. Industrial Oil and Fat Products Ed. : A.E. Bailey. Interscience & Sons New York, London, Sydney 5th Edn.
2. An Introduction of the Chemistry and Biochemistry of Fatty Acids : Gumstone.
3. Progress in the Chemistry of Fats and other liquids (Vols. 1 to 11) T.R. Holmann, Pergamon Press.
4. Fatty Acids : K.S. Markley, Inter Sc. Publishers, 2nd edition, New York.
5. Industrial Chemistry of Fats and Waxes : T. Hilditch Balliere Tindall and Cox, London 2nd Edition.
6. Rancidity of Edible Fats : C.H. Lea, His Majesty's Stationary Office, London, Latest Edition.
7. Analysis of Fats and Oils : V.V. Mellen Bacher, Garrard Press Publishers, Illinois, Latest Edition.
8. Outline of Paint Tech. - H. Hea
9. Introduction of paints by Morgan.

4PC02 PETROCHEMICAL TECHNOLOGY - I

Course Objectives: Basic Concepts of Chemistry of Hydrocarbons, Introduction to Basic Refinery Processes. Formation Theories of Petroleum. Exploration and prospecting for petroleum and gas field, Drilling. Transportation, Storage of Petroleum & Products and future Energy Sources.

Course Outcomes:

- 1) Students will be able to understand the chemistry and composition of petroleum.
- 2) Students will be able to understand the importance petroleum as a source of energy and petrochemicals
- 3) Students will be able to understand the technology involved in exploration and prospecting for petroleum and gas field, as well as drilling for petroleum.

Unit-I: Origin, Occurrence, and Formation of crude petroleum. History of Indian Petroleum and Refining Industry and future trends. Hydrocarbon resources in India, history. World Petroleum Scenario, world Petroleum Reserves and Deposits. Crude Oil and Natural Gas Production and Consumption in India. Petroleum refineries in India, their location, year of commissioning, and organizations, Refining Capacity& throughput, Production& Consumption of Petroleum Products. Advantages and disadvantages of petroleum.

Unit-II: Composition, Chemistry, Classification of Petroleum Hydrocarbon composition of petroleum and petroleum products (liquid and gas). Non-hydrocarbon compounds in petroleum. Properties of hydrocarbons and non-hydrocarbons. Classification and description of crude oils and petroleum gases.

Unit-III: Refining Processes and Operations Various refining processes, operations and chemistry involved. Principle involved in dehydration, desalting and conditioning of crude oil. Thermodynamics, kinetics and reaction mechanism, principle involved in thermal and catalytic processes such as thermal and catalytic cracking, hydro cracking, reforming, isomerisation, polymerization, alkylation.

Unit-IV: Exploration and prospecting for petroleum and gas field Structure of earth and of the earth crust, formation of Sedimentary rocks, Exploration and prospecting for petroleum and gas field, Geological, Geophysical, Geochemical prospecting methods, geophysical borehole logging methods. Migration of petroleum and gas deposits and commercial petroleum accumulations. Petroleum traps and their classifications. Development of an oil or gas field.

Unit-V: Drilling for Petroleum Drilling operation, Cable tool method, Rotary drilling, Turbo drilling, types of drill bits, mud fluids, casing off formations, Deviation of holes, Directional drilling, Offshore drilling rigs, Well control systems.

Unit-VI : Other Sources of Hydrocarbons, Transportation& Storage of Petroleum Sources of hydrocarbons other than crude oil, future automotive fuel resources, new and future energy sources. Transportation and storage of crude oil, petroleum gases, and petroleum products. Shipping tankers, Pipelines: Materials and Corrosion, Onshore and offshore pipeline construction. Pipeline network in India.

Books Recommended :

- 1) Modern Petroleum Refining Processes by B. K. BhaskaraRao, Latest Edition.
- 2) Chemistry of Petrochemical Processes by Sami Matar, Lewis F. Hatch
- 3) The Chemistry and Technology of Petroleum by James G. Speight
- 4) Fundamentals of Petroleum and Petrochemical Engineering by Uttam Ray Chaudhuri
- 5) Modern Petroleum Technology Volume-I Upstream Edited by Richard A. Dawe

4 CT03 / 4CH02 MACHINE DESIGN & DRAWING

SECTION - A

Unit I- (a) Sectional Views Conversion of pictorial view in to sectional orthographic projections, Sectional views with different types of projections, Missing views (12 Hrs)

Unit II- a) Development of surfaces 31 32 Development of surfaces of cubes, prisms, cylinders, pyramids, cones & their cut sections

b) Intersection of solids-prism and prism, cylinder and cylinder, cylinder and prism, cone and cylinder, cone and prism. (12 Hrs)

SECTION B

Unit III- (a) Meaning of Design, Phases of Design, Design considerations.

(b) Simple stresses, Thermal stresses, Torsional Stress, stresses in straight & curved beams and its application- hooks, cclamps

(c) Design & drawing of riveted joints- Caulking & fullering, failures, strength & efficiency of riveted joints.

(d) Welded joints- Symbolic representation, Strength of transverse & parallel fillet welded section e) Design & drawing of Knuckle Joints (12 hrs)

Unit IV :(a) Design of Helical springs- Types of springs, stresses in helical springs, Wahl's stress factor, Buckling & surge, tension spring (b) spiral & leaf springs c) Design of power screw-Torque required to raise loads, efficiency & helix angle, overhauling & self locking of screw, acme threads, stresses in power screw. (12 hrs)

Books Recommended :

Text Books :

- 1) Machine Drawing by N. D. Bhatt, Charator Publication
- 2) Machine Design by R. S. Khurmi & J. K. Gupta , S. Chand Publication .

Reference Books :

- 1) Machine Design by Dr. P. C. Sharma & Dr. D. K. Agrawal, Katsons Books publication
- 2) Design of Machine elements by C. S. Sharma, Kamlesh Purohit, PHI publication
- 3) Design of Machine elements by V. B. Bhandari, Tata McGraw Hill Publication
- 4) Machine Design, Jindal, Pearson publications
- 5) Design Data Book by- P.S.G. Koimbatore
- 6) Design Data Book by Mahadevan.

(Use of any data book from the above will be permitted during the examination).

4CT04 MATERIAL SCIENCE & ENGINEERING

SECTION-A

Unit I : Crystalline and non crystalline structure sensitive and insensitive properties and defects in crystals. Co-relation of mechanical properties with reference to structure.

Unit II: Effect of temperature on mechanical properties various methods of improving the strength failure under service conditions

Unit III : Solid solutions phase diagrams and their relation to mechanical properties with reference to steels and cast irons.

SECTION-B

Unit IV : Heat treatment of steels and common on ferrous alloys.

Unit V: Elastomers and plasiomers, molecular structure and properties of polymers, ceramic materials and refractoriness, High temperature oxide ceramics glasses and their properties, composite materials.

Unit VI : Corrosion: Electrode potentials e.m.f and galvanic series, polarization forms of corrosion, rate factors, inhibition, prevention, control and testing, Corrosion behaviour of metals and alloys chemical resistance of polymers, Forming processes and corrosion. Non destructive methods of testing, Metallic, Plastic and other protective coatings.

Books Recommended :

1. Nature and properties of Engineering Materials by D.Jastrebski.
2. Introduction to Materials science by Guy.
3. Materia! Science and Processes by SK.Hajra Chaudhry
4. Material Science for Engineers by Van Valack.

4CT05 FLUID FLOW OPERATION

Course Objectives:

1. Students will understand the basic concept of fluid flow, types of flow, and application of fluid mechanics.
2. Students will get the knowledge of flow and pressure measurement using different flow meters, and pressure measuring devices.
3. Students will get the knowledge of various pumps used in chemical industries.
4. Students will get the knowledge of various agitators and mixing equipments and power consumption for mixing.

Course Outcomes:

After successful completion of this course student will be able to

1. Understand the knowledge of fluid flow, fluid properties and type of fluid
2. Understand the concept of dimensional analysis
3. Select the agitators for mixing operations and able to calculate the power required for mixing.
4. Understand the concept and applications of Bernoulli's theorem,
5. Understand the principle, working and application of different flow meter
6. Understand the principle, working and application of various pumps and able to calculate the power requirement and NPSH of centrifugal pump.
7. Calculate the pressure drop across packed bed and minimum fluidization velocity in fluidized bed; understand the concept of two phase flow.

Course Contents:

Unit I : Properties of fluid and their classification : Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids, forces on submerged bodies. rigid body motion, pressure measurement, Euler's equation.

Unit II : Kinetics of flow, Description of velocity field, Stream functions, angular velocity, Fluids in circulation, Irrational flow. Dimensional analysis: Buckingham Pi theorem, dimensionless number and their physical significance, simulated criteria. Mixing and agitation of fluid, types of mixers and their selection, power requirement.

Unit III : Fluid flow: Laminar and turbulent flows, pressure drop in pipes and tubes, pipe fitting and pipe network and friction factor, conversion of mass Momentum and energy, Navier-Stokes equation, mechanical energy balance and Bernoulli's theorem.

Unit IV : Flow measuring devices for chemical plants: Orifice metre, Nozzle Venturimeter, Rotameter and pitot tube.

Unit V : Pumping and compressing of chemicals and gases, reciprocating pump, rotary pump, centrifugal pump and blowers. NPSH and calibrations. Mixing and agitation fluids. Compressible fluid flow and Aerodynamics.

Unit VI : Flow past immersed bodies, flow through packed bed and fluidized bed, Introductory concept of two phase flow.

Text Books/ Reference Books :

1. R. P. Vyas, Fluid Mechanics, Central Techno Publications, Nagpur.
2. W. L. McCabe, J. C. Smith and P. Harriot, Unit Operations of Chemical Engineering, 7th Edition, McGraw-Hill International Edition 2005.
3. Chemical Engineering volume 1 coulson J. M. and Richardson J. F. Butterworth Heinemann, Oxford
4. M. White, Fluid Mechanics, 8th Edition, Tata-McGraw Hill, 2016.
5. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall of India, 2005.
6. R. W. Fox, P. J. Pritchard & A. T. McDonald, Introduction to Fluid Mechanics, 7th Edn, Wiley-India 2010.

4 FT 06 FOOD TECHNOLOGY - I –LAB

General methods of proximate analysis of food materials. Analysis of Oils and Fats, Chemical Analysis of carbohydrates and proteins, various vitamins etc. colorimetric methods for starch. and qualitative detection of carbohydrates and proteins, various, vitamins etc. Colorimetric methods for starch, polyphenols, carotenoids Xanthophylls etc. Paper chromatography and qualitative detection of carbohydrates, proteins and, fats oils, Colour. test for oil. Qualitative and quantitative analysis of acids and antioxidants. Chemical Preservatives like benzoic acid and sulfur dioxide, Non-Nutritive Sweetness and emulsifying agents.

Books Recommended :

1. The Chemical Analysis of Foods, Sixth Edition by David Perason, J.O.A. Churbcill, 104 Gloucester place London. 70
2. Manual of Analysis of Fruits and Vegetable Products: S.Ranganna, Ph.D. Central Food Technological. Research Institute, Mysore, Publisher, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Food Analysis by A.G. Woodman, 4th Edition, Publishers, Mc.Graw Hill Book Company, INC, New York and London, Latest Edition.
4. Modern Food Analysis by F.Leslie Hart A.N. and Hary John Stone Fishes. Ph.D. Publishers, Springer - Verlag. Berlin Heidelberg, New York, Latest Edition.
5. Food Analysis by RLees, Published by Leonard Hill Books, London.
6. Official Methods of Analysis of Association of Official Analytical Chemists, Pub.Associ. Office, Anal, Chemist, Washington D.C. Latest Edition.
7. Approved Methods of the American Association of Cereal Chemist, Vols. I & II, Latest Edition. Published by American Association of Cereal Chemist inc. Paul, Minnesota U.S.A.

4 PT 06 PULP & PAPER TECHNOLOGY-I - LAB

Determination of various components of wood such as moisture content, ash content, Water Solubility, alkali, solubility extractives, lignin Cellulose; hemicellulose, holo cellulose pentosans etc. Microscopic observations of fibrous materials.

4 OT 06 OIL AND PAINT TECHNOLOGY-I – LAB

Preparations & Standardization Of Solutions, Determination of various Physical and Chemical characteristics of oils, fats and waxes, colour, solubility and thermal test for purity. Analysis of oilseeds and cakes, estimation of rancidity. Analysis of nickel catalysts and acid oils determination, Physical and Chemical, characteristics of vanaspathi, margarine and ghee. Detection of adulteration in oils & fats Testing of readymade Paints & Raw materials of paints systems like pigments, Solvents, additives, Resins .

4 PC06 PETROCHEMICAL TECHNOLOGY- I –LAB

Course Objectives:

Petrochemical Technology lab provides students first hand experience of conducting preliminary tests for various petroleum products and verifying various standard tests and test methods set for petroleum products and comparing and studying the standard specifications set for petroleum products.

Contents:

Experiments for Petrochemical Technology-I (Chemistry of Petroleum Hydrocarbons) such as Flash Point by Abel's Method, Flash Point by Pensky Martien's Method, Flash and Fire Point by Cleveland Open Cup Method, Smoke Point, Aniline Point, Cloud and Pour Point, API Gravity, Viscosity (by Redwood Viscometer/Saybolt Viscometer/Engler Viscometer), Copper Strip Corrosion, Drop Melting Point of Wax, Melting Point of Wax by Cooling Curve Method, Congealing Point of Wax etc.

Lab. Outcomes :

Students will be able to:

- Learn how to experimentally verify various theoretical concepts.
- Visualize practical testing of petroleum products under standard test conditions.
- Develop experimental skills.

4 CT07 MACHINE DESIGN & DRAWING –LAB

Minimum 8 to 10 practicals based on the Syllabus 4 CT04 MACHINE DESIGN & DRAWING

4 CT08 MATERIAL SCIENCE & ENGINEERING – LAB

Ten experiments based on the above syllabus evenly distribute shall be performed and a report/journal there of submitted by each student. The practical Examination shall consist of practicals and viva voce based on the syllabus and practicals.

4 CT09 FLUID FLOW OPERATIONS – LAB

List of Practicals :

1. Calibration of Venturi metre
2. To obtain the coefficient of discharge for the given orifice meter
3. To study the types of flow and determine critical Reynolds number.
4. To verify Bernoulli's theorem.
5. To study the centrifugal pump
6. To study the reciprocating pump
7. To study the loss of head due to Pipe Friction
8. To study the Loss of head due to Pipe Fittings

Annual Gender Sensitization Action Plan 2017-2022

College of Engineering and Technology Akola is focus on Providing equal opportunity to all students and staff irrespective of gender, caste, colour, language, religion, is our matter of concern in terms of gender sensitization program. To materialise this, following action plans are made.

1. Enrolling the female students and staff in the professional and non-professional bodies.
2. Participating in the women empowerment programs.
3. Encouraging female students to participate in Sports, Cultural, NSS, Technical Competitions, Student Committees, Etc. activities.
5. Encouraging the female students in Presenting road shows/Skits on the current issues On the occasion of flag hoisting in Republic and Independence Day.
6. Adding more female members in NSS unit and inculcating the sense of service to society.
7. Celebrating International Women's Day to make aware of women rights.
8. Creating awareness on health, Women cell planned health awareness and a medical camp.
9. Encourage the female students to participate in competitions, placement drives, sports, curricular and extracurricular activities.

GENDER SENSATIZATION ACTION PLAN



Encouraging Girls Students
Participation in Sports,
Cultural, NSS & Related
Activites



Activities Promoting
awareness on
Empowerment,Health,
Hygiene

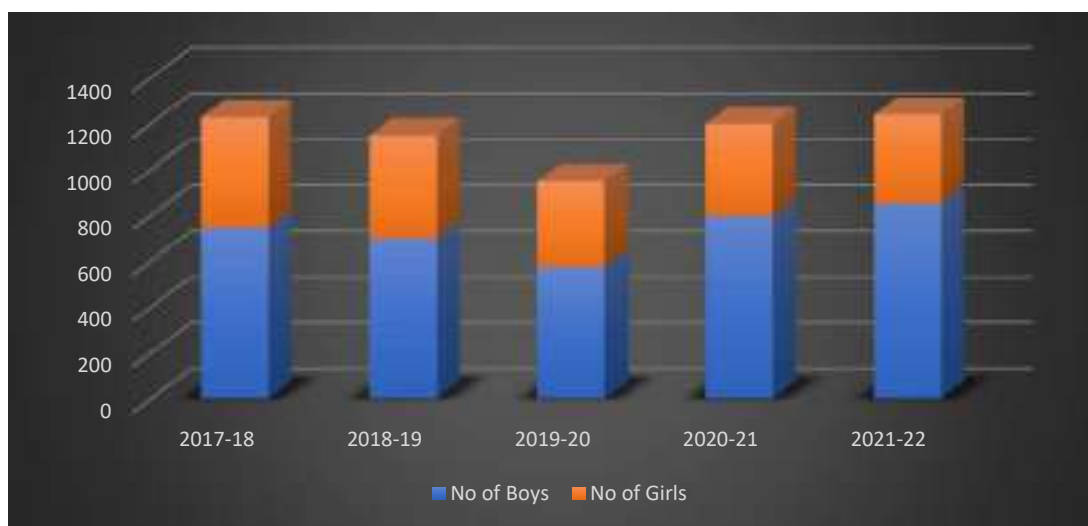


Girls Safety & Security,
Common Rooms, Counselling

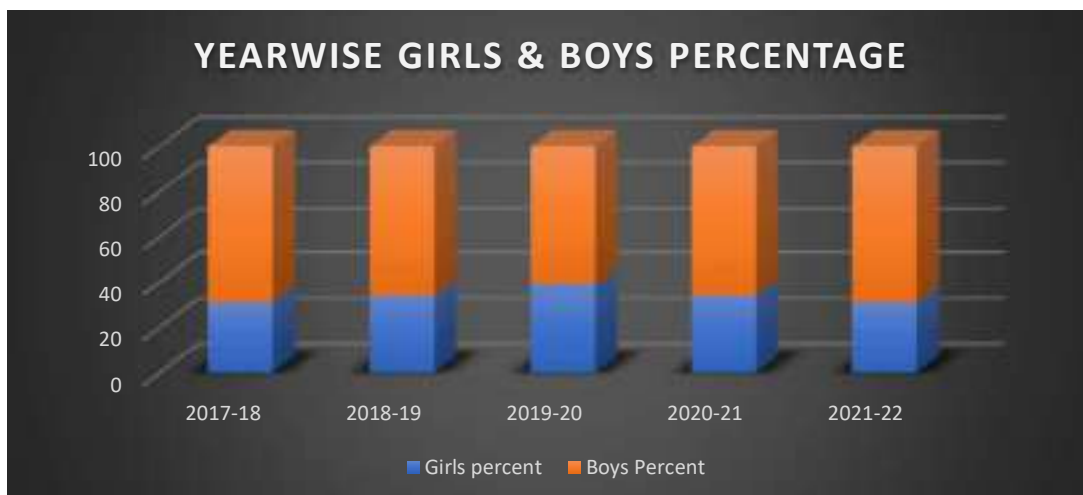
GENDER AUDIT IN THE INSTITUTE

Gender equality Ratio of Students Admitted in our Institute are as under:

Year	2021-22	2020-21	2019-20	2018-19	2017-18
Total Students	1240	1200	949	1150	1230
No of Girls	385	402	370	447	481
No of Boys	855	798	579	703	749
Girls Ratio	45.02%	50.37%	63.90%	63.58%	64.21%



Year	2021-22	2020-21	2019-20	2018-19	2017-18
Girls Percent	31%	34%	39%	39%	40%
Boys Percent	69%	66%	61%	61%	60%



MEASURES INITIATED BY THE INSTITUTION:

A. SAFETY & SECURITY:



COLLEGE ENTERANCE WITH SECURITY GUARD



I -CARD CHECKING AT ENTRY POINT



INSTITUTE CAMPUS IS UNDER CCTV SURVEILLANCE



FIRE SAFETY IN THE INSTITUTE

B. COUNSELLING :



COUNSELLING SESSIONS FOR STUDENTS

C. GIRLS COMMON ROOM & HOSTEL FACILITY:



GIRLS COMMON ROOM FOR STUDENTS WITH FACILITIES



**TEMPORARY GIRLS HOSTEL IN OUR PARENT SOCIETY'S
SHRI SHIVAJI ARTS COMMERCE & SCIENCE COLLEGE AKOLA**

D. VARIOUS ACTIVITIES CONDUCTED BY THE ISTITUTE RELATED TO PARTICIPATION OF GIRLS STUDENTS IN SPORTS, CULTURAL, TECHNICAL ETC. EVENTS:



Participation in Online Women Empowerment Program







HEALTH CHECK UP ACTIVITIES

ACHIEVEMENT OF THE GIRL STUDENTS:







Dr. Shripad Education Society's
**COLLEGE OF ENGINEERING
AND TECHNOLOGY, AKOLA**

SPONSORED BY



Certificate of Achievement

DR. /MR./MRS. BHAGYASHREE K. KALYANDC

Participated in AICTE Sponsored online National Conference & Model Competition on "Recent Trends in Chemical Engineering/Technology" organized by Department of Chemical Engineering in association with Indian Plastics Institute, Akola Chapter held on 28 August 2023 and presented paper on topic "E-WASTE MANAGEMENT - A STEP TOWARDS GREEN COMPUTING"

and He/She stood **FIRST POSITION**


 Dr. D. V. Wele
Organizing Secretary
ETCT-2023


 Dr. S. V. Khedkar
Organizing Secretary
ETCT-2023


 Dr. P. V. Thorat
Coordinator
ETCT-2023



Dr. Shripad Education Society's
**COLLEGE OF ENGINEERING
AND TECHNOLOGY, AKOLA**

SPONSORED BY



Certificate of Achievement

DR. /MR./MRS. SHANIKA PASWAN

Participated in AICTE Sponsored online National Conference & Model Competition on "Recent Trends in Chemical Engineering/Technology" organized by Department of Chemical Engineering in association with Indian Plastics Institute, Akola Chapter held on 28 August 2023 and presented paper on topic "E-WASTE MANAGEMENT - A STEP TOWARDS GREEN COMPUTING"

and He/She stood **FIRST POSITION**


 Dr. D. V. Wele
Organizing Secretary
ETCT-2023


 Dr. S. V. Khedkar
Organizing Secretary
ETCT-2023


 Dr. P. V. Thorat
Coordinator
ETCT-2023



Dr. Shripad Education Society's
**COLLEGE OF ENGINEERING
AND TECHNOLOGY, AKOLA**

SPONSORED BY



Certificate of Achievement

DR. /MR./MRS. PRANALI S. AJAT

Participated in AICTE Sponsored online National Conference & Model Competition on "Recent Trends in Chemical Engineering/Technology" organized by Department of Chemical Engineering in association with Indian Plastics Institute, Akola Chapter held on 28 August 2023 and presented paper on topic "PLASTIC WASTE MANAGEMENT"

and He/She stood **THIRD POSITION**


 Dr. D. V. Wele
Organizing Secretary
ETCT-2023


 Dr. S. V. Khedkar
Organizing Secretary
ETCT-2023


 Dr. P. V. Thorat
Coordinator
ETCT-2023

COLLEGE COMMITTEE:

DISCIPLINARY & ANTIRAGGING COMMITTEE:

Prof. N. B. Bujruk	Chairman	9665720622
Dr. S. M. Taley	Member	9960590228
Dr. Mrs. R. S. Jaiswal	Member	9011023942
Dr. Mrs. J. V. Shegokar	Member	9405315315
Prof. S. P. Dhomane	Member	9970171328
Dr. D. C. Kothari	Member	9527802935
Prof. A. A. Pande	Member	9422653216

INTERNAL COMPLAINTS COMMITTEE(ICC) / VISHAKHA COMMITTEE:

Dr. Mrs. R. S. Jaiswal	Chairman	9011023942
Prof. Mrs. K. U. Deshmukh	Member	9604912498
Prof. N. B. Bujruk	Member	9665720622
Prof. S. J. Ningwal	Member	9730162182
Ms. V. R. Hatwalne (NGO)	Member	9881953694
Adv. Manisha Kulkarni	Member	9823510335
In-Charge M.I.D.C. Akola Police Station.	Member	7242258399

SC / ST (PREVENTION OF ATROCITIES) COMMITTEE:

Prof. S. C. Makwana	Chairman	9960590191
Prof. N. B. Bujruk	Member	9665720622
Dr. Mrs. J. V. Shegokar	Member	9405315315
Shri P. A. Gondchar	Member	9960301173

VARIOUS ACTIVITIES CONDUCTED:



***Facilities for alternate sources of energy and energy
conservation measures :***

Our institution initiated the measures for alternate energy sources for conservation of energy.

- Four poles top solar energy plate has been installed in four important locations as an alternative energy source.
- Institute adopted energy efficient lighting by replacing all the vacuum , tube lights of the classrooms, corridors, office building, street lights are replaced by L.E.D bulbs to promote energy efficiency.
- The process of installation of Solar Energy Panel.

Use of LED bulbs/ Power efficient equipment

Our Institute is using CFL, LED and star rated power equipment's etc. which consume lesser electricity, which in turn result in lesser energy utilization. Institute procures electrical equipment's which have energy star rating as per Bureau of Energy Efficiency (BEE) standard which ensure relatively lesser consumption of electricity. Our Institute has installed the LED light in the whole campus for low consumption of energy and replace the old light systems.

SOLAR PANEL INSTALLATION:





Inward No. 2537022
Dt. 32/08/2022
College of Engg.
& Tech., Akola

Office of The Superintending Engineer
O&M Circle, Second Floor, Vidyal Bhawan,
Ratanlal Ponds, Akola-444005.
E-mail: suakola@gmail.com

No. SE/AKL/Tech/ - 2719

Date: 22 AUG 2022

To,
✓ M/s The Principal College of Engineering & Tech
Consumer no. 318719023920, at Bahubhagwan Tq, Dist. Akola.
(principalceta@gmail.com)

By E-mail

Sub: Approval to install Roof-top Solar PV system, under Net Metering Regulation 2019 in M/s
The Principal College of Engineering & Tech, Consumer no. 318719023920 at Bahubhagwan Tq,
Dist. Akola.

- Ref:
1. Your application no. 41147439 Dt. 20.06.2022
 2. Joint inspection vide letter no. EE/AKL/Tech/434 date 19.07.2022
 3. Technical feasibility vide ref no. EE/AKL/R/T/2348 Date 26.07.2022
 4. Commercial Circular No. 258 Date 25.01.2016
 5. Commercial Circular No. 322 Date 21.01.2020
 6. CE Comm/GIRREGS regulation 2019 /12627 DT 20.07.2020

Dear Sir/ Madam,

Vide application under reference (1), you have requested for approval to install roof-top PV
Solar system, under the provisions of the Maharashtra State Electricity Regulatory Commission (Net
Metering for Roof-Top Solar PV Systems) Regulation 2019, at your premises bearing following
details.

Name of Consumer	: M/s The Principal College of Engineering & Tech
• Consumer No.	: 318719023920
• Sanctioned Load	: 250KW
• Contract Demand	: 55KVA
• Voltage Level	: 11KV
• Registration fee	: Paid Dt 29.06.2022
• Sanctioned RE Capacity Solar	: 51KW

As per powers delegated to the undersigned vide Commercial Circular No. 322 dated
21.01.2020, approval for installation of rooftop Solar PV system at above mentioned premises is
hereby accorded, subject to following conditions.

HOD
Elect
splk urgently
30/8/22

To Consull Dinesh @ Fuse
Solar Consultant

30.08.22

(Moulaye
dent)



CIN No. U40102MH1992PLC000447

Ref: SE/Aloda/Tech/Eng

Maharashtra State Electricity Dist. Ltd. Ltd.
Office of the Superintending Engineer
O&M Circle office, Vidya Bhawan, Bhatnagar Plot, Aloda
Email: seakl@seakl.com

Date: 22-11-2022

To
Executive Engineer,
MSEDCL O&M Division,
Aloda Burel

Subject: Estimate for provision of NET metering arrangement to install Rooftop Solar PV system of 10KW for (114) 101 connection in r/o Mr. The Principal College of Engineering & Tech. Consumer no. 238719023920, at Bhatnagar Pn, Dist. Aloda.

- Ref: -
1. Application no. 41347432 Dt. 20.06.2022
 2. Non Inspection vide letter no. BE/AKL/Testing/434 dno 19.07.2022
 3. Technical feasibility vide ref no. BE/AKL/R/T/2448 Date: 26.07.2022
 4. Ex. Engr Aloda Burel Email dno 12.08.2022
 5. Cost-Dm 2019-20(CF) Dm. Cost Data 2019-20/8014 DT 27.06.2019
 6. CE/Testing/47-CHV/Testing/Circular/3338 Dm 14.04.2018
 7. CE/Testing/Standard CT ratio/Circular/18 Dm 14.05.2018
 8. EDC/Est. ID/NET Conn/15940 Dm 20.08.17 (Commercial Circular No. 291)
 9. Commercial Circular No. 258 (Comm./CE/Solar-Net Metering/3051 Dm 25.01.2014)
 10. Commercial Circular No. 323 (CE/ Comm./GOREGS regulations 2019/1184 Dm 21.01.2020)
 11. Competent authority approved office note date 12.08.2022

Brief Details of Estimate

Sr No	Particulars	Unit	Qty.	Rate	Amount in Rs.
1	Provision of Metering arrangement at Consumer end with HT Metering Cabinet S&A, Class 0.5S, Burden 10 VA & PT-111V/ 51/110V/5, 0.5, 50 VA. Basic Cat/Dm. Type	No	1	As per Sheet	141997.00
A					
2	Transportation			Ex-work price	141997.00
3	T&P on material		4.00%		5679.88
4	Contingencies on material Cost		1.00%		1419.97
5	Erection cost on Material (basic Rs.)		2.50%		3549.92
6	Contractor Supervision on material		15.00%		21299.55
7	Insurance, Labour & Finance Cost		5.00%		7099.85
B			3.00%		4259.91
C				Total Services	40000.00
7	Contractor profit on "C"			Sub-Total "C"	182360.00
D			0%		9265.30
8	GST			Yantai Cost "D"	54473.20
9	Price Escalation on net material cost		10%		15202.81
E			5%		7099.85
				Sub-Total "E"	236094.89
10	CEO supervision charges @ 1.2% of material cost & erection charges		1.20%		2122.80
11	Interest during construction period as "E"		1.50%		3541.20
				Total estimated Cost (DPR Cost) A	247101
	Total Supervision charges with Cat @ 0.08%				2585

As per power delegated vide Commercial Circular No 291, the Superintending Engineer is the competent authority with full power for technical examination & release of bills to HT installations with contract amount above 107 HP & upto 1000 KVA on Non-Express feeder under DPR & all administratively approved scheme. Hence estimate is sanctioned vide no. BE/AKL/TEST/2022-23 / 1.3% Sup. Charges / 07.06.21.08.2022

The amount for estimation purpose is Rs 247101/- (Rs. Two Lakh Forty Seven Thousand One Hundred & One Only).

Brief Details of Estimate (Outside substation) at consumer end

METERS

Sr.No.	Description of Material	Unit	Qty.	RTU Rs.	Am.Rs.
1	11 kV Cubicle, 6/6A, 0.55 (approximate cost not available in Cost data MSEDCL) for meter	Nos	1	₹15000.00	₹15000.00
				Total	₹15000.00

Earthing for cubicle

Sr.No.	Description of Material	Unit	Qty.	RTU Rs.	Am.Rs.
1	Copper Strip 25x6mm for earthing of cubical meter and cable	kg	1.30	₹177	₹232.10
2	HT Earthing set for cubical	Set	1	₹547	₹547.00
3	Bentonite clay	kg	1.500	₹173	₹259.50
				Total	₹2438.60

Cable

1	XLPE Cable 11 kV, 3 C/300 mm sq.	Rmt	23.00	₹154.00	₹3582.00
2	11 kV Heat shrink indoor termination joint (AI) kit for XLPE 3 C X 300 sqmm	No	2.00	₹1643.00	₹3286.00
3	11 kV heat shrinkable Outdoor termination joint kit for 3 C X 300 sqmm	No	2.00	₹2030.00	₹4060.00
				Total	₹10928.00

Sub: Total (a+b+c) ₹141997.00

METERS

Sr.No.	Description of Material	Unit	Qty.	RTU Rs.	Am.Rs.
1	ABT Meter (approximate cost not available in Cost data MSEDCL) for meter	Nos	1	₹9400.00	₹9400.00
2	Generation Meter CT operated (approximate cost not available in Cost data MSEDCL)	Nos	2	₹4282.00	₹8564.00
				Total	₹17964.00

AUDITED

3- Dy. Manager (F & A) Audit
M.S.E.Distribution Co.Ltd.
U & M Circle Akola

By Executive Engineer
M.S.E.D. Co. Ltd.
U & M Circle Akola

Exn. Engineer
Akola R.Dn

Consumption Details

Table 3 Billing Data

Month	kWh	kVAh	Billed MD	Demand Rate (Rs/kVA)	Billed PF	Industrial Units	Basic Unit rate (Rs/kWh)	Demand Charges (Rs)	Energy Charges (Rs)	TOD (Rs)	Electricity Duty (Rs)	Excess MD Charges	Total Current Bill (Rs)
Oct-21	5543	6121.00	44	432	0.905	6121	9.21	109008.00	56374.60	-317.00	16625.00	0.00	96310.00
Nov-21	6414	7458.00	55	432	0.860	7458	9.21	21760.00	68688.18	386.00	20370.00	0.00	118840.00
Dec-21	6473	7650.00	41	432	0.841	7690	9.21	17712.00	70824.50	-750.00	112714.00	0.00	112710.00
Jan-22	6067	6509.00	41	432	0.931	6509	9.21	17712.00	59947.89	-803.00	14905.00	0.00	98610.00
Feb-22	6910	7175.00	48	432	0.963	7175	9.21	20736.00	66081.75	-73.90	19059.00	0.00	111164.00
Mar-22	10354	10715.00	56	432	0.966	10715	9.21	24192.00	98685.15	-362.80	27616.21	648.00	159530.00
Apr-22	10534	10814.00	67	454	0.974	10814	8.96	30418.00	96893.44	-121.00	30130.00	8171.00	175372.00
May-22	10736	11029.00	66	454	0.973	11029	8.96	25964.00	98819.84	121.00	30380.21	7491.00	175130.00
Jun-22	10487	10952.00	64	454	0.957	10952	8.96	25056.00	98129.52	672.30	33427.13	6125.00	192810.00
Jul-22	7380	7916.00	49	454	0.932	7916	8.96	22246.00	70927.16	81.00	23502.23	0.00	136940.00
Aug-22	10514	11599.00	68	454	0.906	11599	8.96	30872.00	103927.04	833.00	35944.30	8851.00	207340.00
Sep-22	8217	8672.00	62	454	0.947	8672	8.96	28148.00	77701.12	177.00	27455.11	4767.00	159880.00
Avg	8302	8888	55	443	0.930	8888	9.09	31585	80583	20	32836	3095	145370
Max	10736	11599	68	454	0.974	11599	9.21	109008	103927	833	112714	8813	207340
Min	5543	6121	41	432	0.841	6121	8.96	17712	56374	-803	16525	0	96310
Sum	96629	105650				106650		383824	967001	243	394028	36060	1744436

3.1 Analysis of Electricity Bills.

The energy consumption of last 12 months is tabulated as follows.

Sr. No.	Month	kWh Consumed	Power Factor	PF Incentives /Penal	Reco Demand (kVA)	Billed Demand	Bill Amount
1	Jan-19	7382	0.910	0.00	32	43	197112
2	Feb-19	7853	0.890	0.00	45	45	201018
3	Mar-19	10228	0.920	0.00	66	66	175708
4	Apr-19	10213	0.950	-5944.36	67	67	176391
5	May-19	10496	0.950	-5927.09	46	50	163761
6	Jun-18	6719	1.000	-5632.16	38	42	75365
7	Jul-18	7967	1.000	-6408	46	46	85770
8	Aug-18	8348	1.000	-6980.28	57	57	94216
9	Sep-18	9326	0.463	27431.76	56	56	246034
10	Oct-18	8107	0.840	3291.32	49	49	219655
11	Nov-18	6584	0.910	0.00	39	43	180431
12	Dec-18	7256	0.920	0.00	27	43	192023
		100479	0.89608333		47.3333	50.6	2008283.55
Cost of electricity per unit							19.9870973



Graph 01- kWh Vs Billed Amt Vs Month



Energy Saving Calculations:

Particular	Value	Unit
Total Annual Consumption	99629	kWh/Year
Unit Rate	9.09	Rs./kWh
Total Annual Energy Charges	905627.61	Rs./year
With Operation of all Capacitor banks, Annual Energy Saving	31696.97	Rs./year
Annual Energy Saving	0.32	Rs (Lakhs)/year
Billed PF Penalty	0.66	Rs (Lakhs)/year
Present Billed Power Factor	0.929	
Desired Billed Power Factor	1	
Multiplying Factor	0.395	
Total Connected Load	216	kW
Size of required Capacitor Bank	85.32	kVAR
Rate of Capacitor Bank	1500	Rs./KVAR
Total Investment	1.28	Rs.
Payback	4.04	Years

Month	Billed PF	PF Penalty (Rs.)
Oct-21	0.905	5425.07
Nov-21	0.860	9733.39
Dec-21	0.841	11327.80
Jan-22	0.931	4182.57
Feb-22	0.963	2567.93
Mar-22	0.966	3515.53
Apr-22	0.974	2697.57
May-22	0.973	2817.67
Jun-22	0.957	4354.33
Jul-21	0.932	4934.81
Aug-22	0.906	9910.01
Sep-22	0.917	4224.05
Avg	0.93	5474.23
Max	0.97	11327.80
Min	0.84	2567.93
Sum		65690.73



MAHARASHTRA ENERGY DEVELOPMENT AGENCY



Maharashtra Energy Development Agency

(Government of Maharashtra Institution)
Aundh Road, Opposite Spicer College Road, Near Commissioner of Animal Husbandry,
Aundh, Pune, Maharashtra 411067
Ph No: 020-25080450
Email: eeo@maheda.com, Web: www.maheda.com

ECN/2021-22/CR-28/3412

06th July, 2021

**CERTIFICATE OF REGISTRATION
FOR CLASS 'A'**

We hereby certify that, the firm having following particulars is registered with **MAHARASHTRA ENERGY DEVELOPMENT AGENCY (MEDA)** under given category as "Energy Planner & Energy Auditor" in Maharashtra for Energy Conservation Programme of MEDA.

Name and Address of the firm : M/s PPS Energy Solutions Pvt. Ltd.
B-403, Bharat Vihar, S.No-7E,
Bhamburda Vidyapeeth, Campus,
Karnaj, Pune-411043.

Registration Category : Equivalled Consultant for Energy Conservation
Programme for Class 'A'

Registration Number : MEDA/ECN/2021-22/Class A/EA-11

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This endorsement is valid till **05th July, 2023** from the date of registration, to carry out energy audits under the Energy Conservation Programme.
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reason thereof.


General Manager (EC)

Water conservation facilities available in the Institution:

College of Engineering and Technology Akola is located in rural area, there is no Municipal Water supply for the college. The college depends on ground water for all its water needs. Hence, efficient usage of available water and adaptation of water conservation measures are essential. The daily requirement of water in the campus is around 6.5 M³/Day.

The following measures are taken for the conservation of water:

1. RAIN WATER HARVESTING :

Run off generated in the campus is collected using a Check dam constructed in the campus on a natural drain passing through the campus. The stored water percolates into the ground to recharge ground water. The rain water coming from roof tops and that flowing within the campus are collected in five numbers of percolation pits of 3m x 3m size each, constructed at all feasible points in the campus recharge ground water.

2. OPEN WELL RECHARGE:

An open well located in the campus is recharged by rain water. The well also receives water from the percolation pits.

3. MAINTENANCE OF WATER DISTRIBUTION SYSTEMS IN THE CAMPUS:

The ground water is pumped into storage tanks located at different places in the campus. There are nine numbers of over head storage tanks and one Elevated Service Reservoir in the campus. The water is distributed through well laid pipe network. Drinking water after treating in RO plant is supplied through a separate set of distribution pipes and water for all other purpose is supplied through another set of distribution pipes. Entire distribution system is well supervised by the maintenance department to ensure that there are no leakages and wastages of precious water through joints, valves etc. Waste usage of water is reduced using low pressure flushes. All the stakeholders of the college are well educated to use water economically and efficiently.





Green initiatives by the college:

II. WATER CONSUMPTION

Water Consumption on the entire campus is as follows:

Sr.No.	Water Used For	Per Day
1	Domestic Purpose including canteen.	4 m ³ /day
2.	Gardening	1.5 m ³ /day
3.	Laboratory Purpose.	1.0 m ³ /day

III. ELECTRICITY CONSUMPTION

Electricity Consumption per Year was 981 KWH. Avg. Electrical Consumption per Month was 81.75 KWH. Avg. Electrical Consumption per Day was 2.68 KWH

IV. CHARACTERISTIC AND DISPOSAL PRACTICES OF SOLID WASTES WASTE MANAGEMENT

1. The waste is segregated at source by providing separate dust bins for waste.
2. Segregation of chemical waste generated in chemistry lab.

Sr.No.	Waste Category	Constituent Parameter	Method of Disposal
1	a. Canteen waste. b. solid waste from tree droppings and lawn	Not Analyzed.	Vermi Composting Organic Manure
2.	Plastic Waste	Not analyzed	Provision Separate Dust bins
3.	Solid Waste from Lab	Not analyzed.	Composting Organic Manure Proposed during year 2014-15

VIII. PLANTATION AWARENESS PROGRAM

The institute has organized various has organized Tree Plantation program at College Campus and surrounding villages through NSS unit within the Institute. The plantation program includes plantation of various types of ornamental and medicinal wild plant species in large numbers in each surrounding villages. This activity is done during the month of August. Every Year the institute organize Tree Plantation program on the eve of Birth Anniversary of Late Dr. Panjabrao Alias Bhausaheb Deshmukh.



Divyangjan-friendly, barrier free environment:

Our Institute provides barrier-free environment where students and staff with disabilities can move about safely and freely and use the facilities within the built environment. The environment supports the independent functioning of individuals so that they can participate without assistance in everyday activities within the campus. Buildings / places / transportation systems are made barrier free

RAMP :

Ramp-Rails, an inclined plane, are built in addition to staircases in the mail building and Computer Department, Architecture departments Buildings. The ramps are carefully designed as per specifications to be used by the differently abled people.

LIFT:

College buildings have provision of lift for barrier free access for students, staff, visitors and differently abled people. The lift facility is provided in the main building.

Divyangjan -friendly washrooms :

College buildings have provision of **Divyangjan** -friendly washrooms for barrier free access for students, staff, visitors with disabilities.

RAMP FACILITY



LIFT FACILITY



TOILET FACILITY



PARKING FACILITY

INITIATIVE TO ADDRESS SOCIAL CONCERNS ACTIVITY

ACTIVITY 1

SOCIAL INITIATIVE IS CHOSEN FOR RENOVATION AND TRANSFORMATION OF THE BLIND SCHOOL, MALKAPUR, AKOLA BY SCHOOL OF ARCHITECTURE COET AKOLA

KANUBHAI VORA BLIND SCHOOL - 15 AUGUST 2017

OBJECTIVE

AS PER THE OBJECTIVES, SOCIAL INITIATIVE IS CHOSEN FOR RENOVATION OF THE BLIND SCHOOL, MALKAPUR, AKOLA BY SCHOOL OF ARCHITECTURE COET AKOLA

THE CONTEXT

The blind school was in very bad condition, Blind school of Akola and nearby students learn there, so School of Architecture Students chosen project to renovate and transform that space into a well-defined space for blind students.

THE PRACTISE – students cleared that space and decorated it into a beautiful learning space for blind students

EVIDENCE OF SUCCESS-

Students learned how to express their ideas into reality in Architectural form how to provide services for specially abled students.

PROBLEM ENCOUNTERED

In Akola the space was in very bad condition and students find some time very hard to clear, renovate and transform. They have to work hard for transformation according to the need of blind people.



BEFORE THE ACTIVITY



BEFORE



USE OF WASTE TILES & BRICKS



AS PER THE OBJECTIVES, SOCIAL INITIATIVE IS CHOSEN FOR THE BLIND SCHOOL, MALKAPUR, AKOLA BY SCHOOL OF ARCHITECTURE COET AKOLA

ACTIVITY

TO IDENTIFY AN ABANDONED PUBLIC SPACE IN YOUR CITY THAT HAS THE POTENTIAL TO BE A VIBRANT URBAN SOCIAL SPACE.

TO EVOLVE A DESIGN FOR **ALTERNATIVE SPACES** THAT TRANSFORMS THE ABANDONED PUBLIC SPACE

TO ENGAGE IN REAL LIFE HANDS ON CONSTRUCTION PROGRAM AT THE CHOSEN SITE AND TRANSFORM THE PLACE

THE CHALLENGE WILL BE TO KEEP THE BUDGETS AFFORDABLE AND ENSURE ECOLOGICAL MATERIALS ARE USED

GIVING IMPORTANCE TO THE SPIRIT OF THE ALTERNATIVE SPACE



TRANSFORMATION BEGIN



BEST FROM WASTE

OUTCOME / RESULT OF THE ACTIVITY

It was really a great experience working for these students.

- these children enjoy each moment of their life while playing, eating, studying & singing.
- we enjoyed serving for them and also learned, that being physically disabled should not be our weakness, we have to accept it and keep going in our life.
- we developed sensory pathways so that they don't get harm even while walking.
- we painted their walls to make a innovative school for them to learn.
- Trees and lawn are provided so they can feel nature, enjoy being outside and feel fresh.
- Different textures for pavers i.e. Sensory pathway is created so they can feel it by their legs.
- toys are cleaned painted and installed properly so that they don't get harm and enjoy their playing time.

finally we enjoyed this experience and created a place where they are happy to live in



BEFORE AND AFTER





BEFORE AND AFTER





Institutional efforts/initiatives in providing an inclusive environment i.e., tolerance and harmony towards cultural, regional, linguistic, communal socioeconomic and other diversities

Our institution believes in equality of all cultures and traditions as is evident from the fact that students belonging to different caste, religion, regions are studying without any discrimination. Though the institution has diverse socio-cultural background and different linguistic, we do not have any intolerance towards cultural, regional, linguistic, communal socio economic and other diversities. With great enthusiasm the national festivals, birth anniversaries and memorials of great Indian personalities like Mahatma Gandhi, Dr. Bhimrao Ambedkar, Sarvepalli Radhakrishnan, LalBahadur Shastri celebrated every year.

In our college teachers and supporting staff, students jointly celebrate the cultural and regional festivals, like traditional day, teacher's day, orientation and farewell program, Induction program, rally, plantation, Youth day, Women's day, Yoga day, etc. religious ritual activities are performed in the campus. Motivational lectures of eminent persons of the field are arranged for all-round development of the students for their personality development and to make them responsible citizens following the national values of social and communal harmony and national integration.

A. EVENTS SHOWING CULTURAL HARMONY:











ECO-FRIENDLY GANPATI IDOL MAKING WORKSHOP

Being eco-friendly is the need of the day. So let us pledge our devotion in a beautiful way. A fun Workshop for the whole IIA Family. Make your own Eco-friendly Ganesha.

LET'S CREATE & EXPERIENCE ART TOGETHER



By Clay Artist- AR.NAVIN DHOTKAR

- Learn to make a Ganesh idol with your own hands
- Take back your own Ganapati bappa home.
- All material will be given, FREE ENTRY
- Limited seats, No age limit.
- Prior registration required.
- Date- 19/09/2023
- Time- Start's at 2.30 PM
- Venue- Shri Keshi Nandan Temple, Balaji Nagar, near Parashar Showroom, Akola



INDIAN INSTITUTE OF ARCHITECTS,
AKOLA CENTER



Sensitization of students and employees of the Institution to the constitutional obligations: values, rights, duties and responsibilities of citizens:

Our institute organizes various programs for the promotion of Constitutional values, rights, duties, and responsibilities of citizens, which are aimed to familiarize about Fundamental Duties and Rights.

We celebrate Independence Day on the 15th of August and 26th of Jan on every year. The day marks the importance of freedom and independence, on this day, Flag hoisting ceremony is organized followed by recitation of the National Anthem.

Our Institute organizes several programs that are aimed at the promotion of various constitutional rights, duties, and responsibilities of citizens. Our Institute organizes a Covid Vaccination Camp, Blood Donation Camps in our college campus. Many teachers and students actively participate in the event to ensure that precious lives are saved. Our institute also celebrates Women Day to mark the achievements of women throughout the history. Similarly we celebrate World Environment Day on the 5th of June every year to ensure the Environmental concern. Similarly, our institute organizes *Swachh Bharat Abhiyan*.







- CSE staff and students contributed for the noble activity of distribution of safety kits containing Mask, Gloves, Goggles, Sanitizers and Paper Soap to our CORONA warriors (Police and Needy people). These activities appreciated widely in the society.





The Students put forth their views for current government as well as opposition and there views on Loksabha election 2019.





CELEBRATION OF INTERNATIONAL YOGA DAY:

