CURRICULUM
OF
ENGINEERING TECHNOLOGIES

Electronics Engineering Technology
Electrical Engineering Technology
Civil Engineering Technology
Mechanical Engineering Technology

(BSc)

(Revised 2016)

HIGHER EDUCATION COMMISSION
ISLAMABAD-PAKISTAN

CURRICULUM DIVISION, HEC

Prof. Dr. Mukhtar Ahmed	Chairman, HEC
Prof. Dr. Arshad Ali	Executive Director, HEC
Mr. Muhammad Raza Chohan	Director General (Acad)
Ms. Ghayyur Fatima	Director (Curriculum)
Mr. Riaz-ul-Haque	Assistant Director (Curr)

PREFACE

The curriculum, with varying definitions, is a plan of the teaching-learning process that students of an academic programme are required to undergo. It includes objectives and learning outcomes, course contents, scheme of studies, teaching methodologies and methods of assessment of learning. Knowledge in all academic disciplines is expanding and even new disciplines are also emerging, it is imperative that curriculum are developed and updated regularly.

University Grants Commission (UGC) was designated as the competent authority to develop, review and revise curricula beyond Class-XII vide Section 3, Sub-Section 2 (ii), Act of Parliament No. X of 1976 titled **"Supervision of Curricula and Textbooks and Maintenance of Standard of Education".** With the repeal of UGC Act, the same function was assigned to the Higher Education Commission (HEC) under its Ordinance of 2002, Section 10, Sub-Section 1 (v).

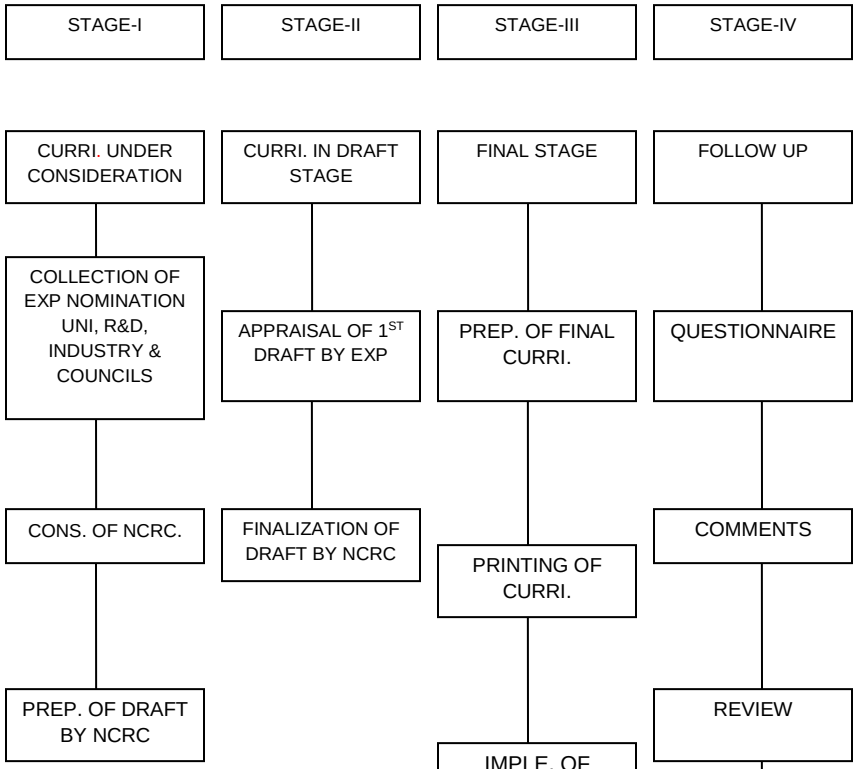
In compliance with the provisions, the Curriculum Division of HEC undertakes the revision of curricula after every three years, through respective National Curriculum Revision Committees (NCRCs) which consist of eminent professors, researchers of relevant fields from public and private sector universities, R&D organizations, councils, industry and civil society nominated by their organizations.

In order to impart education at par with quality international standards, HEC NCRCs have developed unified templates as guidelines for the development and revision of curricula in the disciplines of Basic Sciences, Applied Sciences, Social Sciences, Agriculture and Engineering in 2007 and 2009.

It is hoped that this curriculum document, prepared by the respective NCRC's, would serve the purpose of meeting our national, social and economic needs, and it would also provide the level of competency specified in Pakistan Qualification Framework to make it compatible with international educational standards. The curriculum is also placed on the website of HEC (www.hec.gov.pk).

(Muhammad Raza Chohan)
Director General (Academics)

CURRICULUM DEVELOPMENT PROCESS



Abbreviations Used:

NCRC.	National Curriculum Revision Committee
VCC.	Vice-Chancellor's Committee
EXP.	Experts
COL.	Colleges
UNI.	Universities
PREP.	Preparation
REC.	Recommendations
LI	Learning Innovation
R&D	Research & Development Organization
HEC	Higher Education Commission

CONTENTS

MINUTES OF THE MEETINGS

The preliminary meeting of the HEC National Curriculum Review Committee (NCRC) for the subject of BTech was held at HEC Islamabad from 08th ~ 10th June, 2015. Following is the list of participants;

Dr. Muhammad Kamran, Professor, Department of Electrical & Electronics, University of Engineering & Technology, KSK Campus, Lahore.	Convener
Muhammad Munir Akhtar MS-Electrical Engineering Vice president PTC/HOD NEL Lahore	Secretary
Prof. Dr. Asif Ali Shah Professor, Department of Electrical Engineering, Mehran University of Engineering & Technology, Jamshoro.	Member
Engr. Badshah Munir Chairman & Associate Professor, Department of Electrical Engineering Govt. College of Technology, Kohat Road, Peshawar	Member
Engr. Mohammad Usman Associate Professor, Department of Electrical Engineering, Balochistan University of Engineering & Technology, Khuzdar.	Member
Engr. Abdul Ghaffar Assistant Professor, Department of Tech, Government College of Technology, TEVTA, Samanabad, Faisalabad.	Member
Mohammad Sadiq Assistant Professor, Department of Electrical Engineering, Government College of Technology, Kohat Road, Peshawar.	Member

Mr. Israr Ahmad — Member
Assistant Professor,
Department of Electrical Engineering,
Government College of Technology,
Panr, Mingora, Swat.

Mr. Ikram Ullah Khan — Member
Assistant Professor,
Department of Electrical Engineering,
Government College of Technology,
Dera Ismail Khan.

Mr. Ghulam Rasool Maka — Member
Vice Principal,
Department of Electrical Engineering,
Government College of Technology, SITE, Karachi.

Mr. Mohammad Yaqoob Raza — Member
Convener (B. Tech),
Pakistan Council of Technologists,
Block No. 10, Flat # 14, Category-IV, I-9-/4,
Islamabad.

Mr. Nadeem Warsi — Member
Assistant Professor / HOD,
Government College of Technology,
SITE, Karachi.

Dr. Salah Uddin — Member
Associate Professor,
Department of Civil Engineering
Balochistan University of Engineering & Technology,
BUET, Khuzdar.

Dr. Aneel Kumar — Member
Professor & Co- Chairman,
Department of Civil Engineering,
Mehran University of Engineering & Technology,
Jamshoro.

Muhammad Zafar Iqbal — Member
Associate Professor,
Government College of Technology,
Mardan Road, Nowshera.

Engr. Shafi Durrani — Member
Principal,
Department of Civil Engineering,
Government College of Technology,
Rasul, Mandi Bahauddin

Mr. Muhammad Ismail — Member
Assistant Professor,
Government College of Technology,
Peshawar, KPK.

Dr. Muhammad Ashraf — Member
Associate Professor,
Department of Civil Engineering,
University of Engineering & Technology,
Peshawar.

Mr. Mohammad Khurshid Shinwari — Member
Vice Chairman,
Pakistan Council of Technologists,
Block No. 10, Flat # 14, Category-IV, I-9-/4,
Islamabad.

Engr. Mazhar Abbas Naqvi — Member
Principal,
Government Staff Training College,
Peoples Colony-1, Faisalabad

Dr. Faisal Amir — Member
Dean / Assistant Professor,
Department of Electronics & Power Engg,
National University of Science & Tech.
NUST-PNEC, Habib Rahmat Ullah Road, Karachi

Mr. Ashraf Khan — Member
Assistant Professor,
Government College of Technology,
Near City Hospital, Kohat Road, Peshawar.

Mr. Arshad Hanif — Member
Assistant Professor / HOD,
Department of Electrical Engineering,
Government College of Technology, SITE, Karachi.

Dr. Mohammad Amjad — Member
Assistant Professor,
Department of Electronics Engineering,
New Building, University College of Engg & Tech,
B/J Campus,
Islamia University Bahawalpur, Bahawalpur,

Mr. Mohammad Abid — Member
Assistant Professor,
Department of Electrical Engineering,
Balochistan University of Engineering & Technology,
Khuzdar.

Mr. Khusro Hamid Ali — Member
Associate Professor,
Department of B. Tech (Electronics),
Government College of Technology,
SITE, Karachi.

Engr. Muhammad Naeem-ul-Haq — Member
Assistant Professor,
Department of Electronics Engineering,
Government College of Tech, Seriab Road, Quetta

Dr. Gulistan Raja — Member
Professor,
Department of Electrical Engineering,
University of Engineering & Technology,
Taxila.

Dr. Hassan Ali Khan Durrani — Member
Professor,
Department of Mechanical Engineering,
Mehran University of Engg & Tech, Jamshoro

Mr. Fazal-ur-Rehman — Member
Associate Professor,
Department of Mechanical Engineering,
Government College of Technology,
Dera Ismail Khan.

Engr. Liaquat Ali Lehri — Member
Chairman,
Department of Mechanical Engineering,
Balochistan University of Engineering & Technology,
Khuzdar.

Engr. Muddassir Ahmad — Member
Head Academics,
Karachi Tools, Dies & Module Center,
Sector No. 38, NC # 24, Korangi Greek, Karachi.

Mr. Mashal Khan — Member
Assistant Professor/Principal,
Government Technical & Vocational College for Boys,
Bannu

Engr. Zubair Ahmad Qureshi — Member
Associate Professor,
Department of Mechanical Engineering,
Government College of Technology,
Abbottabad.

Engr. Abbas Soomro — Member
Assistant Professor,
Department of Mechanical Engineering,
Government College of Technology, SITE,
Karachi.

Mr. Amjad Mehmood — Member
Assistant Professor,
Department of Mechanical Engineering,
Government College of Technology, Quetta.

Engr. Niqab Khan — Member
Asst. Professor,
Department of Mechanical Engineering,
Government College of Technology,
Kohat Road, Peshawar.

Dr. Riffat Asim Pasha — Member
Professor,
Department of Mechanical Engineering,
University of Engineering & Technology,
Taxila.

Dr. Khalid Mahmood — Member
Mech Engg
Dept of Mech Engg EME College NUST
Rawalpindi.

DAY 1

On 8th June meeting was started with the recitation of Holy Quran. All participants were welcomed by Madam Ghayyur Fatima Director (Academics). After completion of the introduction. Dr. Muhammad Kamran was selected as Convener of NCRC & Mr. Muhammad Munir Akhtar as secretary. Mr. Sadiq AP from GCT Peshawar raised question, whether previous NCRC-2010 had right to give such equivalence withdrawal recommendation, house unanimously declared that, it was not fall under purview of the said committee. Moreover, different schemes of studies were come into discussion & decided to work out for the course.

Later on Participants were divided into four groups for curriculum development, details as under;-

NCRC Sub-committee for B.Tech Electrical

1. Prof. Dr. Asif Ali Shah, Convener
   Professor,
   Department of Electrical Engineering,
   Mehran University of Engineering & Technology, Jamshoro.
2. Engr. Badshah Munir Secretary
   Chairman & Associate Professor,
   Department of Electrical Engineering
3. Engr. Mohammad Usman, Member
   Associate Professor,
   Department of Electrical Engineering,
   Balochistan University of Engineering & Technology, Khuzdar.
4. Engr. Abdul Ghaffar, Member
   Assistant Professor,
   Department of Electrical Engineering,
   Government College of Technology,
   TEVTA, Samanabad, Faisalabad.
5. Mohammad Sadiq, Member
   Assistant Professor,
   Department of Electrical Engineering,
   Government College of Technology,
   Kohat Road, Peshawar.
6. Mr. Israr Ahmad, Member
   (In Place of Mr. Abid Alam),
   Assistant Professor,
   Department of Electrical Engineering,
   Government College of Technology,
   Panr, Mingora, Swat.

7. Mr. Ikram Ullah Khan, Member
   Assistant Professor
   Department of Electrical Engineering,
   Government College of Technology,
   Dera Ismail Khan.
8. Mr. Ghulam Rasool Maka, Member
   Vice Principal,
   Department of Electrical Engineering,
   Government College of Technology, SITE,
   Karachi.

NCRC Sub-Committee for B.Tech Civil

1. Mr. Mohammad Yaqoob Raza, Convener
   Convener (B. Tech),
   Pakistan Council of Technologists,
   Block No. 10, Flat # 14, Category-IV, I-9-/4,
   Islamabad.
2. Mr. Nadeem Warsi, Secretary
   Assistant Professor / HoD,
   Government College of Technology,
   SITE, Karachi.
3. Dr. Salah Uddin, Member
   Associate Professor ,
   Department of Civil Engineering
   Baluchistan UET, Khuzdar.
4. Dr. Aneel Kumar, Member
   Professor & Co- Chairman,
   Department of Civil Engineering,
   Mehran University of Engineering & Technology,
   Jamshoro.
5. Muhammad Zafar Iqbal, Member
   Associate Professor,
   Government College of Technology,
   Mardan Road, Nowshera.
6. Engr. Shafiq Durrani, Member
   Principal,
   Department of Civil Engineering,
   Government College of Technology,
   Rasul, Mandi Bahauddin
7. Mr. Muhammad Ismail, Member
   Assistant Professor,
   Government College of Technology,
   Peshawar, KPK.

8. Dr. Muhammad Ashraf — Member
   Associate Professor,
   Department of Civil Engineering,
   University of Engineering & Technology,
   Peshawar.
9. Mr. Mohammad Khurshid Shinwari, — Member
   Vice Chairman,
   Pakistan Council of Technologists,
   Block No. 10, Flat # 14, Category-IV, I-9-/4,
   Islamabad.
10. Engr. Mazher Abbas Naqvi, — Member
    Principal,
    Government Staff Training College,
    Peoples Colony-1, Faisalabad

NCRC Sub-Committee for B.Tech Electronics

1. Dr. Faisal Amir, — Convener
   Dean / Assistant Professor,
   Department of Electronics & Power Engg,
   National University of Science & Tech.
   NUST-PNEC, Habib Rahmat Ullah Road,
   Karachi
2. Mr. Ashraf Khan, — Secretary
   Assistant Professor,
   Government College of Technology,
   Near City Hospital, Kohat Road, Peshawar.
3. Mr. Arshad Hanif, — Member
   Assistant Professor / HoD,
   Department of Electrical Engineering,
   Government College of Technology, SITE,
   Karachi.
4. Dr. Muhammad Amjad, — Member
   Assistant Professor,
   Department of Electronics Engineering,
   New Building, University College of Engg & Tech,
   B/J Campus, Islamia University Bahawalpur,
   Bahawalpur,
5. Mr. Mohammad Abid, — Member
   Assistant Professor,
   Department of Electrical Engineering,
   Balochistan University of Engg & Tech,
   Khuzdar.

6. Mr. Khusro Hamid Ali, Member
   Associate Professor,
   Department of B. Tech (Electronics),
   Government College of Technology,
   SITE, Karachi.
7. Mr. Khusro Hamid Khan, Member
   Associate Professor,
   Department of B. Tech (Electronics),
   Government College of Technology,
   SITE, Karachi.
8. Mr. Engr. Mohammad Naeem-ul-Haq, Member
   Assistant Professor,
   Department of Electronics Engineering,
   Government College of Tech, Seriab Road,
   Quetta
9. Dr. Gulistan Raja, Member
   Professor,
   Department of Electrical Engineering,
   University of Engineering & Technology Taxila.

NCRC Sub-Committee for B. Tech Mechanical

1. Dr. Hassan Ali Khan Durrani, Convener
   Professor,
   Department of Mechanical Engineering,
   Mehran University of Engg & Tech, Jamshoro
2. Engr. Fazal-ur-Rehman, Secretary
   Associate Professor,
   Department of Mechanical Engineering,
   Government College of Technology,
   Dera Ismail Khan.
3. Engr. Liaquat Ali Lehri, Member
   Chairman,
   Department of Mechanical Engineering,
   Balochistan University of Engineering &
   Technology, Khuzdar.
4. Engr. Muddassir Ahmad, Member
   Head Academics,
   Karachi Tools, Dies & Module Center,
   Sector No. 38, NC # 24, Korangi Greek,
   Karachi.
5. Mr. Mashal Khan, Member
   Assistant Professor/Principal,
   Government Technical & Vocational College
   for Boys, Bannu

6. Engr. Zubair Ahmad Qureshi — Member
   Associate Professor,
   Department of Mechanical Engineering,
   Government College of Technology,
   Abbottabad.
7. Engr. Abbas Soomro, — Member
   Assistant Professor,
   Department of Mechanical Engineering,
   Government College of Technology, SITE,
   Karachi.
8. Mr. Amjad Mehmood, — Member
   Assistant Professor,
   Department of Mechanical Engineering,
   Government College of Technology, Quetta.
9. Engr. Niqab Khan — Member
   Asst. Professor,
   Department of Mechanical Engineering,
   Government College of Technology,
   Kohat Road, Peshawar.
10. Dr. Riffat Asim Pasha, — Member
    Professor,
    Department of Mechanical Engineering,
    University of Engineering & Technology, Taxila.
11. Dr. Khalid Mahmood — Member
    Depart of Mech Engg EME College,
    NUST Rawalpindi.
12. Muhammad Yousif Shackh — Member
    Asst. Prof Depart of Engg & Tech AIOU
    Islamabad

Day 2

On 2nd day (9th June) Mr. Fida Hussain, DG Academics HEC, along with his staff members joined NCRC meeting & concluded that as per HEC policy guide line scheme shall be converted from Annual system to semester system, therefore sub-committees continue their works to finalize the courses.

Day 3

3rd day B.Tech courses for Civil, Electrical, Electronic and Mechanical on semester system basis were finalized. Group Conveners have taken the responsibility to send course out lines and latest books details in one month time. Scheme of courses along with recommendation so far are being forwarded to HEC for their record. Complete curriculum may be

finalized for implementation in upcoming B.Tech curriculum revision meeting which will be held later on.

Recommendations

1- As per direction of HEC, curriculum has been redesigned on the basis of semester system.
2- All colleges and Universities running this program should hire highly qualified preferably PhD faculty in order to enable students to have broader vision of course with practical knowledge.
3- Institutes are advised to generate head for visiting faculty because of unavailability of highly qualified faculty.
4- Existing faculty should be given opportunity through FDP (Faculty Development Program) to improve their qualification.
5- It is strongly recommended that provincial TEVTA should support, enhance and strengthen laboratories and workshops in these colleges and universities in order to improve hands on skills of students.
6- Institutes are advised to update industrial linkage so that students in their final semester may carry out their industrial training successfully.
7- An independent Liaison office should be established to have continuous monitoring of student training in industry.
8- Students after completion of training must be evaluated by the experts of academics and industry for semester grading.
9- In order to ensure quality of program, affective regulatory body may be constituted.
10- As Laboratory staff play a vital role for smooth running laboratories and workshops, their proper training programs must be conducted on regular basis.
11- Intake of students in B.Tech should be ensured that they might had completed their DAE in English language. HEC may take up with TEVETAS & Technical Board for effective implementation.
12- Majority of Committee members suggested that Intake qualification for B.Tech Program should be Diploma of Associate Engineer.
13- A training/workshop may be arranged by HEC for Principal /chairpersons of Department/concerned faculty to understand semester system rules and regulations as this system is being first time implemented for B.Tech.

MINUTES OF 2ND MEETING OF NCRC B.TECH CURRICULUM MEETING HELD IN ISLAMABAD MAY 18-20, 2016

It is continuation of the meeting dated 8-10 June, 2015

A meeting of NCRC was held at HEC Islamabad from 18th ~ 20th May, 2016. Some new members joined us as under;-

1. Mr. Majid Zaman (in replace of Engr. Shafiq Durrani), Member
   Principal,
   Department of Civil Engineering,
   Government College of Technology, Rasul,
   Mandi Bahauddin
2. Mr. Aftab Iqbal Member
   Eminent Educationist Researcher
   Department of Mech. Engg., University of Wah.
3. Col ® Hafiz Sibhat-ullah Fazil Member
   Department of Mech. Engg University of Wah.
4. Dr. Moshsin Tinwana Member
   Asst. Professor,
   Depart of Mechatronics, NUST, Islamabad

DAY 1

On 18th May meeting was started with the recitation of Holy Quran. All participants were welcomed by Mr. Muhammad Raza Chohan, DG (Academics) HEC & this meeting was coordinated by Madam Ghayyur Fatima, Director (curriculum) HEC. After completion of the introduction, Mr. Raza Chohan invited Maj Gen.(R) Akbar Saeed Awan, Chairperson (National Technology Council) for inaugural address to the participants. Chairperson NTC elaborated Council functions & objectives and added that courses to be developed in a way that may serve the country and met the international standard i-e Sydney Accord. Further chairman NTC advised that one year supervised industrial training to be incorporated in degree program and also that their degree nomenclature shall be the B.Sc Engineering technology to make ensure uniformity of the programs at country level. Therefore, supervised industrial training was inducted in 7th & 8th semesters. Sub-committees started their work and finalized the course structure.

Day 2

On 19th May, 2016 courses out lines were developed keeping in view the requirement of country and latest available text books. Further semester's rules and student evaluation criteria for supervised industrial training was also circulated among the all sub-committees for comments and finalization.

Day 3

On 20th May, 2016 a presentation was given by Dr. Mohsen Tiwana NUST Islamabad on Sydney Accord. After presentation, curriculum finalization was done. Curriculum and recommendations received from NCRC and sub-committees are attached herewith.

Recommendations:

1- In continuation of previous NCRC held in June 2015, curriculum is designed on semester system basis.
2- As per advice of Chairman NTC and keeping in view the Sydney Accord, last two semesters of all technology programs are comprised of supervised industrial trainings to keep psychomotor (Hands on) factor on higher side.
3- It is strongly recommended that Universities and Colleges running technology programs should appoint highly qualified preferably PhD faculty in order to enable students to have broader vision of course with practical knowledge.
4- If Institutes don't have very qualified faculty, they should appoint visiting faculty. A proper head for visiting faculty should be appointed as recommended in previous NCRC meeting held in June 2015.
5- Existing faculty of technology programs should be given opportunity through FDP (Faculty Development Program) to improve their qualification.
6- It is strongly recommended that HEC and NTC should support, enhance and strengthen laboratories and workshops in these colleges and universities in order to improve hands on skills of students.
7- Institutes are advised to update industrial linkage so that their students in 7th and 8th semester may perform 32 Weeks Continuous Supervised Industrial / Field Training successfully.
8- HOD/ Chairman of the Department should establish a Liaison office for correspondence and monitoring of student's participation and contribution towards learning.
9- Students after completion of training must be evaluated after 7th and 8th semester by the experts of academics and industry for semester grading. Evaluation criteria is given in Annexure-K.
10- Laboratory staff should be put through proper training of lab equipment for its smooth utilization. Staff should be vigilant and responsible to update stock register for addition and deletion of any equipment and components and to inform laboratory director.
11- It is recommended that intake of students in B-Tech of all technologies should be ensured that they might had completed their DAE in English language.
12- A copy of generalized semester rules has been circulated. However, a training/workshop may be arranged by HEC for college principals/Chairpersons to understand semester system rules and regulations.

CREDIT HOUR DEFINITIONS:

Theory Period	1 Credit Hr	01 Hour / 60 minutes **-** Teaching per week For a minimum of 14 weeks in a semester
Lab Practical or Workshop	1 Credit Hr	03 Hours **-** Lab work or workshop per week for a Minimum of 14 weeks in a semester
Continuous Supervised Industrial / Field training	1 Credit Hr	01 week Training @ (08 hrs daily X 05 days/week=40hrs/week for a minimum of 16 weeks in a semester

LEGENDS - TABLES:

Description of Course Codes	**AB-XYZ**
EL = Electronics E = Electrical C = Civil M = Mechanical T = Technology based Subject S = Sciences based Subjects H = Humanities based Subjects M = Management based Subjects	A = Nomenclature of Program B = Base Subjects X = Year the course taught in Y = Sequence of the course in x year Z = Total number of credit hour(s) of the course

BSc ELECTRONICS ENGINEERING TECHNOLOGY

1st Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ELH-112	Islamic Studies / Professional Ethics	Humanities	2	0	2	0
2	ELS-113	Applied Mathematics - I	Natural Science	3	0	3	0
3	ELS-123	Applied Physics	Natural Science	2	1	2	3
4	ELS-133	Introduction to Computer Fundamentals	Computer Science	1	2	1	6
5	ELT-111	Electronics Workshop Practice	Engineering Foundation	0	1	0	3
6	ELT-124	Electrical Circuit Analysis	Engineering Foundation	3	1	3	3
Total				**11**	**05**	**11**	**15**
Grand Total				**11 + 05 = 16**		**11 + 15 = 26**	

2nd Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ELH-122	Pakistan Studies	Humanities	2	0	2	0
2	ELS-143	Applied Mathematics- II	Natural Science	3	0	3	0
3	ELT-134	Electrical Technology – I	Engineering Foundation	3	1	3	3
4	ELT-144	Digital Logic Technology	Engineering Foundation	3	1	3	3
5	ELS-153	Computer Programming	Computing	2	1	2	3
6	ELT-151	PCB Design and Fabrication workshop	Engineering Foundation	0	1	0	3
Total				**13**	**04**	**13**	**12**
Grand Total				**13 + 04 = 17**		**13 + 12 = 25**	

BSc ELECTRONICS ENGINEERING TECHNOLOGY

3rd Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ELT-214	Electrical Technology – II	Engineering Foundation	3	1	3	3
2	ELT-224	Electronic Devices & Technology	Engineering Foundation	3	1	3	3
3	ELH-213	Communication Skills	Humanities / English	3	0	3	0
4	ELT-233	Microprocessors	Major based Breadth	2	1	2	3
5	ELT-244	Instrumentation & Measurement	Major based Breadth	3	1	3	3
Total				**14**	**04**	**14**	**12**
Grand Total				**14 + 04 = 18**		**14 + 12 = 26**	

4th Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ELH-223	Technical Report Writing	Humanities / English	3	0	3	0
2	ELT-254	Communication Systems and Techniques	Major based Breadth	3	1	3	3
3	ELT-263	Control Technology	Engineering Breadth	2	1	2	3
4	ELT-272	Electromagnetic Field Theory	Major based Breadth	2	0	2	0
5	ELT-283	Amplifier & Oscillators	Major based Breadth	2	1	2	3
6	ELT-293	Power Electronics	Major based Breadth	2	1	2	3
Total				**14**	**04**	**14**	**12**
Grand Total				**14 + 04 = 18**		**14 + 12 = 26**	

BSc ELECTRONICS ENGINEERING TECHNOLOGY

5th Semester Third Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ELT-314	Industrial Drives	Major based Depth	3	1	3	3
2	ELT-324	VLSI Technology	Major based Depth	3	1	3	3
3	ELT-334	Applied Antenna & wave Propagation	Major based Depth	3	1	3	3
4	ELT-343	Industrial Electronics Applications	Major based Breadth	2	1	2	3
5	ELT-353	Renewable Energy Technology	Major based Breadth	2	1	2	3
Total				**13**	**05**	**13**	**15**
Grand Total				**13 + 05 = 18**		**13 + 15 = 28**	

6th Semester Third Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ELT-364	Industrial Automation and Robotics	Major based Depth	3	1	3	3
2	ELT-374	FPGA Based Systems	Major based Depth	3	1	3	3
3	ELT-384	Communication Networks	Major based Breadth	3	1	3	3
4	ELM-313	Project Management	Management Science	3	0	3	0
5	ELT-393	Project	Major based Depth	0	3	0	9
Total				**12**	**06**	**12**	**18**
Grand Total				**12 + 06 = 18**		**12 + 18 = 30**	

BSc ELECTRONICS ENGINEERING TECHNOLOGY

6th Semester Third Year Summer Project Work:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	ELT-3103	Project (Continue)	0	03	0	09
Grand Total			**00+ 03 = 03**		**00 + 09 = 09**	

7th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	ELT-4116	16 Weeks Supervised Industrial / Field Training (8x5=40Hrs / Week)	0	16	0	40x16 = 640
Total			**0**	**16**	**0**	**640**
Grand Total			**00+ 16 = 16**		**00 + 640 = 640**	

8th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	ELT-4216	16 Weeks Supervised Industrial / Field Training (8x5=40Hrs / Week)	0	16	0	40x16 =640
Total			**0**	**16**	**0**	**640**
Grand Total			**00+ 16 = 16**		**00+ 640 = 640**	

- *Complete guidelines for 32 weeks Continuous Supervised Industrial/ Field Training are available in Annexure-K.*

Summary:

BSc Electronics Engineering Technology		
Semester	**Credit Hours**	
	Theory	**Practical**
1st	11	05
2nd	13	04
3rd	14	04
4th	14	04
5th	13	05
6th	12	06
6th Summer	00	03
7th	00	16
8th	00	16
Total	**77**	**63**
G. Total	**140**	

DETAIL OF COURSES (ELECTRONICS ENGG TECH)

1st Semester

ELH-112	**ISLAMIC STUDIES / PROFESSIONAL ETHICS**	**(Annexure-A)**
ELS-113	**APPLIED MATHEMATICS – I**	**(Annexure-D)**
ELS-123	**APPLIED PHYSICS**	**(Annexure-C)**
ELS-133	**INTRODUCTION TO COMPUTER FUNDAMENTALS**	**(Annexure-H)**

ELT-111 ELECTRONICS WORKSHOP PRACTICES

Objectives:

- The student will be able to identify electronic components
- The student will be able to test the electronic components and sort faulty and good one.
- The student will be able to use different electronic equipment.
- The student will be able to read schematic diagram and implement it on bread board & PCB.
- The student will be able to trouble shoot and align the various circuits.

Lab Outline:

- Familiarization with the Electronic Instruments.
- Familiarization with electronic components.
- Use of multi-meter to test electronic components.
- Use of bread board and circuit lay outs.
- Reading Schematic Diagrams and circuit lay outs.
- To make Simple electronic circuits and study its function.
- To make a simple power supply.
- To make an audio amplifier.
- To study and verify the truth table of different logic gates using digital IC.
- To study different type of transformer and there operation.
- To use circuit simulation software such as Proteus and compare it with practical circuit made on bread board.
- Use of logic tester to trouble shoot a digital circuit..
- To make an SCR Phase control circuit and study waveforms.
- To practice soldering and de-soldering on a PCB based project.
- Measurement of voltage and frequency with Oscilloscope

Recommended Books:

1. Electronic Circuits: Fundamentals and applications by Mike Tooley.

2. Complete Electronics Self-Teaching Guide with Projects by Earl Boysen and Harry Kybet
3. Electronics Projects For Dummies by Earl Boysen and Nancy C. Muir
4. All New Electronics Self-Teaching Guide (Self-Teaching Guides) by Harry Kybett and Earl Boysen

ELT-124 ELECTRICAL CIRCUIT ANALYSIS

Objectives: On completion of this course the students will be able to:

- Understand the concepts of Electrical Circuits with AC & DC sources.
- Discuss various concepts of Laws & Theorems used in Electricity & Electronics.
- Draw the equivalent circuits and circuit models.
- Apply and understand the Resistive, Capacitive and Inductive circuits in series and in parallel combinations.
- Determine the steady state and transient analysis of the circuits.
- Explain the exponential, sinusoidal excitations and their responses.
- Analyze the entire circuit before practical implementation of the network.
- Confidently analyze and build simple electric circuits.
- Identify circuit elements and variables.
- Learn different Techniques of Circuit Analysis.

Course Outline:

Introduction to Network Analysis. Importance of Network Analysis in Electrical & Electronics Technology. Laws & Theorems used in Electricity. Ohm's law, Kirchhoff's Laws. Definitions of Branch, Loop, Node, Mesh. Types of Sources. Current Sources and Voltage sources. Dependent and independent sources. Writing linearly independent (KCL and KVL) equations. Elementary network topologies. Nodal and Mesh analysis by systematic application of KVL and KCL. Series and parallel connections of two terminal circuit elements, Resistive, Capacitive and Inductive circuits. Elementary Transient Response of the Circuits. Differential and Integral forms of circuit equations, First-order circuits, Solution of single first order differential equations, second-order circuits, Exponential excitation and transformed networks, Representation of excitations by exponential functions, Driving point impedance and admittance, network theorems, Linear and non-linear networks, Superposition theorem, Maximum power transfer theorem, Thevenin's theorem, Norton's theorem, T-equivalent networks and other passive circuits. Modern approach to analyze the circuits using CAE (COMPUTER AIDED EDUCATION) Software Packages.

Lab Outline:

1. To study the Resistive Circuits Response excited by AC & DC Sources.
2. To Study the Capacitive Circuits Response excited by AC & DC Sources.
3. To study the Inductive Circuits Response excited by AC & DC Sources.
4. To study the RC Circuits Response excited by AC & DC Sources.
5. To study the RL Circuit Response excited by AC & DC sources.
6. To study the LC Circuit Response excited by AC & DC Sources.
7. To study the RLC Circuit Response excited by AC & DC Sources.
8. To study the Transient Response of RC Circuit.
9. To apply Different Theorems (Superposition, Norton, Thevenin's, Max Power Transfer etc) on passive Circuits.
10. To Apply KVL & KCL to analyze the electrical network.
11. To introduce circuit simulation in electrical network analysis.
12. To work on popular CAE Software (Electronic Work Bench, Multisim, PSICE).

Recommended Books:

1. Engineering Circuit Analysis , 7th Edition, by William H. Hayt , Jack Kemmerly , Steve M. Durbin
2. Introductory Circuit Analysis , 12th Edition, By Robert L. Boylestad.
3. Schaum's Outline of Basic Circuit Analysis, 2nd Edition, by John O'Malley.
4. Laboratory Manual for Introductory Circuit Analysis, 12th Edition, By Robert L. Boylestad, Gabriel Kousourou.
5. Desoor and K., "Basic Circuit Theory",. 6. Fitzgerald G. and Higgan botham, "Basic Electrical Engineering" McGraw-Hill

2nd Semester

ELH-122	**PAKISTAN STUDIES**	**(Annexure-F)**
ELS-143	**APPLIED MATHEMATICS –II**	**(Annexure-E)**

ELT-134 ELECTRICAL TECHNOLOGY – I

Objectives: On completion of this course the students will be able to:

1. Understand the concepts of fundamental electrical quantities, Electromagnetism and Electrostatics.
2. Apply and understand the electric and magnetic circuits.
3. Describe the relationship between the line and phase voltage, relationship between line and phase current in three phase circuits of star and delta connections.
4. Explain the construction, working & applications of electrical machines.

5. Familiarization of electric welding and its types and applications.

Course Outline:

D.C Fundamentals: Current, voltage, resistance, Ohm`s law, series and parallel circuits, effect of temperature on resistance, resistivity, work, power, energy, inductance, magnetic circuits, Faraday's laws of electromagnetic induction, Fleming's right hand rule, Lenz's law, production of electromotive force (e.m.f), dynamically and statically induced e.m.f's, self-induced e.m.f and mutual induction, capacitors, capacitance, capacitance in series & parallel circuits, types, charging and discharging of capacitors.

A.C Fundamentals: Generation of alternating current and voltage, equations of alternating current and voltage, wave form, cycle, time period, frequency, amplitude, phase, phase difference, root mean square (RMS) value, average value, form factor, R, L & C circuits, RLC series and parallel circuits, power factor, generation of poly phase voltage, phase sequence, Star and Delta connections, voltage and current in star and delta connections, power factor improvement.

D.C Generator: Constructional details, principle of operation, types, performance characteristics and applications.

D.C Motor: Motor principle, voltage equation, back e.m.f, production of torque, types, characteristics, applications, methods of speed control.

D.C Servomotor: Principle of operation, characteristics and applications.

Induction Motor: Single – phase induction motor, types, characteristics and applications, three – phase induction motor, constructional details, production of torque, speed control.

Single-phase Motor: Types, capacitors start and run motor, repulsion motor, universal motor, shaded – pole motor, A.C series motor.

Transformer: Constructional details, principle of operation, e.m.f equation, phasor diagrams on no-load/on-load, equivalent circuit, regulation, losses and efficiency; methods of cooling, O.C and S.C tests, auto transformers, instrument transformers, three- phase transformers.

Alternator: Constructional details, e.m.f equation, phasor diagram on load, concept of regulation.

Synchronous Motor: Principle of operation, vector diagrams, effect of load excitation, maximum output, method of starting.

Electric Heating: Resistance furnaces and ovens, methods of temperature control, electric arc furnaces and induction furnace, high frequency heating, induction and dielectric heating, applications.

Lab Outline:

1. Determination of Ohm's law.
2. Calculation & determination of RMS, average and peak values of periodic wave forms using oscilloscope.

3. Draw and study phasor diagrams of RL, RC & RLC series/ parallel circuits.
4. Study of star and delta connections.
5. Determination of relationship between line voltage and phase voltage/ line current and phase current in the three- phase star and delta connections.
6. Improvement of power factor by using static capacitors in a given load.
7. Study the constructional features of D.C machines.
8. Determinations of load test on D.C shunt/compound generators.
9. Determination of open circuit characteristics of D.C generator.
10. Study of constant losses of D.C shunt motor by no – load test.
11. Calculation of speed/torque characteristics of D.C motors.
12. Study and connections of servo motors.
13. Study of load test on single phase induction motor.
14. Starting and speed control of single phase, three phase squirrel cage and wound rotor motors.
15. Study and connections of single – phase shaded - pole and repulsion motors.
16. Speed control by supply voltage of universal motor.
17. Study of load test on single- phase transformer.
18. Determination of polarity of a single – phase transformer.
19. Determination of efficiency of a single – phase transformer.
20. Determination of open circuit and short circuit tests on single phase transformer.
21. Study and connection of a three - phase transformer.
22. Study the effect of field excitation on generation of voltage by an alternator.
23. Determination of regulation of three – phase alternator by direct loading.
24. Study the behavior of synchronous motor on the change of excitation.
25. Starting and running of synchronous machines as synchronous motor.

Recommended Books:

1. B.L.Theraja, A.K.Theraja - A text book of Electrical Technology, Vol. 2, S. Chand & Co.
2. Edward-Hughes- Electrical Technology.
3. Mehta V.K- Principles of Electrical Engineering and Electronics, S.Chand & Co.
4. Partab - Art and Science of Utilization of Electric Energy: Dhanpath Rai & Sons.

ELT-144 DIGITAL LOGIC TECHNOLOGY

Objectives: The in objective of the course is to provide students:

1. Basic understanding of the Digital Electronics (Digital systems and circuits).
2. Foundation for future studies in microprocessors and microcomputer interfacing.

Course Outline: Number systems & Codes ; Binary, Octal, Hexadecimal number systems and their inter-conversion; Binary Arithmetic (Addition, Subtraction, Multiplication and Division); Error detection and correction; Boolean Algebra, basic theorems and properties of Boolean Algebra, Boolean functions, Canonical and Standard forms; Digital Logic Gates; Various logic families, like TTL and CMOS, working and their characteristics; Combinational Logic Design ; The K-map method, two, three, four and five variable maps ; Sum of products and Product of Sums simplification, NAND and NOR implementation; Ex-OR and EX-NOR functions; MSI circuits: Binary adder and sub tractor, comparators, decoders, BCD-to-Seven segment decoder/drivers, seven-segment displays, encoders, code converters, multiplexers, de-multiplexers; Introduction to Sequential logic, S-R Flip-flops, JK flip-flop, D flip-flop, T flip-flop, master slave flip-flops; Classification of sequential circuits, registers, A to D and D to A converter circuits, Counters; Semiconductor memories, introduction, memory organization, classification and characteristics of memories.

Lab Outline:

1. Verification of truth tables of logic gates
2. TTL & CMOS characteristics
3. Logic family interconnection (TTL to CMOS & to TL)
4. Arithmetic circuits
5. Half adder
6. Full adder
7. Adder/subtractor
8. Combinational logic design using decoders
9. Encoders
10. MUXs & DEMUXs
11. Comparators with gates and ICs
12. Code converters and parity circuits using basic gates
13. BCD to Decimal
14. BCD to 7 segment decoder
15. Flip flop circuits (RS latch, D, JK and Master Slave) using basic gates and ICs
16. Design and verify the operation of shift registers and counters using flip flops and ICs

Recommended Books:

1. Morris Mano, “Digital Design”, Prentice Hall, Latest Edition.
2. R. J. Tocci , N. Widmer, G. Moss, “Digital Systems: Principles and Applications”, Pearson Education, 2013
3. S. Jayant, K. Ahmad, N. Ahmad, “Digital Logic Design: Its Application in Communication and Technology”, Global Vision Publishing House, 2012
4. T. L. Floyd, “Digital Fundamentals”, 11th Edition, Prentice Hall 2014

ELS-153 COMPUTER PROGRAMMING

Objectives: The main objective of the course is to

- Familiarize students with computer processing:
- Compile variety of programs in text as well as graphic user interface computer language.
- Improve programming skills.

Course Outline:

Basics of C++ programming: constants and variables, keywords, identifiers, data types, variables and their types, Escape sequence, operators and statements.

Decision and control: if statements, if-else-if statement, switch statement, for loop, while loop, do-while loop, nested loops, break statement,

Functions: defining a function, types function, return statement, default argument, local and global variables, standard function and user defined functions, multifunction, arguments pass as reference or as a value.

Arrays: declaration, initialization, arrays and function, multidimensional arrays.

Structures: declaration, initialization, functions and structures, arrays of structure, nested structure, enumerations.

Classes: declaration, initialization, constructors, destructors, inline member function, static class member, friend function, defining and accessing object, arrays of class object, structure and classes, nested classes.

Inheritance: single inheritance, types of base classes, types of derivation, multiple inheritance containers.

Overloading: function, operator, binary and unary

Polymorphism: early and late binding, virtual functions, pure virtual function abstract base classes, virtual destructors, virtual base classes, constructor and destructor under inheritance.

Lab Outline:

1. Study the integrated development environment for C++ language
2. Basic structure of C++ program

3. Programming experiment in C++ programming
4. Experiments in C++ to cover operators.
5. Functions, arrays and strings, control and decision, structures, classes, inheritance and polymorphism.

Recommended Books:

1. Lafore R. “Object-Oriented programming in C++” practice Hall latest edition.
2. Schildt. H. “C++ the complete Reference”, McGraw-Hill Latest Edition.
3. Deital D. “C++ how to program”, prentice Hall, Latest Edition

ELT-151 PCB DESIGN AND FABRICATION WORKSHOP

Objectives: The course is aimed at:

- To make familiar with PCB design and various processes involved.
- To provide in-depth core knowledge in design, performance analysis and fabrication of Printed Circuit Boards.
- To provide the knowledge in PCB fabrication process and factors affecting PCB performance

Course Outline:

Introduction to PCB technology, Understanding schematics and symbols PCB Fabrication techniques-single, double sided and multiplayer PCB, Etching, chemical principles and mechanisms, Post operations- stripping, black oxide coating and solder masking, PCB component assembly processes, Specification and Manual routing, Component-placing, Artwork generation Methods - manual and CAD , General design factor for digital and analog circuits Layout and Artwork making for SS, DS and ML Boards Design for manufacturability Specification design standards. Specifying Parts, Packages and Pin Names, The Part list, The Net list, Making Net list Files, Placing Parts, Routing Traces, Adding Text, Plot and Drill Files, PCB Layout, Layer List and Selection Mask, Panning and Zooming, Projects, PCB Elements Board Outline; Parts-Anatomy of a Part, Part list, Editing Parts, Reference Designator; Mounting Holes; Nets, Ratlines and Routing; Nets- Net list; Ratlines; Modifying Traces, Swapping Pins, Importing Netlist; Copper Areas; Text; Solder Mask Cutouts; Groups, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, Polylines, Schematic Diagram, Creating the Project, Importing the Netlist File, Drawing the Board Outline, Adding Mounting Holes, Placing Parts, Adding Parts and Editing Nets, Adding Copper Areas, Routing, Nets, Ratlines and Routings, Adding Text, Checking Design Rules, Making Gerber and Drill Files, Fabrication Process and Methodology.

Lab Outline:

1. To identify the various electronic components & form factor.
2. To use bread board for testing & verifying a sample circuit.
3. To draw & read schematic of a sample project.
4. To make a handmade single side PCB.
5. To use some CAD PCB making software, such as EAGLE.
6. To transfer the design on copper laminated sheet by different methods.
7. To make a setup for etching process of a finished PCB Design.
8. To understand masking, labeling, polishing PCB Design.
9. To use automated and manual drilling of PCB board.
10. To use soldering & de-soldering to complete a project.

Recommended Books:

1. Make Your Own PCBs with EAGLE by by Simon Monk
2. Build Your Own Printed Circuit Board by by Al Gibson
3. Designing Circuit Boards with Eagle by Matthew Scarpino
4. Complete PCB Design Using ORCAD Capture and PCB Editor by Kraig Mitzner.

3rd Semester

ELT-214 ELECTRICAL TECHNOLOGY – II

Objectives: On completion of this course the students will be able to: Understand the concepts of Electromagnetism and Electrostatics; Apply and understand the Inductance in simple DC Circuits; Explain the two and three-phase circuits; Describe the relationship between the line and phase voltage, relationship between line and phase current in three phase circuits of star and delta connections.

Course Outline:

Magnetic Circuits and Transformers; Self-Induction, Mutual Induction, Constructional details, principles of operation of emf equation-phasor diagram on load, equivalent circuit, regulation, losses and efficiency; methods of cooling, OC and SC test determination of equivalent circuit; Autotransformers,

DC Generators; Constructional details, principle of operation, performance characteristics and applications;

DC Motors; Production of torque, shunt, series and compound motors, performance characteristics, applications, and methods of speed control;

DC Servomotors; Principle of operation, characteristics and application,

Stepper motors

Fundamentals of Induction Motors

Single phase induction motor: types, characteristics and applications; Three phase induction motor, constructional details, production of torque, **Starters** Star delta and rotor resistance types; Methods of speed control, stator voltage, V/f control; Losses and efficiency; No load and blocked rotor tests;

Alternator& Synchronization

Constructional details, emf equation, phasor diagram on load, concept of regulation; Synchronous motor;

Power Distribution

Power Factor, Power Dissipation, Calculation and Control, Measurements of power and energy in single and three phase system;

Lab Outline:

1. Load test on single phase Transformer
2. Open circuit and Short circuit Test on Single phase transformer
3. Load test on step-up/step-down transformer
4. Speed Control of DC Shunt motor.
5. Open circuit characteristics of DC generator
6. Synchronization and parallel operation of Alternators
7. Load Test on single phase Induction motor
8. Study of stepper and servomotors.
9. To study various type of meters.
10. Measurement of power by 3 voltmeter / 3 ammeter method.
11. Measurement of power in a 3 phase system by two watt meter method.

Recommended Books:

1. Basic Electrical Engineering (2nd Edition): Kothari &Nagarath, TMH
2. Electrical Technology (Vol-I): B.L Theraja& A K Theraja, S.Chand
3. Electrical Engineering Fundamentals: Deltoro, PHI
4. Network Analysis: Valkenburg, PHI

ELT-224 ELECTRONIC DEVICES & TECHNOLOGY

Objectives: After completing this course, the students will be able to understand about:

1. The importance of insulators.
2. To differentiate the conductor and insulator.
3. Working of semi-conductor diode and types of diodes.
4. The commonly used semiconductors and formation of PN Junction.
5. Half wave and full wave rectifier.
6. Construction, working, applications and characteristics of transistors.
7. Construction working and application of field effect transistors (FET's).
8. Working and characteristics of MOSFET.

Course Outline:

Charged Particles, Field Intensity, Potential, Energy, Mobility and conductivity, Intrinsic and Extrinsic semiconductors, Electrons and Holes, Electrical Properties of Ge & Si, Thermocouples, PN Junction as a Rectifiers, Volt Ampere characteristics, Diode Resistance, Breakdown Diode, Junction Diode Switching Timing, Sehottky, zener diode, photodiode, light emitting diode (LED's), varactor diode and tunnel diode, junction Transistor, Transistor current components, Transistor as an Amplifier, Common Base, common collector and common Emitter configuration, CE cut off currents. The CE saturation Region, Integrated circuit Technology, Basic Monolithic Technology, Masking and Etching, Diffusion of Impurities, Transition for Monolithic circuits, Metal Semiconductor contact, Digital operation of a system, OR gate, And Gate, NOT Gate, Exclusive OR Gate, Diode-Transistor Logic (DTL) Gates, Transistor Logic (TTL)Gates, Emitter coupled Logic (ECL), High speed logic, Junction Field effect Transistor, Fabrication of JFET, Metal oxide semiconductor Field effect transistor (MOSFET), MOSFET Inverter, Dynamic MOS Shift Register, RAM, ROM, EPROM, PLD's, Charged Couple devices(CCD), Diode Circuits applications, Half wave, full wave and Bridge rectifier circuits, Capacitor Filters.

Lab Outlines:

1. Characteristics of PN junction Diode
2. Rectifiers-half wave
3. full wave rectification
4. Bridge with and without filter- ripple factor and regulation
5. Clipping and clamping circuits
6. Characteristics of Transistors (CE , CB & CC)
7. Characteristics of FETs & MOSFETs
8. RC Coupled (CE) amplifier using transistors -frequency response characteristics
9. FET amplifier (CS) - frequency response characteristics.

Recommended Books:

1. Microelectronics b Mill-man
2. Floyd
3. Boylsted

ELH- 213 COMMUNICATION SKILLS (Annexure – B)

ELT-233 MICROPROCESSORS

Objective: The main objective of the course is to teach students:

1. Simplified architecture & Programming Model of 8085, 8600 and 8086 microprocessors and their organization.

2. Hardware Issues such as Power supply, Clock Oscillators, Fan-out. Fan-in , etc.
3. Various Programming Languages to Program Microprocessor.
4. Assembly language and high level language such as C language.
5. Study Hardware & Software Interrupts.
6. Interfacing the microprocessor to the Real Analog world.

Course Outline:

Introduction to microprocessors, microprocessor architecture and programming techniques; structure of 8080/8085 Microprocessors and their organization, pin configuration and their functions, data sheet description, hardware and software interrupts, maskable and non maskable interrupts, 8085 instruction set, programming techniques, addressing modes, Memory Organization & Address Decoding, . Addressing Modes, structure of MC 6800/MC6809 microprocessor and its organization, pin diagram and functions, the 6800 instruction set, programming techniques; interfacing, interfacing with ROM & RAM, interfacing with practical I/O ports (serial and parallel); 8255A programmable Peripheral interface, Serial Communication Interface, Intel Microprocessor used in Personal Computers,, PC Mother board Architecture, single board computers, real world applications.

Lab Outline:

1. Familiarization of 8085 trainer development board hardware.
2. Introduction to Assembly language.
3. Use of Assembler and manual assembling a code.
4. Entering a code on a Microprocessor Development board & Debugging.
5. Study of Microprocessor Internal Registers and Intel Hex file format, Computer aided assembly language program.
6. Use of assembler, linker and simulator.
7. Use of Cross Assembler.
8. To make a Program to Add/Subtract two 8 Bit Numbers.
9. To make a Program to Add/Subtract two 16 Bit Numbers.
10. To make a Program to Multiply /Divide Numbers.
11. To make a Program to read interrupts and dealing ISR.
12. Programming using DMA.
13. Programming examples using PPI.
14. Serial EEPROM, Interface an LED array and 7-segment display through 8255 and display a specified bit pattern/character.
15. Real world interfacing with Sensors.
16. Analog to Digital & Digital to Analog Interfacing.
17. To understand Memory Organization.
18. Use of Logic Analyzer & Oscilloscope to visualize timing diagrams.
19. Use of tools to trouble shoot Microprocessor based boards.

20. Interface the given microprocessor kit to a personal computer through R.S-232C.

Recommended Books:

1. Tokheim R., “Microprocessor Fundamentals”, Schuam’s Series.
2. Dotty T.L., “Fundamental Principles of Microcomputer Architecture”
3. Bishop R., “Basic Microprocessors and the 6800” ZAKS R., “Microprocessor from Chips to System”, SYBEX Inc.
4. The Intel Microprocessors, 8th Edition, By Barry B. Brey.
5. Microprocessors and Interfacing, 2nd Edition, By Douglas V. Hall.
6. Microprocessors and Microcomputers, 5th Edition, By Ronald J. Tocci.

ELT-244 INSTRUMENTATION & MEASUREMENT

Objectives: The main objective of the course is to make students familiar with fundamentals of measurements and instruments, their calibrations and error compensation methods.

Course Outline:

Introduction to electrical measurements – Classification of analog instruments – Galvanometers – vibration, tangent and d'Arsonval type. Principle of operation, construction, sources of errors and compensations in PMMC – Moving iron – Dynamometer and induction type instruments. Extension of ranges and calibration of ammeters & voltmeters.

Power measurement – Voltmeter ammeter method, Electrodynamics wattmeter – Theory, errors and compensation methods – Low power factor wattmeter – Power measurement in poly-phase systems-Energy measurement – Single phase and poly phase induction type energy meter – theory and adjustments –DC energy meter – Testing of energy meters – Calibration of wattmeter and energy meter.

Low Resistance: Kelvin's double bridge and Ductor Ohmmeter method – Medium Resistance: Voltmeter Ammeter method – Substitution method – Wheatstone bridge method v High Resistance: Meager– Direct deflection method – Megohm bridge method – Earth resistance measurement. Introduction to A.C. bridges, Sources and Detectors in A.C. bridges. Maxwell’s bridge – Hay's bridge, and Anderson's bridge. Measurement of Mutual Inductance: Heaviside M.I. bridge – Measurement of Capacitance: Schering's bridge – De- Sauty's bridge Measurement of frequency using Wien's bridge. CRO – General purpose and advanced type – Sampling and storage scopes – Signal and function generators – Noise generators – Pulse and square wave generator –Sweep generator, Signal recorders – X-Y recorder – Magnetic tape recorders – Digital recording and data loggers – Basic wave analyzer – Frequency selective and heterodyne spectrum analyzer .

Recommended Books:

1. A Course in Electrical and Electronics Measurements and Instrumentation Sawhney A.K
2. Electrical Measurements and Measuring Instruments Golding. E. W, and Widdis F.C,
3. Electronic Instrumentation Kalsi.H.S
4. Modern Electronic Instrumentation and Measurement Technique Copper. W.D and Hlefrick. A.D

4th Semester

ELH-223 TECHNICAL REPORT WRITING (Annexure- J)

ELT-254 COMMUNICATIONS SYSTEMS AND TECHNIQUES

Objective: The main objective of the course is to teach students the basics of communication systems like modulation both in analog and digital domain, baseband and pass band communication, error probability and some basic concepts related to information theory.

Course Outline:

Introduction to communications systems, random signals and stochastic process, components, signals and channels, sampling, quantization, pulse amplitude modulation (PAM), pulse code modulation (PCM), quantization noise, time division multiplexing, delta modulation. Digital communications: baseband signals, digital PAM, eye diagram, equalization, correlative coding, error probabilities in baseband digital transmission, band pass transmission, digital amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK) and quadrature shift keying (QPSK), error probabilities in band pass digital transmission, a case study of digital communication systems. Introduction to information theory: fundamental limits in communications, channel capacity and channel coding, signal compression.

Recommended Books:

1. Communication Systems Simon Haykin and Michael Moher
2. An Introduction to Digital Communications Kurzweil Communication Systems
3. Communication Systems Engineering Proakis and Salehi Title: Communication Systems
4. Modern Digital and Analog Communication Systems B. P. Lathi

ELT-263 CONTROL TECHNOLOGY

Objective: The main objective of the course is to make students understand the basic concepts in control systems, like transfer functions,

systems' stability, gain and phase margins, root locus, observers and compensators.

Course Outline:
Modeling of physical systems using state space, differential equations, and transfer functions, dynamic response of linear time invariant systems and the role of system poles and zeros on it, simplification of complex systems, stability of feedback systems and their steady state performance, Routh-Hurwitz stability criterion, sketching of root locus and controller design using the root locus, Proportional, integral and derivative control, lead and lag compensators, frequency response techniques, Nyquist stability criterion, gain and phase margins, compensator design in the frequency domain, state space design for single input single-output systems, pole placement state variable feedback control and observer design.

Recommended Books:
1. Control Systems Engineering Norman S. Nise
2. Automatic Control Systems Benjamin C. Kuo
3. Modern Control Engineering Katsuhiko Ogata

ELT-272 ELECTROMAGNETIC FIELD THEORY

Objective:
After completion of this course the students should be able to:
1- Know and understand the basics of e.m.f theory.
2- To differentiate the various types of Electromagnetic waves and their characteristics.

Course Outline:
Introduction; review of vector analysis, scalar & vector products, gradient, divergent and curl of a vector and their physical explanation; transformation amongst rectangular, cylindrical and spherical co-ordinate system; Electrostatics: coulomb's law, electric field intensity from point charges, field due to continuous distribution of charges, gauss's law, Laplace's and poison's equations; Magneto statics:, magnetic field intensity and magneto motive force, ampere's circuital law, energy stored, Biot-savart law, vector potential, magnetic dipole; Maxwell's equations and their interpretations, boundary conditions; wave equations, sinusoidal time varying fields, uniform plane wave in dielectric and conductor media, skin effect and depth of penetration, reflection and refraction of plane waves at boundaries for normal and oblique incidence surface impedance; pointing theorem; transmission lines, Transmission line theory from the circuit concept, properties; constants; transmission line equations; standing wave ratio; impedance matching, Smith chart.

Recommended Books:

1. Electromagnetic waves & radio system by Jorden R.F.
2. Principle and applications of Electromagnetic fields by Ptonsey R and Collin R.P
3. Applied Electromagnetic by Planus M.A.

ELT-283 AMPLIFIERS AND OSCILLATORS

Objectives: After the study of this course students will be able to:

1. Design the small modules that include amplifier at input and output side with load
2. Use Feedback circuits to stabilize gain, improve impedances; reduce noise & distortion, bandwidth increment etc.
3. Use oscillator circuits different applications

Course Outline

The operating Point of BJT, Emitter Bias, Stabilization against ICO, Approximate Signal BJT Model, Transistor Trans conductance, Linear Analysis of a Transistor circuit, common Emitter (CE), and common Base Amplifier, Comparison of BJT Amplifier configuration, Accurate Small Signal BJT Model, The JFET or MOSFET Small Signal Model, Classification of Amplifiers, Feed Back concept, Negative Feed Back Amplifiers, Input and output Impedance, Voltage series Feed Back, Current Series Feed Back, Current Shunt and voltage Shunt Feed Back, Frequency Distortion, RC coupled Amplifier, The Hybrid Parameters Transistor Model at high Frequency, CE short circuit current Gain, Generalized voltage Gain Function, Multistage CE Amplifier at High Frequencies, common source Amplifier at High Frequencies, Common Drain Amplifier at High Frequencies, Effect of feed Back on Amplifier Bandwidth, Double Pole and three pole Transfer Function with Feedback, Voltage Shunt and Current Series Feed Back Amplifiers, Current Shunt and voltage Feed Back Pair, Stability.

Lab Outline:

1. Single stage BJET/FET amplifier.
2. 2 stage RC coupled amplifier – Frequency response
3. Cascade amplifier – Frequency response
4. Power amplifiers (Transformer less) – Class B and Class AB.
5. Measurement of Power
6. Tuned amplifiers – frequency response
7. Feedback amplifiers (current series, voltage series) – Gain and frequency response
8. Phase shift oscillator using BJT/FET, Hartley/Colpitts oscillator using BJT/FET, Crystal oscillator.

   Text Book: Microelectronics by Millman Floyd Boylested

Recommended Books

1. Cirovic M.M “Basic Electronics Devices, circuit and Systems” Prentice-Hall
2. Hayt and Neudeck, “Electronic Circuit Anaalysis and Design” Houghton Miffin Co ,Boston

ELT-293 POWER ELECTRONICS

Objective: The main objective of the course is to give students familiarization of power electronics circuits and their applications.

Course Outline:

Introduction to power electronic converters and systems; applications of power electronic converters; power semiconductor devices; uncontrolled rectifiers: single- and three-phase; non-isolated dc-dc converters: buck, boost and buck-boost; isolated dc-dc converters; single- and three-phase; uninterruptible power supplies; battery chargers and renewable energy systems; electric and hybrid electric vehicles technologies, design of converters and systems, single phase voltage source invertors, three phase voltage source invertors, current source invertors, closed loop operation of invertors , AC/AC voltage controllers, Cyclo converters, Matrix Converter.

Recommended Books:

1. Power Electronics: Converters, Applications and Design N Mohan, T M Undeland and W P Robbins
2. Power Electronics Handbook Muhammad H. Rashid
3. Introduction to Modern Power Electronics AM Trzynadlowski
4. Modern DC-to-DC Switch mode Power Converter Circuits R P Severns and G E Bloom
5. Practical Design of Power Supplies R Lenk
6. Solid-State Power Conversion Handbook R E Tarter

5th Semester

ELT-314 INDUSTRIAL DRIVES

Objective: The main objective of the course is to make students understand the functionality and requirement of the industrial drives.

Course Outline:

Electric Drives and their Classification, Requirements of Electric Drives, Power electronics improvements, DC Motor Speed and Position Control,

Inverter – Current Hysteresis Controlled PWM, Induction Motor Drives, d-q Model of Induction Motors, Power Semiconductor Devices, DC Motor Drives including conventional, Modeling of DC Machines, brushless and modern PM motors, AC Motor Drives including Induction Motor Drives and Synchronous Motors Drives, Servo Drives, Stepper Motor Drives, Reluctance Motor Drives, Vector and Direct Torque Controlled Drives, Vector Control Model and Structure, Artificial Intelligence Based Drives, Fuzzy Logic in Electric Drives, Simulation of Motor Drives.

Recommended Books:

1. Fundamentals of Industrial Drives B. N. Sarkar
2. Modern Power Electronics and AC Drives Bimal K. Bose
3. Electric Motor Drives, Modeling, Analysis and Control R. Krishnan
4. Electric Machines and Drives - A First Course N. Mohan
5. Power Electronics Handbook Muhammad H. Rashid

ELT-324 VLSI TECHNOLOGY

Objective:

This course covers in detail the technology that is behind VLSI circuits. The course starts with an introduction to integrated circuit technology and then covers device modelling in detail. Basic gate circuits using MOS technology are thoroughly discussed. The course also gives an overview of ultra-fast VLSI circuits and systems.

Course Outline:

1. Review of Integrated Circuits. Basic terminologies, size and complexities, overview of IC design process, economics, yield, trends in VLSI design.
2. Integrated Circuit Technology. IC production process, semiconductor processes, design rules and process parameters, layout techniques and practical considerations.
3. Device Modelling. Small signal model, MOS model, diode model, BJT model, passive component models (monolithic capacitors and resistors).
4. Introduction to MOS Technology. MOS technology, basic MOS transistors, NMOS and PMOS enhancement and depletion mode transistors, nMOS fabrication, CMOS fabrication, thermal aspect of processing, BiMOS technology, basic electrical properties of MOS and BiMOS.
5. Integrated Circuit Parameters. Sheet resistance, area capacitance of layers, inverter delays, propagation delays, wiring capacitances.
6. Overview of Utra-Fast VLSI Circuits and Systems. Submicron CMOS technology, Gallium Arsenide (GaAs) VLSI technology,

Gallium arsenide devices, Metal semiconductor FET (MESFET), GaAs MESFET classes of logic.

7. Overview of Utra-Fast VLSI Circuits and Systems. Submicron CMOS technology, Gallium Arsenide (GaAs) VLSI technology, Gallium arsenide devices, Metal semiconductor FET (MESFET), GaAs MESFET classes of logic.

Lab Outline:

1. Introduction to SPICE
2. Overview of Device Simulation using SPICE
3. Diode Modelling and Simulation
4. BJT Modelling and Simulation
5. BJT Noise Model
6. MOSFET Modelling and Simulation
7. Gate Realization using MOS devices
8. A Simple 4-bit ALU design and analysis
9. Mini Project

Recommended Books:

1. S.M. Kang & Y. Leblibici, "CMOS Digital Integrated Circuits-Analysis & Design", TMH, Ed. 2003.
2. B.G. Streetman & S. Banerjee, "Solid State Electronic Devices", PHI.
3. K. Eshraghian & Pucknell, "Introduction to VLSI", PHI.
4. B. Razavi, "Design of Analog CMOS Integrated Circuits", TMH.
5. N.H.E. Weste & K. Eshraghian, "Principles of CMOS VLSI Design: A System Perspective", McGraw Hill Pub.
6. Zainalabedin Navabi, "Verilog Computer-Based Training Course", First Edition, 2002 McGraw-Hill.

ELT-334 APPLIED ANTENNA AND WAVE PROPAGATION

Objective: The main aim of the course is to give students understanding of Radio Frequency concept, basic understanding of antenna elements and polarization.

Course Outline:

- Basic RF Concepts
- Review of fundamental RF Concepts
- Basic design and performance requirements of a wireless communication system
- Basic Antenna Concepts
- Definitions of basic antenna properties - impedance, VSWR, bandwidth, directivity, gain, radiation patterns, polarization, etc.
- types of Antennas

- Resonant antennas
- Traveling wave antennas
- Frequency Independent antennas
- Aperture antennas
- Phased arrays
- Electrically small antennas
- Circularly polarized antennas
- Classification of Antenna Types
- By frequency
- By size
- By directivity
- Fundamental Antenna Elements
- The monopole
- The dipole
- The loop
- The folded dipole
- The slot
- Micro strip Antennas
- Element types
- Micro strip element design
- Design trade-offs
- Designing and 802.11 micro strip patch
- Baluns
- Ground Plane Considerations
- horizontally polarized antennas
- Vertically polarized antennas
- The impact of the surrounding environment on antenna performance
- Circularly Polarized Antennas
- Achieving circular polarization
- The helix antenna
- The crossed dipole antenna
- The micro strip patch
- The quad rifilar helix
- Aperture Antennas
- Aperture design concepts
- The horn antenna
- The reflector antenna
- The corner reflector
- Impedance Matching
- Impedance matching networks
- Broadband Antennas

- Monopole configurations
- Feed considerations
- Dipole configurations
- Bandwidth improvement techniques
- Frequency Independent Antennas
- The log-periodic antenna
- The spiral antenna
- Electrically Small Antennas
- Impedance, bandwidth and quality factor of antennas
- Defining electrically small
- Fundamental performance limitations
- The small dipole
- The small loop
- Design and Optimization of small antennas
- Antenna Arrays
- Fundamental array theory
- Types of antenna arrays
- Feed network design considerations
- Beam steering and shaping concepts
- Performance trade-offs
- Microstrip patch arrays
- Dipole element arrays
- Friis and Link Budget
- The communication link
- Understanding and calculating path loss
- Receiver Sensitivity and antenna noise figure
- Link budget calculations
- Receive Properties of Antenna
- How does an antenna capture power
- Aperture area and efficiency
- Coupling between antennas
- Fractal Antennas
- Fractal antenna types
- Performance properties of fractal antennas
- RFID Antennas
- RFID system basics
- Performance properties of RFID antennas
- Ultra Wideband (UWB) Antennas
- Time domain considerations in antenna design
- Antenna performance requirements in UWB systems
- Low Profile Antennas
- The inverted L and inverted F antennas

- The planar inverted F antenna (PIFA)
- Device Integrated Antennas
- Antennas commonly used in wireless device applications
- Propagation Channel Considerations
- RF path loss
- Reflection, multipath and fading
- Noise and interference
- Polarization distortion
- Diversity implementation
- MIMO
- Types of Antennas used in Communications Systems
- Wireless base station antennas
- Wireless handset and portable device antennas
  GPS antennas
- HF, UHF and VHF communication antennas
- Earth station and satellite communication antennas
- Numerical Modeling of Antennas
- Software packages
- Comparison with measurements
- Antenna Design and Simulation Examples Using Commercial Antenna Design Software

Recommended Books:

1. John D. Krauss;Antennas for all applications 3rd edn TMH
2. K.D Prasad; Antenna & wave Propagation ,Satyaprakashan 2000 New Delhi
3. R.E Collin;Antenna & Radio wave propagation Mc -Graw-Hill
4. Terman; Electronics & Radio Engineering Mc-Graw-Hill
5. E.C Jordan & KG Balmain Electromagnetic waves & radiating system 2nd ed PHI

ELT-343 INDUSTRIAL ELECTRONICS APPLICATIONS

Objective: After completing this course the students will be familiar with the applications of the industrial electronics. They will understand different phenomenon, sensors to sense those and control of those phenomenon with actuators.

Course Outline:

Electric heating: Principles and applications; induction and dielectric heating; high-frequency welding. Spot welding control. Industrial control: Speed control of DC, AC, and servo motors. Process control. Measurement of non-electrical quantities: Temperature, displacement,

pressure, time, frequency; digital industrial measuring systems. Ultra sonic generation and applications. X-ray applications in industry.
Photo-electric devices. Industrial control using PLCs, Basics of PLC Programming, Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs, Program Control Instructions, Timers and Counters, Data acquisition, Distributed control system in process industries, SCADA Systems.

Recommended Books:

1. Programmable Logic Controllers Frank D. Petruzella
2. Industrial Electronics Frank D. Petruzella
3. Principles of Industrial Instrumentation Patranabis. D

ELT-353 RENEWABLE ENERGY TECHNOLOGY

Objectives:
On completion of this course the student will be able to:

- Describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
- Explain the technological basis for harnessing renewable energy sources.
- Recognize the effects that current energy systems based on fossil fuels have over the environment and the society.
- Describe the main components of different renewable energy systems.

Course outlines: Introduction to Renewable Energy: energy and society, types of renewable energy, advantages and disadvantages, energy and power, Pakistan and world energy consumption and demand, Environmental impact assessment and sustainability issues.
Solar Energy: introduction, sources and uses, solar thermal electricity, concentrating solar power, solar thermal Molten salt technology, Photovoltaic cell materials, Principle of photovoltaic, conversion of solar energy, V-I characteristics of solar Photovoltaic cell, types of solar cells and fabrication. Photo voltaic applications.
Wind Energy: introduction, wind resource, wind turbine and shear, wind speed monitoring, Betz limits, construction, types, conversion system, harvesting energy form wind, small and large wind system, storage of electricity, grid connection, characteristics and applications.
Biomass: biomass resources, feedstock collection, feedstock preprocessing and treatment methods, biomass conversion technologies, thermo-chemical platform, combustion technology, Gasification technology, pyrolysis technology, biodiesel technology, biomass into ethanol, waste to energy, recent advances and applications of bioenergy technology.

Hydropower: introduction, construction methods, turbines and their types, small and large hydroelectric power system, efficiency.
Wave and Tidal energy: introduction, water power, Wave power, tidal current energy, tidal Barrage method, principle of operation, tidal turbines and their types, Ocean Thermal Energy Conversion(OTEC), components of OTEC system
Geothermal energy: introduction, resource, types of geothermal resource, heat pumps, geothermal electricity, applications.

Lab Outline:
Study of thermal performance of solar water heater, solar dryers, solar PV cell characterization and its networking, solar cooker, solar still, Building dueling solar cells.
Study of thermal performance and efficiency of biomass downdraft gasifier and sampling and analysis of air and flue gas from biomass energy systems i.e. gasifier, combustor and cook stoves using gas chromatography technique. Biogas production by anaerobic digestion and analysis.

- Fuels: Density, Viscosity, Flash-point, Fire-point, ASTM (American society for testing and materials) distillation of liquid fuels.
- Power Plant Visit (At least one visit to Thermal/Hydro-electric/Nuclear/Wind Power Plant).

Recommended Books:

1. Renewable energy Fourth Edition by Bent Sirensen.
2. Fundamental of renewable energy process Third Edition by Aldo Vieira Da Rosa.
3. Renewable Energy Conversion, Transmission, and Storage By Bent Sorensen
4. Wave Energy Conversion By John Brooke
5. Alternative Energy Sources By Efstathios E. Stathis Michaelides

6th Semester

ELT-364 INDUSTRIAL AUTOMATION AND ROBOTICS

Objective:

- Learn about basic control theory and automation process in industry.
- Implementation of transducers, sensors and actuators in control mechanism.
- Generate interest amongst students in applying robotic tools to problems.
- Learn the basics of Transducers/Sensors, Actuators, Analyzers and Drives.

Course Outline:

Introduction to Electromechanical Engineering. Fundamentals of control system. Theory of Automation, introduction to automatic control systems, implementation of industrial control systems, Feedback and feed-forward systems, study of various analog sensors, types of sensors ,motion, position s, force, hydraulic, pneumatic, ultrasonic, proximity, infrared, temperature, humidity , light, radiation sensors. Non linearity of sensors. Analog-to-digital conversion of sensors output. computer controlled machines, computer interfacing, digital input/output processing, control of dc and ac motors, stepper motor control, servo motors control, position control friction, backlash and resilience machine tool control, remote position control; process control, pneumatic controllers, analog and digital electronic process controllers, hybrid systems; hydraulic control systems, hydraulic pumps and valves, actuators, PI Controllers, PD Controllers, PID Controllers, introduction to Robotics, requirement of a robot, types of Robot, Robot hard ware, Joint arrangements; Grippers and tools, encoders, motors and control, path control, kinematics, Robot sensors and vision systems, Color Recognition, Image processing involved in Robotics, Robot Mechanics, Robot control Electronics by Micro controllers, Arduino and various modules, Robot applications.

Lab Outline:

1. Introduction to Robot Basics & Anatomy of a Robot.
2. Use of proper Tools in making Robots.
3. Common Electronic Components, their Identification & testing.
4. To learn Electronic Construction Techniques (Prototyping & PCB)
5. Introduction to Programming Concepts.
6. Building a Robot Platform from different materials.
7. Use of batteries & solar panels to Power up the Motors and electronics.
8. Different Robot Locomotion Principles.
9. Working with DC Motors, Stepper Motors, Servo Motors, and Encoders.
10. Experimenting with Gripper Designs, Arm System,
11. Use of Computers and Microcontrollers Control system.
12. Use of Arduino , Raspberry Pi & other similar boards.
13. To build Remote Control Systems.
14. Experiments with Sensors and Navigation control.
15. How to make Collision Avoidance and Detection system.
16. To Study Mechanism of actuators.
17. To make Sound Output and Input systems.
18. Introduction to common PLCs used in industrial Automation.
19. To design and apply PID Controllers in automation.
20. To experiment with color recognition & image processing.

Recommended Books:

1. R.R. Hunter, "Automated process control systems", Prentice Hall Inc.
2. N.M. Morris, "Control Engineering", Mc-Graw-Hill.
3. Dr. Malcolm Jr., "Robotics and introduction", Breton Publishers.
4. W.E. Snyder, "Industrial Robots Computer Interface and Control, Prentice Hall Inc.
5. Robot Builder's Bonanza, 4th Edition, By Gordon McComb.
6. Robot Building for Beginners , 2nd Edition, By David Cook.
7. Practical Arduino Engineering By Harold Timmis

ELT-374 FPGA BASED SYSTEMS

Objective:

After completion of this course students should be able to:

1. Fully understand the fundamental of designing techniques.
2. Gain knowledge to design digital system.
3. Understand fully the Hardware Description Language (HDL)
4. Use HDL to design hardware components and systems
5. Gain sufficient knowledge to simplify a complex logic design using software tools.
6. Acquire sufficient knowledge and inner working of programmable logic devices.
8. Implement the designs and verify the complete system.

Course Outline:

1. Course organization and requirements, Overview of digital systems design, testing and verification.
2. Hardware Description Languages (HDL); Selection of HDL Language, Fundamentals of theLanguage, Design and Modeling Recommendations , Design Simulation, Synthesis of Designs
3. Design Implementation Technologies; Programmable Array Logic, Programmable Logic Array,Complex Programmable Logic Devices (CPLD), Field Programmable Gate Array (FPGA)Technologies
4. System Arithmetic Algorithms and Hardware Designs
5. Electronic Design Automation; Usage of CAD Tool , Programmable Device Design Flows
6. Physical Design Automation -- Systems; Partitioning; Placement; Routing
7. Clock Design Considerations -- Timing Margins, Clock Skew, Clock Distribution
8. Logic Circuit Testing and Testable Design; Design of a test bench , Digital Logic Circuit Testingand Test Vector Generation, Combinational and Sequential Logic Circuit Testing

9. System-on-chip (SOC) design and intellectual property (IP) cores
10. Digital Design Examples and Applications
11. Programmable Logic Devices : Introduction to SPLD, CPLD, FPGA

Lab Outline:

1. Introduction to Verilog HDL gate-level modeling
2. Data flow modeling, behavioral modeling; design
3. Simulation, synthesis and fitting of combinational circuits
4. Design and implementation of FSM and memory
5. Verilog simulation and hardware implementation of combinational circuits such as MUX/DEMUX, encoder/decoder, arithmetic logic unit (ALU)
6. Verilog simulation and hardware implementation of sequential circuits such as flip-flops, shift registers, counters
7. Realization of simple digital circuits using VHDL
8. Familiarization of FPGA trainer kits
9. Realizations of digital circuits using FPGA.

Recommended Books:

1. Wayne Wolf, "FPGA-Based System Design," with CD-ROM, 2004, Prentice Hall, ISBN: 0131424610.
2. Samir Palnitkar, "Verilog HDL", Prentice Hall, ISBN: 0130449113.
3. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL", Prentice Hall, ISBN: 0130891614.
4. Michael John Sebastian Smith, "Application-Specific Integrated Circuits", Addison Wesley, ISBN: 0201500221.

ELT-384 COMMUNICATION NETWORKS

Objective:

1. To provide students the basic understanding of the principles of network communication.
2. Understanding of the operation of the protocols that are used inside the Internet

Course Outline:

Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, The OSI Model, Analog and Digital Signals and their conversions, Transmission Media, Switching, Data link layer, Wired and Wireless Networks, Network Layer, Internet Protocol, Transport Layer and its Protocols, Application Layer Protocols.

Lab Outline:

1. Ethernet Cabling: straight cable and cross over cable
2. PC network TCP/IP configuration

3. Connecting two computers using cross over cable
4. Setting up a small Network
5. Network Emulators &simulators
6. Basic Switch Configuration
7. Basic Router Configurations

Recommended Books:

1. Behrouz A. Forouzan, "Data Communications and Networking, 5/e", MacGraw- Hill, 2013
2. Ata Elahi "Network Communications Technology", Latest Edition
3. J. Kurose and K. Ross, "Computer Networking: ATop-Down Approach", Peason / Addison Wesley, 6th Edition, 2014

ELM-313 PROJECT MANAGEMENT (Annexure - I)

ELT-393 PROJECT
ELT-3103

Objectives:

To develop the ability of exercising the problem analysis, design & its validation, prototype production on economical scale.

Course Outline: Project work is basically to complement Engineering Technology study. The student is in close consultation with department faculty will complete the project using Library, Computer or Laboratory facilities. It shall be considered as Engineering Technology Subject to a minimum of 06 Credit Hours work that entails the following activities in general:-

i. Detailed problem analysis
ii. Project timeline Schedule
iii. Literature Review
iv. Conceptual and actual Design
v. Design validation
vi. Material selection
vii. Manufacturing / Fabrication (Economical Prototype / Model production if required)
viii. Assembly, test & Trials and logging of results
ix. Report writing and presentation

Note:

The student(s) to undertake project during 6th semester and its following summer. Six credit hours academic work be undertaken as follows:-

- Three credit hours work during 6th Semester under the

guidance of departmental faculty. The work that entails supervised work entails problem analysis, timeline & Schedule, Literature Review, conceptual / Actual design, design validation and material selection.

- Three credit hours during summer where student(s) will work independently and may seek guidance from the concerned Faculty / Project Supervisor. The independent working of student(s) entails Manufacturing / Fabrication (Economical Prototype / Model production if required), Assembly, test & Trials and logging of results, Report writing and presentation.

7th Semester

ET-4116	**16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING**	**(Annexure - K)**

8th Semester

ET-4216	**16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING**	**(Annexure - K)**

BSc ELECTRICAL ENGINEERING TECHNOLOGY

1st Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	EH-112	Islamic Studies / Professional Ethics	Humanities	2	0	2	0
2	ES-113	Applied Mathematics-I	Natural Science/ Math	3	0	3	0
3	ES-123	Applied Physics	Natural Science /Physics	2	1	2	3
4	ET-114	Linear Circuits Analysis	Major based Breadth	2	1	2	3
5	ET-123	Engineering Drawing	Engineering Foundation	1	2	1	6
6	ES-133	Introduction to Computer Fundamentals	Computer Science	1	2	1	6
Total				**11**	**06**	**11**	**18**
Grand Total				**11+06=17**		**11+18=29**	

2nd Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	EH-123	Communication Skills	Humanities / English	3	0	3	0
2	EH-132	Pakistan Studies	Humanities	2	0	2	0
3	ET-134	Electronics	Major based Breadth	2	2	2	6
4	ET-143	Basic Mechanical Technology	Engineering Foundation	2	1	2	3
5	ES-143	Applied Mathematics – II	Natural Science / Math	3	0	3	0
6	ET-153	Electrical Machines – I	Major based Breadth	2	1	2	3
Total				**14**	**04**	**14**	**12**
Grand Total				**14+04=18**		**14+12=26**	

BSc ELECTRICAL ENGINEERING TECHNOLOGY

3rd Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ET-212	Power Generation Systems	Engineering Foundation	2	0	2	0
2	EH-213	Technical Report Writing	Humanities / English	3	0	3	0
3	ET-224	Electrical Instruments and Measurements	Major based Breadth	2	2	2	6
4	ET-234	Electrical Machines - II	Major based Depth	2	2	2	6
5	ET-244	Digital Electronics	Major based Breadth	2	2	2	6
Total				**11**	**06**	**11**	**18**
Grand Total				**11+06=17**		**11+18=29**	

4th Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ET-254	AC Circuits Analysis	Major based Depth	2	2	2	6
2	ET-262	Electro-Magnetic Fields	Major based Depth	2	0	2	0
3	ET-273	Electrical Power Transmission	Major based Depth	2	1	2	3
4	ET-283	Electrical Power Distribution and Utilization	Major based Depth	2	1	2	3
5	ET-294	Power Electronics	Major based Depth	2	2	2	6
Total				**10**	**06**	**10**	**18**
Grand Total				**10+06=16**		**10+18=28**	

BSc ELECTRICAL ENGINEERING TECHNOLOGY

5th Semester Third Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	ET-313	Micro-Processor Theory & Interfacing	Major based Depth	2	1	2	3
2	ET-323	Switch Gear & Protective Devices	Major based Depth	2	1	2	3
3	ET-334	Communications Technology	Major based Depth	2	2	2	6
4	ET-343	Control Technology	Major based Depth	2	1	2	3
5	EM-312	Total Quality Management	Management Science	2	0	2	0
6	ET-353	High Voltage Technology	Major based Depth	2	1	2	3
Total				**12**	**06**	**12**	**18**
Grand Total				**12+06=18**		**12+18=30**	

6th Semester Third Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	EM-323	Project Management	Management Science	3	0	3	0
2	ET-362	Power System Analysis	Major based Depth	2	0	2	0
3	ET-374	Data & Computer Communication	Major based Depth	2	2	2	6
4	ET-384	Industrial Drives & PLC	Major based Depth	2	2	2	6
5	ET-393	Project	Major based Depth	0	3	0	9
Total				**09**	**07**	**09**	**21**
Grand Total				**09+07=16**		**09+21=30**	

BSc ELECTRICAL ENGINEERING TECHNOLOGY

6th Semester Third Year Summer Project Work:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	ET-3103	Project (Continue)	0	03	0	09
Grand Total			**00+ 03 = 03**		**00 + 09 = 09**	

7th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	ET-4116	16 Weeks Supervised Industrial / Field Training (8x5=40Hrs / Week)	0	16	0	40x16 =640
Total			**00**	**16**	**0**	**640**
Grand Total			**00+ 16 = 16**		**00 + 640 = 640**	

8th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	ET-4216	16 Weeks Supervised Industrial / Field Training (8x5=40Hrs / Week)	0	16	0	40x16 =640
Total			**0**	**16**	**00**	**640**
Grand Total			**00+ 16 = 16**		**00+ 640 = 640**	

- *Complete guidelines for 32 weeks Continuous Supervised Industrial / Field Training are available in Annexure-K.*

Summary:

BSc Electrical Engineering Technology		
Semester	Credit Hours	
	Theory	Practical
1st	09	07
2nd	12	06
3rd	11	06
4th	12	06
5th	12	06
6th	09	07
6th Summer	00	03
7th	00	16
8th	00	16
Total	**65**	**73**
G. Total	**138**	

DETAILS OF COURSES (ELECTRICAL ENGG TECH)

1st Semester

EH-112	**ISLAMIC STUDIES / PROFESSIONAL ETHICS**	**(Annexure - A)**
ES-113	**APPLIED MATHEMATICS - I**	**(Annexure - D)**
ES-123	**APPLIED PHYSICS**	**(Annexure - C)**

ET-114 LINEAR CIRCUITS ANALYSIS

Objectives: To enable the students to analyze simple electric circuits with DC sources and learn basic circuit solving skills.

Course Outline:

ELECTRICAL ELEMENTS AND CIRCUITS: Resistance, inductance, and capacitance, laws of resistances, Ohm's law, Kirchhoff's laws, The R circuit, The L-circuit, The C-circuit PHASOR QUANTITIES: Phasors; representation of Phasors by „J" notation, Addition, Subtraction and Multiplication of Phasors. Complex expression for current, voltage, Power and impedances.

SERIES AND PARALLEL CIRCUITS: RL, RC and RLC Series circuits, Parallel circuits. Solution of simple RL, RC and RLC series and parallel circuits. Resonance in series and parallel RLC circuits.

DC NETWORK THEOREM: Mesh/Loop Analysis, Nodal analysis of resistive network with DC voltage sources and DC current sources, Conversion of sources, Ideal *Constant current sources and Ideal constant voltage sources, Network Theorems*- Superposition, Thevenin's, Norton, Reciprocity and Maximum Power Transfer Theorems with resistive Networks and DC Sources

Lab Outline:

1. Demonstration and verification of Ohm's Law
2. Demonstration and verification of Kirchhoff's Voltage Law.
3. Demonstration and verification of Kirchhoff's Current Law
4. Demonstration and verification of Superposition Theorem with Resistive Network and DC sources.
5. Demonstration and verification of Thevenin's Theorem with Resistive Network and DC sources
6. Demonstration and verification of Reciprocity Theorem with Resistive Network and DC sources
7. Draw Phasor diagrams and Impedance diagram for RL, RC and RLC Series Circuits.
8. Determination of Impedances of RL, RC and RLC Series Circuits

9. Determine Power Factor for inductive and capacitive loads
10. Demonstration of Series and Parallel resonance in R, L and C circuits.

Recommended Books:

1. AC Circuits by K Y Tang
2. Electrical Technology Vol-I by Theraja

ET-123 ENGINEERING DRAWING

Objectives:

To enable students to learn and develop engineering drawing skills.

Course Outline:

MECHANICAL DRAWING: Use of drafting instruments. Basic drafting techniques, drawing and lettering, dimensioning, projections and section of solids, Orthographic projections, Isometric views with particular reference to piping and ducting, Practice of assembly drawing. CIVIL DRAWING: Plan, Elevations (front, left and right) and details of buildings .Elements of perspective drawings.
ELECTRICAL DRAWING: Electrical safety drawings, Electric substation equipment layout, Schematic Diagrams of substations, lighting and power distribution boards in contrast with house and industrial wiring diagrams, Electrical Symbols and one line diagrams of a typical power system and its parts using all details.

Recommended Books:

1. Mitchel & Spencer, "Technical Drawing" (Latest Edition)
2. Choudhry, " Elements of Workshop Technology" (Volume –I)
3. Chapman, "Workshop technology" (Part-I, II, & III)

ES-133 INTRODUCTION TO COMPUTER FUNDAMENTALS (Annexure – H)

2nd Semester

EH-123 COMMUNICATION SKILLS (Annexure – B)
EH-132 PAKISTAN STUDIES (Annexure – F)

ET-134 ELECTRONICS

Objectives:

To enable the students to understand fundamentals of Electronic principles and devices.

Course Outline:
Semi-conductor Diodes: Conduction in Solids – Donors and acceptors, Impurities, Simple Diode Circuits, Biasing and applications.
Rectifiers and power supplies, Diode clipper, Diode Clamper, diode multipliers, special purpose diodes, Zener diodes.
Bipolar Junction (BJT) and field effect transistors (FET) – JFET, MOSFET, Construction, Biasing and working as amplifiers.
Operational amplifiers and relevant circuits such as summer, integrator, differentiator etc.

Lab Outline:
Study and plot the characteristics of semiconductor diodes.
Perform half-wave and full-wave rectification.
DC non-regulated power supply.
Regulated power supply using zener diode.
Perform biasing of BJT and determine Q-point.
Study and plot the characteristics of a BJT transistor for all configurations.
Study and plot the characteristics of a junction field effect (JFET) and metal oxide field effort transistor (MOSFET).
Study and observe the input / output parameters of operational amplifier.
Use operational amplifier in inverting and non-inverting configuration.
Use operational amplifier as summer, integrator and differentiator.

Recommended Books:

1. Paynter, “Introductory Electronics”
2. Elder, R.L. Boylestod, “Electronics Devices and Circuit Theory”
   A.P. Malvino, “Electronic Principals” (Latest Edition)
3. Thomas Floyd, “Electronic Devices” (Latest Ed.)

ET-143 BASIC MECHANICAL TECHNOLOGY

Objectives: To familiarize students with basics of Mechanical Technology

Course Outline:
Force, types of force, effect of force on various mechanical and structural members Moment of force, Couple of force, Equilibrium Simple stress, Shear stress, bearing stress Bending moment and shearing force Bending Stresses Deflection of beams Torsion of bars of circular cross section Design of shafts, Pulleys, flywheels, bearing and couplings Power Transmission belts, spur gears and friction clutches.

Lab Outline:

1. Study of Universal Testing Machine (UTM)
2. Perform tensile test on UTM for a mild steel specimen
3. Verification of Hook's Law and determination of Modulus of Elasticity
4. Determination of Modules of Rigidity for circular shaft
5. Determination of central deflection of rectangular section simply supported and fixed ended beams
6. Verification of Bending moment and shearing force principles
7. Determination of co-efficient of V shaped leather belt in contact with a cast iron pulley
8. Determination of mechanical advantage, velocity ratio, and mechanical efficiency of simple gear train.

Recommended Books:

1. Crustar Nieman, "Machine elements design and calculations in mechanical engineering" , Springer International, latest edition
2. F.P. Beer and Johnston, "Mechanics of Materials", McGraw Hill Book Co. Latest SI edition
3. Thomas Beven "Theory of Machine"
4. F.L. Singer, "Strength of Materials", Latest SI edition

ES-143 APPLIED MATHEMATICS – II (Annexure- E)

ET-153 ELECTRICAL MACHINES – I

Objectives:

To comprehend students about construction and working principles of DC machines and transformers

Course Outline:

ELECTROMAGNETIC INDUCTION AND BASIC CONCEPTS IN ROTATING MACHINES:
Introduction to magnetic circuits, magnetically induced e.m.f. and force, AC operation of magnetic circuits, Hysteresis and Eddy current losses. Magnetic fields in rotating machines, generated voltages, torque.
DC GENERATORS: Constructional features and principle of operation, EMF equation, excitation types, load and no-load characteristics, commutation, armature reaction.
DC MOTORS: Principle of operation, back e.m.f., torque equation, types of DC motors, speed-torque characteristics, speed control, applications.
TRANSFORMERS: Principle of operation, constructional features of single and three phase transformers, EMF equation, transformer on no-load and load, three phase transformer connections, auto-transformers.

Lab Outline:

1. Running of DC motor as generator action.
2. Speed control of DC motor by armature control.
3. Speed control of DC motor by field control.
4. No load saturation characteristics of separately excited DC generator.
5. Speed/voltage characteristics of self-excited DC generator.
6. Speed/torque characteristics of DC motor.
7. Determination of BHP of motor by brake test.
8. Determination of torque and efficiency by dynamo meter.
9. Regenerative or Hopkinson's test.
10. Determination of efficiency of a single phase transformer by open and short circuit tests.

Recommended Books:

1. Stephen J. Chapman. Electrical Machinery Fundamentals McGraw Hill,
2. B.L Theraja. Electrical Technology

3rd Semester

ET-212 POWER GENERATION SYSTEMS

Objectives:

To familiarize students with conventional and non-conventional methods for Electrical Power Generation.

Course Outline:

Conventional and non-conventional sources of energy, various types of plants and their efficiencies.
Hydroelectric power plant: Site selection, plant layout, types of dams and turbines.
Thermal power plant: Site selection, plant layout, steam and gas turbines; flue gas, coal and ash flow diagrams.
Nuclear power plant: Basic theory of nuclear energy, reactors, shielding, generating station layout, safety and health hazards
Electrical Power Generation Through PV Cells

Recommended Books:

1. S. L. Uppal, Electric Power
2. Soni, Gupta, A course in Electrical Power

EH-213 TECHNICAL REPORT WRITING (Annexure- J)

ET-224 ELECTRICAL INSTRUMENTS AND MEASUREMENTS

Objectives:
To enable the students to develop measuring skills with different types of instruments.

Course Outline:
MEASUREMENT FUNDAMENTALS: Classification of measuring instruments – according to construction and working principle, measurements, errors and their compensation, accuracies and tolerances, probability of error and noise.
ELECTRO MECHANICAL INSTRUMENTS: Galvanometer, AC ,DC voltmeter, ammeter, wattmeter, watt hour meter, power factor meter, frequency meter, KVAR meters.
ELECTRONIC INSTRUMENTS: Digital volt meters, ammeters and multi meters, Digital counters, Oscilloscope.
Calibration of instruments. AC and DC bridges, sensors and transducers, measurement of non-electrical quantities.
INSTRUMENT TRANSFORMERS: Theory and construction of current and potential; Transformers and their characteristics.

Lab Outline:
1. Familiarize with different type of analog and digital meters.
2. Understanding of signal generator and oscilloscope.
3. Measurement of power by three voltmeters method.
4. Measurement of power by three ammeters method.
5. Measurement of power factor of a load by voltmeter, ammeter and wattmeter.
6. Measurement of resistance by Wheatstone bridge, Kelvins double bridge.
7. Measurement and loss angle of capacitor by Schering Bridge.
8. Measurement of inductance by voltmeter method.
9. Measurement of voltage, phase and frequency using oscilloscope.
10. Find transformation ratio of instrument transformers.

Recommended Books:
1. Berlin, “Electronic Instruments & Measurements”.
2. An introduction to electrical instrumentation by B.A. GREGORY.

ET-234 ELECTRICAL MACHINES – II

Objectives:
To enable students to understand principles and working of single and three phase AC machines

Course Outline:

Construction of Poly-Phase Induction Motors and their Principle, Type and Applications, Construction of Alternators and their principle of Operation, Field Excitation, Parallel Operation and Regulation Installation, Construction of Synchronous Motors and their Principle of Operation, Characteristics and Applications as Synchronous Condensers, Characteristics and Applications as Synchronous Generators, Construction of Single Phase Induction Motors and their Principle, Types and Applications, Single-Phase Capacitor-Start Motors, Single-Phase Permanent-Capacitor Motors, Shaded-Pole Motors, Reluctance Motors, Stepper Motors, Universal Motors, Hysteresis Motors.

THREE PHASE INDUCTION MOTORS: Construction, working principle, types, equivalent circuits, starting methods, speed control and applications.

Lab Outline:

1. Study the effect of field excitation on the generation of voltage by an alternator.
2. Draw the load characteristic curve of an alternator.
3. Study the parallel operation of alternators using dark lamp and bright lamp methods.
4. Study the effect of applied voltage on an induction motor at no load.
5. Study the speed/torque characteristic of the single phase induction motor.
6. Study the speed/torque characteristic of 3-phase induction motor.
7. To carry out no load test of 3-phase induction motor.
8. Observe the changes in power factor and current with excitation of 3-phase synchronous motor.
9. Observe the effect of increasing load on power factor, armature current and speed of 3-phase synchronous motor.

Recommended Books:

1. Stephen J. Chapman. Electrical Machinery Fundamentals
2. B.L Theraja. Electrical Technology

ET-244 DIGITAL ELECTRONICS

Objectives:

This subject covers the basics of digital logic circuits and design. Through the basic understanding of Boolean Algebra and Number systems, it introduces the student to the fundamentals of combination logic design and then to sequential circuits (both synchronous and asynchronous).Memory systems are also covered.

Course Outline:

Number Systems, operations and codes. Digital Electronic Signals and Switching devices, Logic Gates, AND, OR, NOT, NAND, NOR, XOR, XNOR.

Boolean Algebra and Logic Simplification, Modular implementation of combinational logic circuits. Karnaugh maps & truth tables.

Different logic families: TTL, Emitter Coupled Logic, NMOS, CMOS.

Combinational logic circuits: adders, subtractors, comparator, encoder, decoder, multiplexer, de-multiplexer, A/D and D/A converter.

Components of sequential circuits: Flip flops,
their characteristics and transition tables for sequential circuit design, registers, counters, Multi-vibrators, Memories

Lab Outline:

1. Study the characteristics of a Transistor as a switch.
2. Construction of a NOT gate using TTL.
3. Construction of AND and OR gates.
4. Construction of NAND and NOR gates.
5. Construction of adder and comparator.
6. Construction of Analog to Digital and Digital to Analog convertors.
7. Study the operation and truth tables of SR, D, JK and T flip flops.
8. Study and Construction of Adders and Sub tractor Circuit.
9. Study of encoder/decoder circuits.
10. Study of multiplexer/de-multiplexer circuits.
11. Study and construction of digital counters

Recommended Books:

1. T. L. Floyd, Digital Fundamentals.
2. M. M. Mano, Digital Circuits and Computer Logic.
3. William Kleitz, Digital Electronics A Practical Approach
4. Digital Computer Electronics by A.P. Malvino

4th Semester

ET-254 AC CIRCUITS ANALYSIS

Objectives:

To enable the students to learn advanced circuits solving skills

Course Outline:

A.C. FUNDAMENTALS: Sinusoidal wave form, Cycle, Time period, RMS, average and maximum values of sinusoidal current and voltage. Solution of simple RL, RC and RLC circuits using instantaneous values of currents and voltages

AC CIRCUIT ANALYSIS: Loop Analysis of AC Networks and nodal

analysis of AC Networks,. Transients in RL, RC and RLC circuits.
AC NETWORK THEOREMS: Superposition, Thevenin's, Norton's, Reciprocity and Maximum Power Transfer Theorems with AC sources
POLY-PHASE CIRCUITS: Introduction to three Phase system. Star and Delta connections and Transformation. Voltage, Current and Power calculations for three phase loads, Power Factor, causes of low Power Factor, Power Factor improvement,
ELECTRIC FILTERS: RC low pass and high pass filter circuits, band pass and band stop filters.

Lab Outline:

1. Draw a Sine Wave for Single Loop Generator
2. Measurement of Vpp, Vp and RMS value of a sinusoidal Voltage with Oscilloscope
3. Study of Phase displacement between sinusoidal voltage and current using oscilloscope.
4. Observe variation of impedance and current in RLC series circuit with changes in frequency.
5. Study and observe transient response of R L, RC & RLC circuits with the help of oscilloscope.
6. Demonstration of Superposition Theorem with AC sources.
7. Demonstration of Thevenin's Theorem with AC sources
8. Demonstration of Reciprocity Theorem with AC sources
9. Determine active and reactive power for single phase circuits.
10. Determine active and reactive power for three phase circuits
11. Determine Power factor of an inductive Load by Voltmeter, Ammeter and Wattmeter Method.
12. Determine Power factor of a Capacitive Load by Voltmeter, Ammeter and Wattmeter Method.
13. Study of Star and Delta connection
14. Demonstration of RC low pass filter circuits.
15. Demonstration of RC high pass filter circuits.

Recommended Books:

1. Boylested, Introductory Circuit Analysis.
2. Floyd, Circuit Analysis
3. W. Hayt, Engineering of Circuit Analysis
4. K. Y. Tang, Circuit Analysis

ET-262 ELECTROMAGNETIC FIELD

Objectives:

Introduce the concepts and mathematical methods to understand and analyze electromagnetic fields and waves and their applications

Course Outline:

Vector Algebra: Scalar and vectors, unit vector, dot and cross products of vectors, position and distance vector, component of a vector

Coordinate systems: Cartesian coordinates, circular cylindrical coordinates, spherical coordinates

Vector calculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stoke's theorem, Laplacian of a scalar

Electrostatic Fields: Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses' Law – Maxwell's equation, Electric potential, Electric dipole and flux lines, energy density in electrostatic fields.

Electric field in material space: Properties of materials, convection and conduction currents, conductors, dielectric constants, continuity equation,

Magneto-static fields: Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static magnetic fields. Forces due to magnetic field, magnetic torque and moment

Maxwell's equations: Faraday's Law, transformer and motional electromotive forces, displacement current, Maxwell's equations in final form.

Recommended Books:

1. Sadiku, Matthew N, "Elements of Electromagnetics", Oxford University Press, ISBN: 0195103688, Latest Edition.
2. William Hayt and John A. Buck, "Engineering Electromagnetics", McGraw-Hill,ISBN: 0073104639, Latest Edition.
3. Kong J. A., "Electromagnetic Wave Theory", Cambridge, Latest Edition.
4. John D. Kraus, "Engineering Electromagnetics", McGraw-Hill Inc., New York, Latest Edition
5. N. N. Rao, "Elements of Engineering Electromagnetics", Pearson Education, Latest Edition

ET-273 ELECTRICAL POWER TRANSMISSION

Objectives:

To familiarize students with the elements of Electrical Power transmission systems

Course Outline:

TRANSMISSION LINES: Purpose of transmission, choice of frequency and voltage, parameters of overhead transmission lines, types and calculations of transmission lines. Ferranti, corona and skin effects on transmission lines.

MECHANICAL DESIGN OF OVERHEAD LINES: Line supports, sag and tension calculations, effect of wind pressure and ice loading, conductor vibration and use of dampers.

INSULATORS: Insulator material, types of insulators, voltage distribution over insulator string, string efficiency, methods of improving the string efficiency, testing of insulators.

Lab Outline:

1. Determine the phase sequence of 3-phase source.
2. Observe the flow of real and reactive power in a 3-phase transmission line with known passive loads.
3. Observe the voltage regulation at receiving end of a 3-phase transmission line as function of type of load.
4. Study of various types of insulators used in transmission and distribution systems.
5. Study of voltage distribution along a model of string of suspension insulators.
6. Study of various poles and towers used for transmission and distribution systems.

Recommended Books:

1. AT Starr, Transmission and Distribution.
2. TuranGonan, Transmission and Distribution.
3. Power System By V.K Mehta , Rohit Mehta.

ET-283 ELECTRICAL POWER DISTRIBUTION AND UTILIZATION

Objectives:

To familiarize students with the elements of Electrical Power distribution and Utilization systems.

Course Outline:

DC AND AC DISTRBUTORS: Pointed and uniform AC and DC distributors, distributors fed at one and both ends, ring mains, stepped mains, unbalanced loading of three-phase AC distributors.

UNDERGROUND CABLES: Cable resistance, inductance and capacitance, methods of cable installation, voltage drop and power loss, types of cables used in industries, cable fault localization.

STATIC SUBSTATION: Substation location and layout,

classification of substations, bus bar arrangement, grounding of star neutral point.
UTILIZATION: Illumination, Electrical heating- Resistive, induction and dielectric heating, electric furnaces. Electrical Traction systems, classification and layout

Lab Outline:
1. Study construction of various cables and nomenclature
2. Calculation Cable size of for various loads.
3. Prepare a layout scheme for a substation.
4. Visit of substation for familiarization with substation equipment.
5. Use of software for luminance arrangement and lay out design.
6. Demonstration of different tests of cables.
7. Measurement of Earth resistance and insulation resistance.
8. Measurement of high voltage and current using PT and CT.
9. Demonstration of Resistance & Induction heating.
10. Demonstration of different types of welding methods.
11. Verification of laws of Illumination.
12. Demonstration on different types of lamps.

Recommended Books:
1. AT Starr, Transmission and Distribution.
2. Turan Gonan, Transmission and Distribution
3. Power System By V.K Mehta, Rohit Mehta.

ET-294 POWER ELECTRONICS

Objectives:

- Identify different Power Electronic devices and describe their industrial applications.
- Describe operation of Power Converters.
- Install and Repair Power Electronic circuits.

Course Outline:
INTRODUCTION TO POWER SEMICONDUCTOR DEVICES: Power diodes, Power Transistors, Power MOSFET, Insulated Gate Bipolar Transistor (IGBT) and their characteristics, Diodes with RC, RL, LC and RLC loads.
THYRISTORS: Principle of operation, characteristics, two transistor model of SCR, Thyristor types, ratings, protection and cooling, thyristor turn-on and turn-off, series and parallel operation of thyristors, thyristor firing circuits.
THYRISTOR CONVERTERS: AC voltage controllers, controlled rectifiers, inverters, DC link converters, DC choppers, cyclo-converters.

Lab Outline:

1. Study the characteristics of an SCR.
2. Study the characteristics of power transistors.
3. Single phase half-wave controlled rectifier with resistive load.
4. Single phase full-wave controlled rectifier with resistive load.
5. Single phase rectifier with inductive load.
6. Three- phase half-controller rectifier.
7. Three-phase full-controller rectifier.

Recommended Books:

1. B. W. Williams, Power Electronics
2. M. H. Rashid, Power Electronics
3. Power Electronics by P S Bhimbra, Khanna Pub

5th Semester

ET-313 MICROPROCESSOR THEORY AND INTERFACING

Objectives:

- Describe Microprocessor's Architecture.
- Describe basic Assembly language Instructions.
- Interface using I/O Ports.
- Program a basic Microprocessor control system

Course Outline:

MICROPROCESSOR FUNDAMENTALS:
Introduction, simplified CPU organization and instruction set, Bus systems.

MICROPROCESSOR ARCHITECTURE AND PROGRAMMINGTECHNIQUES:
Structure of Intel 8086/88 microprocessor and its architecture, pin diagram and functions, data sheet descriptions, Interrupts, 8086/88 Instruction set, programming techniques. Assembly language programming of Intel microprocessor.

INTERFACING THE MICROPROCESSORS:
Interfacing concepts, Interfacing of Microprocessor with RAM & ROM, Basic of I/O Interfacing with I/O ports (serial and parallel), Memory Map and Address Decoding, D/A & A/D interfaces, Study of CD – ROM, controllers.

MICROPROCESSOR CONTROLLED SYSTEMS:
Closed loop control systems – temperature monitoring and control system, washing machine controller, diesel generator set controller, stepper motor controller.

Lab Outline:

1. Study of 8086/88 processor, its instruction set and pin layouts.
2. Execute Data transfer group of instructions.
3. Execute Arithmetic group of instructions.
4. Execute I/O instructions.
5. Execute Logic group of instructions.
6. Execute Shift and rotate instructions.
7. Execute Transfer of control instructions
8. Use ADC/DAC with 8086/88.
9. Interface a printer with 8086/88.
10. Mini Project

Recommended Books:

1. Douglas V. Hall., Microprocessor's interfacing. (Latest Edition)
2. Berry B. Bari., Intel Microprocessors. (Latest Edition)

ET-323 SWITCH GEAR AND PROTECTIVE DEVICES

Objectives:

- To discuss the causes of abnormal operating conditions (faults, lightning and switching
- Surges) of the apparatus and system.
- To understand the characteristics and functions of relays and protection schemes.
- To understand the problems associated with circuit interruption by a circuit breaker

Course Outline:

Importance of protective schemes for electrical apparatus and power system. Qualitative review of faults and fault currents - relay terminology – definitions - and essential qualities of protection.

Operating Principles and Characteristics of Relays

Electromagnetic relays – over current, directional and non-directional, distance, differential and under frequency relays – Introduction to static relays.

Circuit Breakers

Circuit Breakers, Principle of operation, arc phenomena and arc interruption – re-striking voltage and recovery voltage - rate of rise of recovery voltage, Types of circuit breakers – Air circuit b the secondary. Carryout the performance test of Breakers, Oil circuit breakers , SF6 circuit breakers and vacuum circuit breakers ,Apparatus Protection

Main considerations in apparatus protection - transformer, generator and motor protection,

bus bar protection. Transmission line protection, zones of protection. CTs and PTs and their applications in protection schemes.
Protection Against Over Voltages
Protection against over voltages due to lightning and switching - arcing grounds - Peterson Coil -ground wires –Lightning Arresters - surge absorber and diverters- Power System earthing – neutral Earthing

Lab Outline:

1. To study different types of switch gear equipment used in electrical power systems
2. To identify the components of different types of circuit breakers
3. To study the operation of over current relay and plot the performance characteristics
4. To study the directional over current relay
5. To study the magnetization of CT and its associated problems
6. Plot the characteristics of fuse wire
7. To determine the transformation ratio of current transformer with different primary currents and load influence on the secondary, carryout the performance tests
8. To determine the transformation ratio of a voltage transformer and load influence on the secondary. Carryout the performance tests
9. Connection of the voltage transformers with open delta of 3-phase lines
10. To study transformer differential protection
11. To understand the protection schemes of alternators and sketch labeled schematic diagram of alternator, types of protection of alternators.
12. To understand types and specifications of neutral earthing and specification of earthing at different substations
13. To understand types and specifications of lightning assertors of different manufacturers
    through literature/brochures.
14. Visit to a local high voltage substation.

Recommended Books:

1. M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, ‘A Text Book on Power System Engineering’, Dhanpat Rai& Co., 1998. (For All Chapters 1, 2, 3, 4 and 5).
2. R.K.Rajput, A Texbook of Power System Engineering. Laxmi Publications, First
   Edition Reprint 2007.
3. Sunil S. Rao, ‘Switchgear and Protection’, Khanna publishers, New Delhi, 1986.
4. C.L. Wadhwa, ‘Electrical Power Systems’, Newage International (P) Ltd., 2000.

5. B. Ravindranath, and N. Chander, 'Power System Protection & Switchgear', Wiley Eastern Ltd.1977.
6. Badri Ram, Vishwakarma, 'Power System Protection and Switchgear', Tata McGraw-Hill, 2001.
7. Y.G. Paithankar and S.R. Bhide, 'Fundamentals of Power System Protection', Prentice Hall of India Pvt. Ltd., New Delhi–110001, 2003

ET-334 COMMUNICATION TECHNOLOGY

Objectives:

- To provide basic understanding of the Analog Communication Systems.
- To introduce and develop technical expertise in various modulation techniques as applicable in Analog and Digital Communication Systems.

Course Outline:

Various frequency bands used for communication ; types of communication and need of modulation; Modulation techniques: introduction to AM, FM and PM, frequency spectrum of AM waves, representations of AM, power relation in AM waves, need and description of SSB, suppression of carrier, suppression of unwanted side bands, Independent side band system, vestigial side band system, mathematical representation of FM, frequency spectrum of the FM waves, Phase modulation, comparison between analog and digital modulation, wide band and narrow band FM, Sampling theorem, frequency division multiplexing and time division multiplexing; Pulse Modulation: Sampling and Quantization, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, Quantization Noise, Signal to Quantization Noise Ratio, Pulse code Modulation, half duplex and full-duplex transmission. Various types of Receivers.

Lab Outline:

1. Study of Basic Concepts of different modulation techniques
2. Investigation and analysis of Amplitude modulation
3. Investigation and Analysis of Frequency and pulse modulation
4. Study of basic concepts of demodulation techniques
5. Analysis of the main parameters of the single sideband modulation
6. Study of use of filters to generate the SSB
7. Demodulation of SSB signals using product/synchronous detection;
8. Familiarization of Digital modulation and demodulation
9. Examination of the operation of RF(Radio Frequency) transmitter
10. Examination of the operation of AM-RF (Radio Frequency) transmitter

11. Examination of the operation of SSB-RF (Radio Frequency) transmitter
12. Examination of the operation of RF (Radio Frequency) receiver
13. Study of super heterodyne AM receiver and measurement of sensitivity
14. Experimental modules for FDM, TDM and PCM
15. MATLAB/SIMULINK modeling and simulation of a simple transceiver.

Recommended Books:

1. B. P. Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press
2. Electronic communication Systems by George Kennedy.
3. Principle of Communication Systems by Taub and Schilling.
4. Electronic communication Systems by Dennis Roddy and John Coolen

ET-343 CONTROL TECHNOLOGY

Objectives:

To enable students to understand principles and working of control systems

Course Outline:

Introduction to control systems, open and close loop control systems. Principle of feedback systems.

Modeling of electrical and mechanical control systems, time and frequency domain analysis. Block diagram, transfer function, unit and impulse response, signal flow graphs. Control system components, gear trains, levers, servo mechanism; study of feedback system for automatic control of physical quantities such as voltage, speed and mechanical position. Industrial application of servo mechanism. Overview of PID controllers. Stability, Routh-Hurwitz stability criteria.

Lab Outline:

1. Study of DC servomechanism.
2. Perform speed control of servo motor in open loop configuration.
3. Perform position control of servo motor in open loop configuration.
4. Perform speed control of servo motor in closed loop configuration.
5. Perform position control of servo motor in closed loop configuration.
6. Demonstration of Temperature Control Loop on Temperature Trainer.
7. Demonstration of Pressure Control Loop on Pressure Trainer.
8. Demonstration of Level Control Loop on Level Trainer.

9. Demonstration of Flow Control Loop on Flow Trainer.
10. Study of AC Servomechanism.
11. Servomotor control using PID controller.
12. Mini-project – demonstration of feedback control system controller.
13. Calibration of Control Valve w.r.t position.
14. Calibration of Differential Pressure Transmitter
15. Calibration of Electric and pneumatic recorder.

Recommended Books:

1. Norman Nice, Control Systems
2. B. Kuo, Automatic Control Systems.
3. D'Azzo Control System
4. Shaum Series. Feedback Control System

EM-312 TOTAL QUALITY MANAGEMENT

Objectives:

- To enable students to develop quality management skills.

Course Outline:

1. Introduction to Quality: Quality concepts, types and aspects, Significance of quality.
2. Commitment and Leadership: Commitment and Policy, Creating or changing the culture, effective leadership.
3. Quality Planning: Flow charting, process charting, purchase planning, planning for JIT.
4. Design for Quality: Innovation, Quality Function Deployment and the house of Quality.
5. Quality Related Costs: Prevention, Appraisal and Failure Costs, Models for Quality Costing.
6. Quality Measurement: Significance, Methods
7. Tools and Techniques for Quality Improvement: Basic Tools, Advanced Tools.- Quality Management System (ISO 9000 series): Significance, Documentations, Implementation and Certification, Audits, Expected Problems
8. Environmental Management System (ISO 14000 series): Significance, Documentations, Implementation and Certification, Audits, Expected Problems.

Recommended Books:

1. Oakland J. S. TOTAL QUALITY MANGEMENT, Bulterworth HeinemannLtd. UK.
2. ISO 9000 series of standards
3. ISO 14000 series of standards
4. Feigenbaum, TOTAL QUALITY CONTROL. McGraw Hill Book

Co.,USA.
5. Gillow H. S. and Gillow S. J. TOTAL QUALITY MANGEMENT INACTION, Prentice Hall UK.

ET-353 HIGH VOLTAGE TECHNOLOGY

Objectives:

To provide knowledge about effects of increasing transmission voltage level and different breakdown mechanism

To enable students to familiarize with theory and practices in High voltage technology.

Course Outline:

Introduction to high voltage technology.

Ionization, Townsend theory, cathode process, decay process, streamer breakdown.

Conduction and Breakdown in gases, liquid dielectrics, breakdown in solid dielectrics.

Applications of Insulating materials in power transformers, rotating machines, circuit breakers, cables.

Generation of high voltage and currents, measurement of high voltage and currents, need of high voltage, voltage levels, transient voltage.

Overvoltage phenomenon and insulation coordination in power systems.

Testing of high voltage electrical apparatus.

Lab Outline:

1. Study of high voltage testing transformers.
2. Study of Vandergrift generator
3. Observation of corona inception and breakdown voltage in air.
4. Measurement of high voltage by sphere gap and uniform field gap.
5. Measurement of dielectric strength of solid insulation.
6. Measurement of Dielectric strength of insulating liquids.
7. Measurement of Impulse voltage.
8. Flashover along line insulators

Recommended Books:

1. Naidu, High Voltage Engineering.
2. Alston, High Voltage Technology
3. Dr. Abdullah, High Voltage
4. E. Kuffel, W.S. Zaengl, High Voltage Engineering Fundamentals.

6th semester

EM-323 PROJECT MANAGEMENT (Annexure- I)

ET-362 POWER SYSTEM ANALYSIS

Objectives:
To enable students to learn various types of electrical faults and their calculation.

Course Outline:
Representation of Power Systems: One-line diagram, impedance and reactance diagram, percent or per-unit quantities, selection of base and change in base of p.u. quantities, per unit representation of single phase transformer, per unit reactance diagram of a power system, per unit impedances of three winding transformers.
Symmetrical Three Phase Faults: Symmetrical three phase faults on an unloaded synchronous machine, short circuit currents and reactance of synchronous machines, internal voltages of loaded machines under transient conditions, fault calculation and numerical problems.
Symmetrical components: Symmetrical components of unsymmetrical phasors, power in terms of symmetrical components; sequence networks, positive, negative and zero sequence networks, unsymmetrical series impedances.
Unsymmetrical faults: Unsymmetrical faults on unloaded generators, unsymmetrical faults on power systems; single line-to-ground faults; line to-line faults, double line-to-ground faults, double line to line faults; demonstration problems.
Power system stability: Steady state and transient stability, swing equation, the power angle equation, equal area criterion of stability and its application, demonstration problems.

Recommended Books:
1. D. Stevenson, Jr., Elements of Power System Analysis
2. V.K. Mehta, Principle of Power Systems

ET-374 DATA AND COMPUTER COMMUNICATION

Objectives:
To help the students gain an understanding of the terminology and standards in modern day data and computer networks. To make the students understand communication basics, data networking and network technologies; with emphasis on data and computer communication within the framework of the OSI and TCP/IP protocol

architectures, internet and internetworking and how to apply these in the design and analysis of data and computer networks.

Course Outline:

Physical Layer Concepts: Data Communication through physical layer, analog and digital transmission of data and multiplexing techniques, Shift Keying Techniques, Error Detection and Correction Schemes, Network architectures and switching techniques, characteristics of transmission media. Channel access protocols and their efficiency. Link control protocols, and their efficiency. Routing algorithms and protocols. Interconnection of network at the link level and at the network level, the Internet Protocol (IP) and associated Control protocols. End-to-end protocols, with TCP and UDP as examples; congestion control and flow control. Cursory view of application-level protocols, including electronic mail, HTTP and DNS. Introduction to network calculus.

Lab Outline:

1 Study basic network topologies and IP addressing modes.
2. Use hyper terminal to establish a console session between two systems.
3. Use of LAN switch to create simple networks.
4. To Study the structure & basic Configuration of a Router.
5. Configure a Router for different network scenarios.
6. Perform network operations such as file and printer sharing.
7. Interface serial, parallel ports for data transfer.
8. Study of Wide Area Network (WAN).
9. Static and Dynamic IP Assignment for various types of networks.
10. Perform and Analyze Amplitude Shift Keying Technique
11. Perform and Analyze Frequency Shift Keying Technique
12. Perform and Analyze Phase Shift Keying Technique
13. Perform and Analyze Quadrature Amplitude Shift Keying Technique
14. Basic Function of Modem
15. Study and Design of various Multiplexing Techniques

Recommended Books:

1. " Data Communication and Networks" By James Irvine and David Harle, John Wiley and Sons, 2002
2. "Computer Networks: A Systems Approach" By Bruce S. Davie, Morgan Kaufmann Publishers, Latest edition

ET-384 INDUSTRIAL DRIVES AND PLC

Objectives:
The students will be able to run PLC for the industrial drives.

Course Outline:
Introduction to Electrical Drives: Concept of Electric drive, Types of drive, Trends in Drive Technology, Classification of Drives
Motor Characteristics: DC Motors, AC Motors
Electric Braking: Requirements of Braking System, Types of Braking.
Selection of Motors: Electrical Characteristics, Mechanical Characteristics
Programmable Logic Controller: Introduction to PLC, Ladder logic diagram and programming of PLC, Computer controlled machine interfacing of PLC.

Lab Outline:
1. Perform speed control operation of DC motor.
    a. Shunt Motor
    b. Series Motor
    c. Compound motor
2. Study Mechanical and Electrical Braking Systems.
3. Perform a simple ON-OFF operation on a standard PLC.
4. Perform AND, OR, AND-OR, OR-AND operation on a standard PLC.
5. Perform a Time Delay operation on a standard PLC.
    a. OFF-Time Delay
    b. ON-Time Delay
6. Perform a Counter operation on a standard PLC.
7. Perform a Flip-Flop Operation on a standard PLC.
8. Perform Reverse-forward operation on a standard PLC.
9. Perform a motor speed control operation on a standard PLC.
10. Perform a fault finding on a PLC controlled system.

Recommended Books:

1. Fundamentals of Industrial Drives by B.N. Sarkar
2. Electric Motors and Drives by Austin Hughes and Bill Drury
3. M. Birmingham, K. Brown, Programmable logic controllers
4. Automating Manufacturing Systems with PLCs by Hugh Jack

ET-393 PROJECT
ET-3103
Objectives:
To develop the ability of exercising the problem analysis, design & its validation, prototype production on economical scale.

Course Outline: Project work is basically to complement Engineering Technology study. The student is in close consultation with department faculty will complete the project using Library, Computer or Laboratory facilities. It shall be considered as Engineering Technology Subject to a minimum of 06 Credit Hours work that entails the following activities in general:-

i. Detailed problem analysis
ii. Project timeline Schedule
iii. Literature Review
iv. Conceptual and actual Design
v. Design validation
vi. Material selection
vii. Manufacturing / Fabrication (Economical Prototype / Model production if required)
viii. Assembly, test & Trials and logging of results
ix. Report writing and presentation

Note:

The student(s) to undertake project during 6th semester and its following summer. 06 credit hours academic work be undertaken as follows:-

- Three Credit hours work during 6th Semester under the guidance of departmental faculty. The work that entails supervised work entails problem analysis, timeline & Schedule, Literature Review, conceptual / Actual design, design validation and material selection.
- Three credit hours during summer where student(s) will work independently and may seek guidance from the concerned Faculty / Project Supervisor. The independent working of student(s) entails Manufacturing / Fabrication (Economical Prototype / Model production if required), Assembly, test & Trials and logging of results, Report writing and presentation.

7th Semester

ET-4116 **16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING** **(Annexure - K)**

8th Semester

ET-4216 **16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING** **(Annexure - K)**

BSc CIVIL ENGINEERING TECHNOLOGY

1st Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	CH-112	Islamic Studies / Professional Ethics	Humanities	2	0	2	0
2	CS-113	Applied Mathematics-I	Natural Sciences	3	0	3	0
3	CS-123	Introduction to Computer Fundamentals	Computer Science	1	2	1	6
4	CT-113	Civil Engineering Drawing	Engineering Foundation	1	2	1	6
5	CT-124	Surveying	Engineering Foundation	2	2	2	6
6	CM-112	Occupational Health & safety Management	Management Science	2	0	2	0
Total				**11**	**06**	**11**	**18**
Grand Total				**11+06 = 17**		**11+18 = 29**	

2nd Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	CT-134	Concrete Technology	Engineering Foundation	2	2	2	6
2	CH-123	Communication Skills	Humanities / English	3	0	3	0
3	CT-144	Applied Mechanics	Engineering Foundation	2	2	2	6
4	CT-154	Materials and Methods of Construction	Engineering Foundation	2	2	2	6
5	CS-133	Applied Mathematics - II	Natural Science	3	0	3	0
Total				**12**	**06**	**12**	**18**
Grand Total				**12+06 = 18**		**12+18 = 30**	

BSc CIVIL ENGINEERING TECHNOLOGY

3rd Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	CT-212	Introduction to Architecture and Town Planning	Engineering Foundation	2	0	2	0
2	CH-212	Pakistan Studies	Humanities	2	0	2	0
2	CT-223	Quantity Surveying and Contract Documents	Engineering Foundation	1	2	1	6
3	CT-233	Soil Mechanics	Major based Breadth	2	1	2	3
4	CT-243	Fluid Mechanics	Major based Breadth	2	1	2	3
5	CT-254	Mechanics of Solids	Major based Breadth	2	2	2	6
Total				**11**	**06**	**09**	**18**
Grand Total				**11+06 = 17**		**09+18 = 29**	

4th Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	CT-264	Transportation Engineering	Major based Breadth	2	2	2	6
2	CT-274	Water Supply & Waste Water Management	Major based Breadth	2	2	2	6
3	CM-213	Environmental Management	Management Sciences	2	1	2	3
4	CT-283	Theory of Structures	Major based Depth	2	1	2	3
5	CH-223	Technical Report Writing	Humanities / English	3	0	3	0
Total				**11**	**06**	**11**	**18**
Grand Total				**11+06 = 17**		**11+18 = 29**	

BSc CIVIL ENGINEERING TECHNOLOGY

5th Semester Third Year

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	CT-313	Hydrology	Major based Breadth	2	1	2	3
2	CT-323	Reinforced Concrete Structures	Major based Breadth	2	1	2	3
3	CT-333	Construction and Hydraulic Machinery	Major based Depth	2	1	2	3
4	CT-343	Computer Aided Building Modeling and Design	Major based Depth	1	2	1	6
5	CT-353	Foundations Engineering	Major based Depth	2	1	2	3
6	CM-313	Project Management	Management Science	3	0	3	0
Total				**12**	**06**	**12**	**18**
Grand Total				**12+06 = 18**		**12+18 = 30**	

6th Semester Third Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	CT-363	Pre-stressed & Precast concrete	Major based Depth	2	1	2	3
2	CT-373	Geology & Earthquake Engineering	Major based Depth	2	1	2	3
3	CT-383	Irrigation and Hydraulic Structures	Major based Depth	2	1	2	3
4	CT-393	Steel Structures	Major based Depth	2	1	2	3
5	CT-3103	Project	Major based Depth	0	3	0	9
Total				**08**	**07**	**08**	**21**
Grand Total				**08+07 = 15**		**08+21 = 29**	

BSc CIVIL ENGINEERING TECHNOLOGY

6th Semester Third Year Summer Project Work:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	CT-3113	Project (Continue)	0	03	0	09
Grand Total			**00+ 03 = 03**		**00 + 09 = 09**	

7th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	CT4116	16 Weeks Supervised Industrial / Field Training (8x5=40 hrs / Week)	0	16	0	40x16 =640
Total			**0**	**16**	**0**	**640**
Grand Total			**0+ 16 = 16**		**00 + 640 = 640**	

8th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	CT4216	16 Weeks Supervised Industrial / Field Training (8x5=40 hrs / Week)	0	16	0	40x16 =640
Total			**0**	**16**	**0**	**640**
Grand Total			**0+ 16 = 16**		**0+ 640 = 640**	

- *Complete guidelines for 32 weeks Continuous Supervised Industrial/ Field Training are available in Annexure-K.*

Summary:

BSc Civil Engineering Technology		
Semester	**Credit Hours**	
	Theory	**Practical**
1st	11	06
2nd	12	06
3rd	11	06
4th	11	06
5th	12	06
6th	08	07
6th Summer	00	03
7th	00	16
8th	00	16
Total	**65**	**72**
G. Total	**137**	

DETAILS OF COURSES (CIVIL ENGG TECH)

1st Semester

CH-112	**ISLAMIC STUDIES / PROFESSIONAL ETHICS**	**(Annexure-A)**
CS-113	**APPLIED MATHEMATICS - I**	**(Annexure-D)**
CS-123	**INTRODUCTION TO COMPUTER FUNDAMENTALS**	**(Annexure-H)**

CT-113 CIVIL ENGINEERING DRAWING

Course Outline:

Introduction:

Principles of orthographic projection related to simple solids.

Descriptive geometry:

Plane curves; Cycloids; Hypocycloid; Involutes; Curves of interpenetration of solids; Development of surfaces; Isometric views.

Machine drawing:

Representation of riveted joints, Screwed fastenings, Keys and cotters;

Building drawing:

Introduction to architectural and structural drawings of simple buildings.

Symbols and abbreviations:

Building materials; Electric and plumbing symbols and abbreviations.

Practical:

1. Draw Regular Polygons by Universal Method (with given dimensions).
2. Draw a 3-Centered Arch (with given dimensions).
3. Draw a 4-Centered Arch (with given dimensions).
4. Draw Ellipse by Focal Point Method and Parallelogram Method (with given dimensions of major and minor axes).
5. Draw Ellipse by Concentric Circle Method and Four Center Method.
6. Draw Parabolas by Offset Method and Basic Method.
7. Draw Parabolas by Parabolic Arc Method and Tangent Method.
8. Draw Isometric Views of given objects.
9. Draw Oblique Views of given objects.
10. Draw Isometric View of the given stairs steps.
11. Draw Oblique View of the given stairs steps.
12. Draw Oblique View of a Beam resting on two Columns.
13. Draw Development Drawing of a Cube and Cylinder.

14. Draw Development Drawing of a Cone.
15. Draw Development Drawing of a Hexagonal Prism.
16. Draw different forms of Rivet Heads.
17. Draw Orthographic Views of Hexagonal Bolt.
18. Draw Orthographic Views of Hexagonal Nut.
19. Draw a Plan and section of isolated and combine footing showing reinforcement also draw the Schedule of Footing.
20. Draw a four storied Building Column's elevation and cut section at each floor reducing reinforcement and cross-section of column.
21. Draw Schedule of Beam also draw Typical Elevation of Beam , showing Bottom bar, Extra bottom bar, Hanger bar, Top bar, Extra Top bar, and rings.
22. Draw single span Beam Elevation and its Section showing reinforcement using bent up bar.
23. Draw a three span RCC Beam elevation and its section showing reinforcement also develop Schedule of Beam.
24. Draw a Plan (13 X 17) and its X-section of single span RCC Slab, showing reinforcement. Short way #3@6"c/c , long way #3@9"c/c.Slab thickness 6"
25. Draw Plan and X-section of oneway slab of three spans showing reinforcement.
26. Draw Plan and X-section of Septic Tank.
27. Draw a Plan of 120 sq. yard residential bungalow.
    Note: Draw any 16 Drawings from the above Practical list.

Recommended Books:

1. Engineering Drawing by N.D. Bhatt (53rd Edition 2014) Charotar Publisher.
2. Drawing for Engineering By Paul Smith
3. Basics Of Engineering Drawing By Zahid Ahmad Siddique, 2nd Edition, M/S Technical Publisher Lahore.

CT- 124 SURVEYING

Objectives:

1. To develop an understanding of surveying & leveling theory and practice.
2. To develop an ability to translate survey information for design and construction purposes.
3. To develop a skill in the use of modern survey instruments.

Course Outline:

- Introduction: Introduction to advanced surveying and its application,

- Triangulation, trilateration, field procedures and application, EDM, strength of figure, computation and plotting.
- Theory of errors and Weights: quality of observations, weighted observations, distribution and adjustment of errors. Most probable value.
- Curves: Various types of curves with application: simple circular curve, compound curves, transition curves, vertical curve and reverse curves, Design and layout of curves.
- Tunnel surveying: Use of gyroscope.
- Hydrographic surveying: Horizontal and vertical controls, submarine surface contours. Discharge measurement, reservoir capacity calculation.
- Field astronomy: Solar and stellar observations for position and azimuth determination.
- Remote sensing/satellite imagery and its applications: Introduction & applications of remote sensing in Surveying, Types of remote sensing, sensors and platforms used for remote sensing.
- Use of stereoscopy and GPS.
- GIS: Introduction & applications of GIS in surveying, digitizing and topographic mapping using GIS software.

Practical:

- Study and use of conventional instruments & EDM surveying instruments.
- Base line measurement,
- Theodolite traversing.
- Profile and precise leveling.
- curve layout (simple circular curve, reverse curve, composite curve, vertical curve)
- computation and plotting,
- field astronomy,
- total station/gyro station,
- GPS based survey, integration of GPS data in GIS software, creation of contour sheet using GIS.

Recommended Books:

1. Surveying Theory and Practice by R. E. Davis, J. Anderson, F.S. Foote, McGraw-Hill (Latest Edition).
2. Surveying by Jack C. McCormac (Latest Edition).
3. Schaum's Ouline Series of Introductory Surveying by R. H. Wirshing, Roy Wirshing, Jaews R. Wirshing (Latest Edition).
4. Surveying with Construction Applications by Barry F. Kavanagh, Prentice Hall (Latest Edition).
5. Plane and Geodesic Survey Vol. I and II by David Clarck, Trans-Atlantic Publications (Latest Edition).

CM-112 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT

Objective:
To enable students to develop occupational health and safety awareness and skills

Course Outline:
Construction Safety: Safety and Health in the local and International Construction Industries, OSHA in the USA, Overview of Cost of Accidents, Roles of Construction Personnel in Safety, Overview of Accident Causation Theories, Ethics and Safety, Insurance and Safety, Compliance to Safety Standards.
Safety Application on the Job: Construction Safety & Health Program, Plans and Policies, Components of the Plan, Roles, Safety Rules and Regulations, Example of Safe Work Procedures, Jobsite Inspections, Accident Prevention, Medical and First Aid Facilities and Services, Protection of the General Public, Fire Protection, Substance Abuse, Personal Protective Equipment, Site Safety and Hazard Analysis, Safety Communications, Accident Reporting and Investigation, Recording Injuries and Illnesses, Training, Emergency Response.
Strategic Safety Improvement: Promoting Safety by Example, Employee Participation in Promoting Safety, Safety Training, Safety Committees, Employee and Management Participation, Incentives, Teamwork Approach to Promoting Safety, Establishing a Safety-First Corporate Culture, Total Safety and its Components, a Brief Discussion of Zero Accident Strategies, Continuous Safety Improvement.
Safety Management Techniques: Accident prevention, health and safety policy, safe systems of work, first aid provisions, health and safety training, spill response protocols, accident investigation, recording and analysis, communicating safety measures, techniques of inspection, Health and safety regulations at work place.

Recommended Books:
1. Mark Friend, Fundamentals of Occupational Safety and Health.
2. A Guide to the Control of Substances Hazardous to Health in Design and Construction. CIRIA Report 125. Thomas Telford Publications (Latest Edition)

2nd Semester

CT-134 CONCRETE TECHNOLOGY

Objectives:
1. To develop an understanding of the composition and behavior of plain and reinforced concrete.

2. To understand various methods of proportioning of constituent materials for a required concrete quality.
3. To analyze the problems of transportation, pouring, bleeding of concrete.
4. To understand methods of curing and compaction and factors affecting strength of concrete.
5. To know the benefits of testing of concrete and to understand the procedure of quality control.
6. To get introduction of the design of simple beams for flexure and shear.

Course Outline:

Concrete Properties and Its Behavior:

Properties of aggregates, cement and concrete, properties of fresh and hardened concrete, strength, elastic behavior, shrinkage and creep and durability to chemical and physical attacks. Methods of testing concrete cylinders and cubes in compression. Effects of impurities in water and in aggregates on the performance and durability of plain and reinforced concrete. Effect of water/cement ratio upon workability and strength of concrete.

Mix Design:

Requirements of cube cylinder strength, workability and aggregate size. Prescribed mix, design mix and the effect of varying proportions of the component parts. Procedure for design of concrete mix (ACI, British Standard Specifications and Road Note No.4). Laboratory and site testing for assessing the quality, performance and strength of a design mix.

Reinforced Concrete:

Mechanics of reinforced concrete and its behavior under working and ultimate loads. Basics of reinforced concrete design. Analysis and design of RC beams and columns for flexure, shear, axial load, and anchorage by ultimate strength design method. Design for diagonal tension and bond. Behavior of one-way and two-way slabs and their design.

Detailing and Fabrication of Reinforcement:

Function of reinforcement in structural concrete elements with respect to resisting tension, compression, shear and shrinkage cracking. Concrete cover to reinforcing bars and its variation in different structural elements, lapping of reinforcement, details of bar bending and preparation of schedules. Preparation of working drawings of structural elements. Introduction to different types of concrete foundations.

Practical:

1. Organic impurities and water absorption of aggregates.
2. Determination of specific gravity and bulk densities of aggregates,

aggregate gradations.

3. Casting specimens for varying w/c ratio and bulk densities, slump test and casting 6" cubes and cylinders.
4. Effect of w/c ratio on strength of concrete (compressive strength test on cubes and cylinders as (3) above.
5. Preparing test specimens from hand mixed, machine mixed and hand compacted concrete.
6. Compression tests on specimens as (5) above and making comparisons.
7. Determination of initial and final setting time for Portland cement.
8. Comparison of cube and cylinder strength.
9. Casting of beam specimens and testing specimen of 4", 6", 8" cubes and 6" cylinder.
10. Slump test on course & fine aggregates from different sources.
11. Modulus of rupture test on beam specimens.

Recommended Books:

1. Properties of Concrete by A. M. Neville; Wiley John & Sons. (Latest Edition).
2. Concrete Design by Zahid Ahmad Siddiqi, Help Civil Engineering Publishers, Lahore, 2009.
3. Design of Concrete Structures by H. Nilson, McGraw-Hill. (Latest Edition).
4. Reinforced Concrete - Design & Behavior by C. K. Wang & Salmon.
5. Structural Concrete Theory and Design. By M.Nadim Hassoun & Akthem Al-Manaseer. 3rd Edition

CH-123 COMMUNICATION SKILLS (Annexure-B)

CT- 144 APPLIED MECHANICS

COURSE OUTLINE:

Introduction to statics:

Mechanics: Basic concepts; Scalar and vector; Vector addition, subtraction and product, concept and unit of measurements of mass, force, time, space

Force system: Force: Introduction; Two-dimensional force system; Rectangular components; Law of triangle, parallelogram, moment, couple, resultants; solution of problems.

Equilibrium: Equilibrium in two dimensions; Equilibrium conditions; free body diagram; solution of problems.

Friction: Introduction; Types of friction; Laws of solid friction; Co-efficient of friction, Solution of problems

Kinematics of rectilinear and curvilinear motion: Introduction; Displacement; Types of motion; Speed, velocity, acceleration; Equation

of motion under uniform acceleration; Normal and tangent acceleration, Solution of problems

Work and energy: Work, Energy, Power, Impulse; Momentum; Simple harmonic motion and free vibration.

Practical:

1. To determine the resultant of forces.
2. To study the law of moment and equilibrium conditions.
3. To determine the reaction of a simply supported beam through load cell.
4. To determine the tension in the simple cable through load cell.
5. To determine the reaction of a simply supported truss through load cell.
6. To study the projectile motion using photogate.
7. To study acceleration on an inclined plane using photogate.
8. To study Newton's second law of motion.

Recommended Books:

1. Hibler, RC. Engineering Mechanics, Prentice Hall (Latest Edition)
2. Engineering Mechanics And Dynamics by R.C.Hibbeler & Ashok Gupta, 11th Edition, Prentice Hall.
3. An Introduction to MECHANICS by David Kleppner, Robert Kolenknow Publisher: Tata MaGraw – Hill Education.

CT-154 MATERIALS & METHODS OF CONSTRUCTION

Objectives:

1. To develop an understanding of the properties, uses and behavior of the building materials, standards for material quality, various tests on materials.
2. To develop the basic understanding of construction techniques and methods of building construction with particular reference to R.C. work, brick work, flooring, damp-proofing, roofing and stairs.

Course Outline:

Bricks, Blocks and Tiles: Manufacture of bricks/blocks and its classifications, standard tests of bricks/blocks and characteristics of good bricks/blocks, process of manufacture of tiles. Ceramic materials.

Stones: Characteristics of good quality stones, dressing of building stones, properties and uses of common construction stones used in Pakistan. Location of stone queries in Pakistan.

Aggregate: Properties of aggregates, Los Angeles Abrasion Test, crushing strength, gradation, weathering effects, T.D.S.

Water, Lime, Cement and Timber: Qualities of water used for concrete mixes. Test and uses of lime. Methods of manufacture and storage of cement in different conditions. Classification and grading of sand and its bulking, cement sand mortars used for building construction. Characteristics, properties and performance of Pakistani timber used in construction. Seasoning and preservation of wood. Use of plywood, hard board and chipboard in construction.

Paints and Varnishes: Types of paints, Composition, preparation and application of paints, plaster, varnishes and distempers in building works.

Metals: Manufacture, characteristics and uses of Ferrous and Non--Ferrous metals and their alloys. Composition and uses of mild steel, cast iron, brass and aluminum in buildings.

Glass and Plastics: Composition, varieties, properties and uses of glass, plastics, laminates and adhesives in constructions. Properties and uses of asphalt, bitumen, rubber, asbestos and its products, plastic pipes, reinforced plastics.

Methods of Construction: Bonds in brick masonry and their formation in building construction, corbel, cornice, string course, parapets and slip joints. Masonry block. Stone masonry, Uses of stone in civil engineering. Use of Gabion walls.

Scaffolding work design and its importance in construction work. R. B. beams, columns, lintels and slab construction in buildings. ASTM Standards and testing of bricks.

Hand tools for construction. Foundation for walls and piers. Load bearing walls in brick and masonry construction, composite walls cavity construction, concrete framed structures panel walls, and external finishes. Reinforced concrete, materials in roof and floor construction, and floor finishes. Internal walls and partitions, surface finishes to internal walls and ceiling, doors and windows, staircases, damp proofing of walls and ceiling. Fire resistant construction. Tunnel and Cofferdams construction. Formwork for slabs, beams, columns & walls, etc. and its design. Formwork for shells. Standards, inspection & quality control of materials.

PRACTICAL:

1. Standard consistency test of cement.
2. Standard sizes of brick and blocks.
3. Determination of water absorption of a brick and stone.
4. Determination of efflorescence of brick.
5. Determination of compressive strength of brick/block.
6. Determination of moisture content of wood.
7. Determination of specific gravity of wood.
8. Fineness of Cement.
9. Fineness modulus of various sands.

Recommended Books:

1. Materials of. Construction by R. C. Smith and C. K. Andres, ISBN: . 0070585040, McGraw Hill. January 1987 (Latest Edition).
2. Fundamental of Building Construction: Material and Methods, by Edward B. Allen, (Latest Edition).
3. Building Construction Vol. I to Vol. IV by Mckay (Latest Edition).
4. Building Construction by Mitchall (Latest Edition).
5. Building Construction by Huntington (Latest Edition).
6. Civil Engineering Materials by Neil Jackson (Latest Edition).
7. Construction Materials by P. D. Domone, University College, London (Latest Edition).

CS-133 APPLIED MATHEMATICS – II (Annexure-E)

3rd Semester

CT-212 INTRODUCTION TO ARCHITECHURE AND TOWN PLANNING

Objectives:

To know about Architecture and Town Planning and their importance in civil engineering.

Course Outline:

Architecture:

General Introduction to history of architecture. Emergence and development of Islamic Architecture. Geographical, climatic, religious, social, historical aspects of architecture. Truth, purpose and beauty. Strength, vitality, grace, breadth and scale. Proportion, colour and balance Acoustics.

Forms and Molds. Introduction to architectural standards, public toilets, circulation areas, parking, public assembly. Local architecture, arches, cavity walls, local energy efficient materials. Thermal insulation of buildings. Ceiling height, external wall thickness etc.

Town Planning:

General Definitions, trends in urban growth, objectives of town planning, modern planning in Pakistan and abroad.

Preliminary Studies. Study of natural resources, economic resources, legal and administrative problems, civic survey preparation of relevant maps.

Land Use Patterns. Location of parks and recreation facilities, zoning and its aspects, public and semipublic building, civic centres, commercial centres, local shopping centres, public schools, industrial area and residential areas.

Street Pattern. Layout of streets, road crossings and lighting. Community planning.

City Extension and Master Planning. Suburban development, neighborhood unit, satellite towns and garden cities. Introduction to master planning.

Urban Planning. Inner city urban designs, Up-gradation of square/scattered settlements.

Recommended books:

Faculty may choose

CH-212 PAKISTAN STUDIES (ANNEXURE-F)

CT-223 QUANTITY SURVEYING AND CONTRACT DOCUMENTS

Objectives

1. To develop ability to measure construction works.
2. To develop a systematic approach of cost estimation of a construction job.
3. To develop an understanding of preparing of contract documents and managing / execution of civil engineering works.

Course Outline:

1. **Quantities**: Working out earthwork quantities for various civil engineering constructions. Calculating quantities for road embankments in plain and hilly areas and for irrigation channels. Quantities for roads, buildings, reservoirs, water supply, drainage projects, steel works and bridge construction. Estimates using computer spreadsheets
2. **Rate Analysis:** Scheduled and non-scheduled rates. Analysis of rates, abstract of costs. Significance of rate analysis and its application to market rates of material and labor. Rate analysis for various items of civil engineering works.

3. **Cost Estimates:** Systematic and logical approach to the estimating and costing of civil engineering works, rough cost & detailed estimates, bill of quantities and part bills for construction, costs and profit margins to be considered in the cost estimates. Estimates for roads, buildings, reservoirs, water supply, drainage projects, steel works and bridge construction. Estimates using computer spreadsheets.
4. **Contract Documents:** Introduction to work contracts and tendering. Types of contracts. Requirements of a specific contract, drawings necessary for a contract and those required during the execution of work. Tender documents, construction specifications, bill of quantities and other setting out data required for a contract. Time scheduling of different construction activities for the execution of the projects. General conditions of contract and special conditions of contract. International conditions of contract (FIDIC), Safety and control aspects required in the execution of the contract.
5. Use of Computer Spreadsheets in making bill of quantities (BOQ).
6. Labor output, incentives and laws.

PRACTICAL:

1. Workout 1:2:4 concrete for foundations, columns below plinth and plinth beams.
2. Workout 1:2:4 concrete for columns above plinth roof beams, roof slabs and projections.
3. Workout the quantities of single span and multi span beam reinforcement from given drawing.
4. Workout the quantities slab reinforcement from given drawing
5. Workout the quantities of overhead water tank concrete and its reinforcement.
6. Workout the quantities of RCC retaining wall concrete and its reinforcement.
7. Prepare material estimate for a single room complete in all respect.
8. Prepare complete estimate of a steel truss.
9. Prepare a detailed estimate of an RCC water overhead reservoir of 20,000 gallon capacity.
10. Prepare detailed estimate of a manhole.
11. Prepare detailed estimate of a septic tank and soakage pit.
12. Prepare bill of quantity and abstract of cost for a manhole and septic tank.
13. Estimate the quantities of all necessary items of work required for 1500ft long bituminous road.

14. Estimate the cost of construction of a concrete road 24'-6" wide and one mile long for given section. The concrete will have a proportion of 1:3:6 and 0.5 % reinforcement is to be used.
15. Calculate the volume of earth work from contour map.
16. Calculate the volume of earth work for irrigation channel (i) fully in cutting (ii) partially in cutting and filling.

Recommended Books:

1. Estimating Construction Costs by R. L. Peurifoy. McGraw-Hill. (Latest Edition).
2. Contract Specifications by Daniel and W. Mead (Latest Edition).
3. Construction Scheduling, Cost Optimization and Management by H. Adeli and A. Karim. (Latest Edition).
4. MES/Pak PWD Schedule of Rates (Latest Edition).
5. WAPDA Drafting Standards (Latest Edition).

CT-233 SOIL MECHANICS

Objectives:

1. To develop a basic understanding of the composition, classification, structure and properties of soils.
2. To obtain knowledge of application of soil as a construction material
3. To acquire the laboratory skills for determination of soil properties.

Course Outline:

Significance. Soil, rock and their types and formation. Physical properties of soil: water content, voids ratio, porosity, degree of saturation, specific gravity, unit weight and their determination, mass-volume relationships.

Soil Classification: Importance of classification tests. Atterberg's limits, grain size distribution; Classification systems.

Permeability and Seepage: Darcy's law, factors affecting permeability, laboratory and field determination of permeability. Seepage force, estimation of seepage quantity, quick sand condition, sand boiling and filters.

Compaction: Fundamentals, moisture density relationship, compaction standards, factors affecting compaction, field control and measurements of insitu density. Field compaction equipment.

Stress Distribution in Soils: types of soil stresses, stress induced due to structural loads: Westergaurd and Boussinesq's theories for stress evaluation. Pressure bulb, Stress distribution diagrams, Fadum Charts.

Consolidation: Mechanics of consolidation, Odometer test and data interpretation, primary and secondary consolidation. Normally and pre-consolidated soils.

Shear Strength: Concept, parameters, Coulomb's law, shear strength of cohesive and non-cohesive soils. Factors affecting shear strength of soil and its applications in engineering. Laboratory and field tests for determination of shear strength.
Earth Pressures: Definition, pressure at rest, active and passive earth pressures. Coulomb's and Rankine's theories. Earth pressure problems.
Slope Stability: Types of slopes, Factors affecting stability and remedies. Types of failure Methods of analysis.
Earth and Rock Fill Dams: Introduction, types of earth and rock fill dams and their components, general design considerations and typical cross-sections.

Practical:
1. Determination of moisture content of a soil sample.
2. Determination of Liquid limit of a soil sample.
3. Determination of Plastic limit of a soil sample.
4. Determination of Shrinkage limit of a soil sample.
5. Determination of Specific Gravity of a soil sample.
6. Determination of Grain size distribution of a Fine Grain Soil by Hydrometer Analysis.
7. Determination of Permeability of soil by constant Head Method
8. Determination of Permeability of soil by falling Head Method
9. Direct shear test of a soil sample.
10. Unconfined compression test of a soil sample.
11. Tri-axial compression test of a soil sample.
12. Consolidation test of a soil sample

Recommended Books:
1. Fundamentals of Soil Mechanics by M. S. Qureshi & Aziz Akbar, A-1 Publishers, Urdu Bazar, Lahore. (Latest Edition).
2. Soil Mechanics by A. R. Jumikis (Latest Edition).
3. Fundamental of Soil Mechanics by D. W. Taylor (Latest Edition).
4. Soil Mechanics by T. W. Lambe, Robert V. Whitman, John Willey & Sons. (Latest Edition).

CT-243 FLUID MECHANICS

Objectives:
1. To provide a broad concept of fluid mechanics.
2. To enable students to solve problems relating to pipe flow and open channel flow.

Course Outline:
Introduction: Fluid mechanics, hydrostatics, kinematics, hydrodynamics, hydraulics, solids and fluids, liquids and gases, units and dimensions.

Physical properties of fluids; Specific weight, density, specific volume, surface tension, compressibility, viscosity, units of viscosity, measurement of viscosity, Newton's equation of viscosity.

Fluid Statics: Pressure intensity and pressure head: pressure specific weight relationship, absolute and gauge pressure, measurement of pressure, Piezometer, Manometer, Pressure Transducers. Differential manometer and Bourden gauge.

Forces on submerged planes and curved surfaces and their applications. Buoyancy and floatation, Equilibrium of floating and submerged bodies.

Fluid Kinematics: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow. Path line, streamlines and stream tubes, Velocity and discharge, Equation of continuity for compressible and incompressible fluids.

Hydrodynamics: Different forms of energy in a flowing liquid, head, Bernoulli's equation and its application, E.L. & H.G.L., free and forced vortex.

Flow Measurement: Orifices and mouthpieces, sharp -crested weirs and notches, pitot tube and pitot-static tube, Venturimeter, Salt velocity method, colour velocity method, Radioisotope methods.

Steady Flow through Pipes: Losses in pipe lines, minor and major losses, Darcy-Weisbach equation for major loss of head in pipes, Pipes in series and parallel, Transmission of energy through pipes, Introduction to computer aided analysis of pipe networks.

Uniform Flow in Open Channels: Chezy's and Manning's equations, Bazin's and Kutter's equation. Most economical sections for rectangular and trapezoidal channels.

Practical

1. Determination of viscosity of a given liquid using viscometer.
2. Determination of velocity through Pitot tube.
3. Determination of coefficient of discharge using venturimeter.
4. Determination of coefficient of discharge of the orifices.
5. Determination of coefficient of discharge using rectangular notch.
6. Determination of discharge using V-notch.
7. To investigate the validity of the Bernoulli"s equation for steady flow of water.

Recommended Books:

1. Fluid Mechanics for Civil Engineers by N. B. Webber, Chapman & Hall, (Latest Edition).
2. Fluid Mechanics with Engineering Applications by Dougherty, Franzine and Fennimore, McGraw Hill, New York. (Latest Edition).
3. An Introduction to Engineering Fluid Mechanics by J. A. Fox, Macmillan Company (Latest Edition).

4. Mechanics of Fluids by B. S. Massey, Wan Nost Reinhold International Rand hold Company Ltd., London (Latest Edition).
5. Mechanics of Fluids by J. W. Ireland, Bulterworth & Company, London (Latest Edition).

CT 254 MECHANICS OF SOLIDS

Objectives

1. To develop an understanding of analysis of the magnitudes and distribution of internal forces in the body by the concept of free body diagram under external loads.
2. To calculate the shearing force and bending moment in simply supported and cantilever beams.
3. Understanding of equilibrium conditions.

COURSE OUTLINE:

Stress & Strain: Kind of stresses and strain, Hook's law, Modulus of elasticity, Lateral & Volumetric strain, Poison's ratio, Load extension diagrams for different materials, Temperature stresses and compound bars. Principle Stress & Strain: Construction of Mohr's circle for stress & strain.

Bending Theory: Theory of simple bending, position of neutral axis, moment of resistance and section modulus, Bending and shearing stress distribution in beams; Relationship between load, shear force and bending moment.

Slope and Deflection of Beams: Relation between slope deflection and radius of curvature. Slope and deflection of a beam using Integration method.

Torque in Structural Member: Theory of torsion in circular shafts. Derivation of torsion equation and its application to solid and hollow circular cross-section. Sources of torsion in structures.

Columns and Struts: Behaviour of short and long columns. Euler's theory of buckling of long columns and other empirical formulae.

Practical:

1. To determine the compressive strength of cement.
2. To determine the Tensile strength of cement.
3. To familiarize the students about the functions of Universal Testing Machine.
4. To perform tensile test on a mild steel specimen and to determine yield strength, ultimate strength, rupture strength and percentage elongation.
5. Hardness test on a given metal specimen using Avery's Rockwell testing machine.

6. To perform the Izod Impact Test for the given metals.
7. To perform the Charpy's Impact Test for the given metals.
8. To determine shear strength of a half-inch dia steel bar.
9. To determine the modulus of elasticity of the material of given rectangular beam.
10. To determine modulus of rigidity of the material of given specimen with circular cross-section.
11. To perform Bending test on wooden beam.
12. To determine the Brinell hardness number of given specimen by Brinell hardness testing machine.
13. Torsion test on a given specimen by torsion Testing Machine.

Recommended Books:

1. Strength of Materials by Andrew Pytel Ferdinand L.Singer. Harper Collins Publishers.
2. Strength of Materials By R. K. Bansal
3. Mechanics of Materials By James M. Gere, Barry J. Goodno (Seventh Edition)
4. Mechanics of Materials By Andrew Pytel, Jaan Kiusalaas (Second Edition)

4th Semester

CT-264 TRANSPORTATION ENGINEERING

Objectives:

1. To develop an understanding of the fundamentals of highway geometry and to apply it in the design of Highways & Railways.
2. To produce an ability to use the survey works in the development of layouts of Highways & Railways.

Course Outline:

1. **Road Standards:** NHA, AASHTO and Road Note 31, recommendations for the design of roads regarding:
    - i) Design parameters.
    - ii) Cross-sectional elements of roads such as lane widths, shoulder widths, median widths, edge clearance, ROW (right of way) requirements, sight distances etc.
    - iii) Road layout parameters.
    - iv) Road camber gradient and super elevation.
    - v) Vertical and horizontal alignment of road.
2. **Geometric Design:** Geometric aspects of highways, design of transportation facilities based on operational capacity, site constraints and safety considerations. Layout of circular, transition

and vertical curves. Traffic surveys for design and improvement of roads.

3. **Intersections:** Factors influencing the layout of junctions and design of roundabouts, provision of junctions on single carriageway and dual carriageway sites. Parking spaces, underpasses, motorways, flyovers, motorway intersections. Widening of roads on curves.
4. **Road Drainage and Protection:** Surface and sub-surface road drainage, camber and grade for highways surface drainage and proper sub-grade for sub-surface drainage, drainage structures of the required capacity for cross drainage.
5. **Airports:** Factors affecting site selection and layout of airport with respect to geographical, aeronautical, political and economic conditions. Wheel loads of different aircrafts. Introduction to pavements and typical cross-sections. Introduction to layout of airport buildings.
6. **Railways:** Track structure, railway alignment & grades, cross section of railway tracks & their laying, points, crossing and level crossing. Modern method of laying railway tracks. Railway organization in Pakistan.
7. **Mass Transit Systems**

PRACTICAL:

1. To determine the C.B.R Sub grade soil for soaked sample of soil.
2. To determine the C.B.R Sub grade soil for unsoaked sample of soil.
3. To determine Resistance to degradation of small-size Coarse Aggregate by Abrasion and Impact in the LOS ANGLES machine.
4. To Determine Specific Gravity and Absorption of Course Aggregate.
5. To Determine Penetration grade of bituminous materials.
6. To Determine flash and fire points By Cleveland Open Cup.
7. To Determine Softening Point of Asphalt (Bitumen) and tar by Ring and Ball apparatus.
8. To Determine Impact Value of Aggregates.
9. To Determine the Flakiness index and Elongation Index.
10. Float Test Bituminous Material.
11. To Determine Viscosity of Asphalt by Vacuum Capillary Viscometer.
12. To Determine Specific Gravity of Semi Solid Bituminous Materials by Pyconometer.
13. To Determine Ductility of Bituminous Materials
14. Exercises to calculate the quantities of materials required for various types of pavements and various sections of highways.
15. Exercises for provision of transition curves and re-alignments of curves.
16. Performing standard and modified Proctor test.
17. Find field density by core cutter and sand replacement method.

18. Performing standard penetration test.
19. Demarcation of road alignment on a given contour map.

Recommended Books:

1. Highway Engineering by C. H. Oglesby, Russell G. Hicks. ISBN: 047102936X. John Willey & Sons. (Latest Edition).
2. A Policy on Geometric Design of Highways & Streets AASHTO Staff, ISBN: 1560510013. (Latest Edition).
3. Hand Books of Highway Engineering by Baker (Latest Edition).
4. Railways, Bridges and Tunnels by S. K. Sharma (Latest Edition).
5. Roads, Railways, Bridges and Tunnels by Deshpande Antia and Shahna (Latest Edition).
6. Highway Design Manual, Highway Department, Govt. of the Punjab (latest edition)

CT-274 WATER SUPPLY AND WASTE WATER MANAGEMENT

Objectives:

1. To introduce basic concepts relating to the provisions of water supply and wastewater collection facilities.
2. To enable students to design water supply and wastewater collection systems.

Course Outline:

1. **Introduction:** Water supply and wastewater collection systems and their importance with respect to human health. Water borne diseases. Types of impurities and their affects on human health standards, WHO standards. Study of water treatment plant
2. **Estimation of Water Demand:** Water consumption. Components of water consumption. Factors affecting consumption. Fire demand. Variations in demand: average daily consumption maximum daily consumption and peak hourly consumption. Commonly used values of water consumption. Local design guidelines. Design period: factors affecting design period. Commonly used design period and local criteria. Population forecasting: mathematical and graphical methods of forecasting population. Population density.
3. **Source of Water:** Ground and surface source. Selection of water sources with respect to quantity and quality considerations.
4. **Collection and Distribution of Water:** Intake structure: reservoir, river and canal intakes. Methods of water distribution. Components and layout of water distribution system. Storage capacity of overhead reservoirs. Use of Hazen William formula for the design of water distributions systems. Hardy Cross method. Use of microcomputers

in design. Types of pipes and their use in water distribution. Pipe joints, service connection. Valves and fire hydrants. Construction of water distribution systems. Disinfections of old and new pipes. Water waste surveys and tracing of leakages. Pipes in series and parallel, heard losses, major losses minor losses.

5. **Estimation of Wastewater Quantities:** General considerations. Classification of sewage and sewer systems. Combined and separate sewer systems. Estimation of sanitary sewage quantities. Estimation of storm flow: the rational method, runoff coefficients, Intensity-Duration Frequency relationships. Study of waste water treatment plant
6. **Design of Sewer Systems:** Layout of sewers. Sewer appurtenances: manholes, drop-manholes and storm water inlets. Design criteria for sanitary and storm sewers. Self-cleansing velocity. Use of Manning's Equation for the design of sanitary and storm sewers. Construction of sewers: types of beddings, joints and laying of sewers. Sewer testing. Sewer cleaning equipment.

Practical:

1. Forecasting population of various cities using different methods.
2. Detailed study of different types of valves.
3.. Detailed study of different pipe material and joints for water supply and sewerage.
3. Design of a transmission main.
5. Design of water distribution system for a housing scheme.
6. Design of a sanitary sewer system.
7. Design of storm sewer system.
8. Preparation of drawings for different bedding of sewers.
9. Preparation of working drawings for manholes, drop manholes and storm water inlets.
10. To determine the Bio-chemical Oxygen Demand of waste water sample.
11. To determine the amount of suspended solids in drinking water and waste water samples by photometric method.
12. Determination of volatile suspended solids (MLVSS) in waste water samples by gravimetric method.
13. To determine the turbidity of continuous flow by Low Range Turbid meter.
14. Determination of oil and grease by Partition- Gravimetric method in wastewater.
15. Determination of ortho-phosphate in water and wastewater sample by Ascorbic acid method.
16. To determine the concentration of Nitrate and Lead in different water samples by ion Selective electrode.

Recommended Books:

1. Water Supply and Sewerage by E. W. Steel and L. J. McGhee. McGraw Hill, New York. (Latest Edition).
2. Water and Wastewater Technology by M. J. Hammer, John Wiley & Sons. New York, (Latest Edition).
3. Wastewater Engineering: Collection and Pumping of Wastewater by Metcalf and Eddy. McGraw-Hill, New York, (Latest Edition).

CM-213 ENVIRONMENTAL MANAGEMENT

Course Outline:

1. Introduction to solid waste, classification of solid waste. Collection methods, transfer and transportation of solid waste, type of equipment, recycling, reuse and disposal of solid waste, BOD and COD.
2. Sewage treatment and disposal: Primary, secondary and tertiary treatment
3. Air pollution: Introduction to air pollution, sources of air pollution, its effects, classification and control. Introduction to EIA functions of Environmental Pollution Council, role of provincial EPAs, Environmental Protection Act, 1977, National Environmental Quality Standards.
4. Introduction to noise pollution and its mitigation measures.
5. Environmental health and safety.

Practical:

1. To determine the Bio-Chemical Oxygen Demand of waste water sample.
2. To determine the amount of suspended solids in drinking water and waste water sample by photometric method.
3. To determine the amount of settle able solids in waste sample.
4. To determine the turbidity of continuous flow by Low Range Turbid meter.
5. To determine the amount of volatile suspended solids (MLVSS) in waste water sample by gravimetric method.
6. Determination of Oil and Grease by Partition – Gravimetric Method in wastewater
7. Determination of the impact of discharges on the surface water (river, canal etc)
8. Composition of solid waste (percentage)
9. Energy Value.
10. Moisture content.
11. Nox and Sox by hand meters.
12. Carbon monoxide by hand meters.

Recommended Books:

1. Introduction to Environmental Engineering by Peavy (McGraw-Hill)
2. Environmental Engineering by Mckenze (McGraw-Hill)
3. Environmental Profile of Pakistan by IUCN.
4. National Conservation Strategy by IUCN.
5. ILO laws regulations

CT-283 THEORY OF STRUCTURES

Objectives:

1. To develop the understanding of the behavior of determinate structures with reference to beams and frames.
2. To provide the concept of statically indeterminate structures illustrating their application to structures like beams, trusses and rigid frames.
3. To understand the behavior of arches and suspension cables.

Course Outline:

Determinacy of Structures: Static stability and determinacy of structures.

Analysis of Determinate Structures; Common types of trusses, analysis of truss by method of joints. Analysis of frames, Arches, Cables and Suspension bridges.

Moment Distribution Method: Concept, stiffness and carry-over factors, distribution factors, analysis of continuous beams and frames without sideway.

Influence lines: Concept of influence lines, influence line diagrams for statically determinate beams and its application. Maximum shear force and bending moment for moving loads.

Rotation and Deflection: Rotation and deflection of beams by Unit Load Method Moment- Area Method and Conjugate beam method.

Beams and frames under complex loading: Bending moment and shear force diagrams for statically determinate beams and frames under complex loading.

PRACTICAL: Practical work will be based on above theory Design Class.

Recommended Books:

1. Structural Analysis by R.C.Hibbler. Prentice Hall. 6th Edition.
2. Theory of Structures by J. C. McCormac. Harper & Colins Publishers
3. Statically Indeterminate Structures by C. K. Wang, McGraw-Hill (Latest Edition).

CH-213 TECHNICAL REPORT WRITING (Annexure-J)

5th Semester

CT-313 HYDROLOGY

Objectives:
1. To provide a broad concept of basic hydrology.
2. To enable students to calculate surface runoff and ground water flows.

Course Outline:
Introduction: Hydrology, hydrological cycle and the hydrological equation, practical uses of hydrology, importance of hydrology.
Meteorology: The atmosphere and its composition, relative humidity, dew point and their measurement devices, Saturation deficit, Solar radiations as a source of heat, adiabatic changes and the laps rate, air temperature, seasonal and diurnal variation of air temperature, The general circulation of wind system, the monsoon and western disturbances, Measurement of air temperature, relative humidity, radiation, sunshine and atmospheric pressure.
Precipitation: Type of precipitation, factors necessary for the formation of precipitation, measurement of precipitation, interpretation of precipitation data.
Evaporation and Transpiration: Factors affecting evaporation, measurement of evaporation, evapo-transpiration.
Stream flow: Water stage and its measurement, selection of site for stage record, selection of control and metering section, methods of measurement of stream flow, interpretation of stream flow data.
Runoff: Factors affecting runoff, estimating the volume of storm runoff.
Hydrograph: Characteristics of hydrograph, components of hydrograph, hydrograph separation, estimating the volume of direct runoff, introduction to unit hydrograph concept, S-curve.
Floods and their estimates: Introduction to floods, causes of floods, methods for the estimation of floods, flood estimation from past flood marks, Rational formula, empirical formulae, using unit hydrograph method and flood frequency analysis.
Ground Water Flow: Introduction, sources and discharge of ground water. Water table and artesian aquifer. The Thiem and Theis formula and its application to aquifer tests.

Practical
1. Determination of velocity and discharge using current meter.
2. Determination of velocity and discharge using floats.
3. Study of the barometer.
4. Study of the rainfall gauge.

5. Measurement of wind velocity.
6. Measurement of humidity.
7. Measurement of atmospheric temperature.

Recommended Books:

1. Hydrology for Engineers by Linsley, Kohler and Paulhus. McGraw-Hill, New York, 1982 (Latest Edition).
2. Handbook of Applied Hydrology by Chow, McGraw Hill, New York (Latest Edition).
3. Introduction to Hydrology by Viessman, Lewis and Knapp. Harper and Row, New York (Latest Edition).

CT-323 REINFORCED CONCRETE STRUCTURES

Objectives:

1. To develop an understanding of the behavior of reinforced concrete members.
2. To develop an ability of design and preparing working drawings of concrete structures.

Course Outline:

Principles of Reinforced Concrete. Basic concepts of reinforced concrete; basic concepts of working stress method and ultimate strength method.

Slabs. Analysis of one-way and two-way slabs with general discussion of other slab system; Design for flexure and shear.

Columns; Analysis of section in pre compression; Design of short columns under pure compression and with eccentric loading.

Beams; Analysis and design of prismatic singly reinforced, doubly reinforced and T-beams section in flexure, shear by using ultimate strength design method.

Detailing . Preparation of working drawings of structural elements. Details of bar Bending and preparation of schedules.

Staircase. Design of staircase of different types spanning both horizontally and vertically.

Joints. Introduction to columns and beam joints

Practical: Practicing problem of slabs, beams, columns

Recommended Books:

1. Design of Concrete Structures by H. Nilson, McGraw- Hill.
2. Reinforced Concrete – Design & Behavior by C. K. Wang & Salmon.
3. Reinforced Concrete by J-Faber and F. Meed; Chapman & Hall.
4. Reinforced Concrete design by Keneth Leet (Latest edition)

CT-333 CONSTRUCTION & HYDRAULIC MACHINERY

Course Outline:

Brief Discussion on Use, Productivity and Economics of Equipment for Heavy Construction Operations, including; Tractors, Dozers, Scrapers, Motor Graders, Power Shovels, Off-Road Haulers, Front-End Loaders, Backhoes, Draglines, Trenchers, Rock Drilling Equipment, Crushers, Conveyors.

Impulse Turbine: Introduction, types of Impulse turbines, Pelton Wheel and Turgo Turbine; their main components and functions, work done by the Pelton wheel, specific speed.

Reaction Turbine: Introduction, types, Francis reaction turbine and Kaplan turbine, main components and their functions. Cavitation and Pitting. Governing of turbines. Similarity laws and factors for turbo machines.

Pumps: Introduction and types of pumps.

Centrifugal pump: classification, main components and their functions. Work done by the Centrifugal Pump. Maximum suction lift of the pump, Specific Speed, Shut-off head and Normal discharge of the pump.

Reciprocating pump: Introduction, types, single and double acting pinups, indicator diagram, acceleration head, maximum suction head and use of air vessels.

CT-343 COMPUTER AIDED BUILDING, MODELING AND DESIGN

Objective:

1. To enhance the capabilities of student to independently prepare the building drawings and develop an ability to analyses and design structures by commercially used computer packages

Course Outline:

Fundamentals of CAD; Introduction, the design process, application of computers for design, creating the manufacturing data base, benefits of CAD.

Hardware in CAD; The design workstation, graphics terminal, operator input devices, plotters and other output devices, the central processing unit, secondary storage.

Computer Graphics Software and Data Base; The software configuration of a graphics system, functions of a graphic package, constructing the geometry, data base structure and content, wire-frame versus solid modeling, other CAD features and CAD/CAM integration.

Mathematical Elements of CAD; Two dimensional transformations, Translation, Scaling, and Rotation, Concatenation, Various techniques for design optimization, finite element analysis / modeling.

Design Software; Use of different software packages employed in several Civil Engineering applications.

Recommended books

- Faculty may choose

CT-353 FOUNDATIONS ENGINEERING

Objectives:

1. To develop an ability of applying the layout and alignment parameters to the highway design and its construction.
2. To develop an understanding of the design of rigid and flexible pavements.
3. To understand the design of foundations.

Course Outline:

- **Definitions:** Foundation, contact pressure, allowable bearing capacity, total and differential settlements, permissible settlement.
- **Foundation Types:** Shallow foundation, deep foundation. Choice of foundation, type and depth of foundation, foundation design requirements. Foundation design geotechnical design and structural design.
- **Shallow Foundation:** Types of shallow foundation, Design of Isolated and combined footing.
- **Deep Foundations:** Piles, caissions, piers, well foundation. Types of piles, pile capacity, pile group, proportioning of pile cap. Function of piles and their uses. Negative skin friction (down drag).
- **Lateral Earth Pressure:** Rankine‟s & coulomb‟s Theories of Lateral earth pressure; analysis of earth retaining structure, Types of retaining wall.
- **Slope stability**

Practical:

1. Boring log with SPT values up to 30 ft.
2. Plate load test.

Recommended Books:

1. Foundation Analysis and Design by J. E. Bowles, 5th Edition, McGraw-Hill. ISBN: 0070068739. January, 1996.
2. Foundation Engineering by Ralph B. Peck, W.E. Hanson, Thomas H. Thorn burn; John Willey & Sons, (latest Edition).
3. Foundation Design and Construction by Michael. J. Tomlinson; Longman Publishing Group. ISBN: 058222697X. January 1996.
4. Foundation Design by W. C. Teng; Prentice Hall. ISBN: 0133298051.

5. Geotechnical Engineering: Foundation Design by John. N. Cernica, John; Willey & Sons. ISBN: 0471308870. January 1994.
6. Principles of Pavement Design by E. J. Yoder and M. W. Witezak,

CM-313 PROJECT MANAGEMENT (Annexure-I)

6th Semester

CT-363 PRE-STRESSED & PRE-CAST CONCRETE

Objectives

1. To develop a basic understanding of the properties of steel and concrete to be used in pre-stressed concrete structures.
2. To analyze the behavior of pre-stressed concrete members.
3. To study casting of pre-cast & pre stressed concrete members.

Course Outline:

Introduction: Materials, pre-stressing system, end anchorages, pre-stress losses, methods of pre-stressing, pre-tensioning and post--tensioning procedures. Merits and demerits of Pre-stressing.

Design: Analysis and design of pre-stressed concrete members for flexure, shear bond and bearings. Ultimate strength, composite sections, beam deflection and layouts. Steel strands, tendon layouts.

Precast Units: Shapes of precast units, single tee, double tee and hollow core-sections. Design aids, load tables, design of precast units, casting and curing of units. Typical joints for precast elements. Erection methods, precast units and their specifications.

PRACTICAL:

1. A general study of essential equipment for precast concrete industry.
2. Making form work for precast concrete members and grills and casting of the specimens.
3. Study of equipment and machinery for pre-stressed concrete industry
4. Casting and testing of specimens of pre-stressed concrete units.
5. Casting and testing of specimens of precast RC concrete units. \

Recommended Books:

1. Pre-stressed Concrete Structures by T. Y. Lin, Ned H. Burns, (Latest Edition).
2. PCI Design Handbook: Precast & Pre-stressed Concrete by Precast/Pre-stressed Concrete Institute, (Latest Edition).
3. Pre-stressed Concrete Design by Computer by R. Hulse, W.H.

Mosley, (Latest Edition).
4. Introduction to Pre-stressed Concrete Vol. I by B. W. Abeles (Latest Edition).
5. Pre-stressed Concrete by Khachaturain (Latest Edition).
6. Pre-stressed Concrete Beams Design and Logical Analysis by Nilby (Latest Edition).
7. Pre-stressed Concrete for Architects Engineers by H. Kent. Preston (Latest Edition).
8. Modern Pre-stressed Concrete by James R. Libby (Latest Edition).

CT-373 GEOLOGY & EARTHQUAKE ENGINEERING

Objectives:

1. To understand geology or various minerals and rocks and their properties.
2. To learn to select and evaluate proper site for civil engineering projects.
3. To provide a fundamental understanding of causes responsible for occurrence of Earthquake.
4. To provide basic knowledge about the response of buildings when subjected to Seismic excitations
5. To identify the type of seismic damages in buildings.
6. To provide knowledge about various methods of strengthening the building structure against earthquake.

Course Outline:

1. **Introduction.** Introduction to Geology. Importance of Geology in civil engineering projects. Sedimentary, igneous and metamorphic rocks. Volcanic activity. Internal structure of the Earth. Engineering and physical properties of rocks. Identification of common rock forming minerals.

2. Geology in Civil Technology. Role of geology in selection of sites for dams, reservoirs, tunnels and other important civil engineering projects, such as highways, airfield and bridges.

Ground subsidence: Mining subsidence due to alteration of fluid levels. Methods of avoiding mine collapses. Introduction to blasting. Geological survey for tunneling, lining of tunnels. Brief introduction to local geology.

3. Structural Geology. Introduction to structural Geology and plate tectonics.

Land-sliding and its causes. Introduction to Hydrogeology: wells, springs, streams and ground water conditions. Causes of glaciers and their types

4. Introduction to Earthquake Engineering: Introduction, Earthquake magnitude & intensity, importance of ground conditions, Nature of seismic forces, Factors affecting the severity of seismic forces, Retrofitting its objectives, approaches & Techniques

PRACTICAL

1. To study physical properties of minerals.
2. To identify minerals on the basis of physical properties.
3. Prepare data sheet for mineral identification.
4. To study rock types and their classification.
5. To differentiate between different types of rocks.
6. To identify and classify igneous, plutonic and volcanic rocks.
7. Prepare data sheet for identification of igneous rocks.
8. To Study sedimentary rocks.
9. To differentiate between different types of sedimentary rocks.
10. Prepare data sheet for identification of sedimentary rocks.
11. To study Metamorphic rocks.
12. To identify and classify metamorphic rocks.
13. Prepare data sheet for identification of metamorphic rocks.
14. Study and interpretation of a geological map
15. To draw a geological cross section from a geological map.

Recommended Books:

1. A Geology for Engineers, Blyth, F G H 7th Arnold International student edition.
2. Principles of Engineering Geology and Geotechnics, Krynine, DP 1st Edition McGraw-Hill International edition.
3. Geology and Tectonics of Pakistan by Kazmi and Jan (Latest Edition)
4. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrihande published by Prentice Hall of India.
5. Seismic Design for Architects by Andrew Charleson ISBN: 978-0-7506-8550-4

CT-383 IRRIGATION AND HYDRAULIC STRUCTURES

Objective:

To develop an understanding of irrigation resources and apply for head works & barrages.

Course Outline:

- Irrigation; Definition and types of irrigation.
  - Merits and demerits of irrigation
  - Indus basin irrigation system.
- Design of irrigation channels
  - Regime (Empirical) Methods for design of irrigation channels.
  - Semi Empirical Approaches
  - Rational methods for design of irrigation channels.
  - Comparison of various methods.

- Canal Irrigation
  - Elementary concept about canal head works
  - Selection of their site and layout
  - Weirs and barrages
  - Various components and functions.
- Dams
  - Types of Storage Dams.
  - Forces on Dams.
  - Design of Gravity Dams.
  - Reservoir Engineering.
  - Regulation of Storage Reservoirs.
- Hydro Power Engineering
- Water Logging and Drainage:
  - Soil salinity, water logging their environmental impact & assessment.
  - Introduction to Drainage and Drainage system.

Practical

1. Design of channels in alluvial soil.
2. Study of canal fall.
3. Study of outlet.
4. Study of a barrage on pervious foundation.
5. Determination of loss of total head in converging and diverging flow.
6. Measurement of velocity with pitot tube in a closed conduit.
7. To determine the discharge in orifice under varying head.
8. Study of Hydraulic Jump.
9. To study flow channel (by Hydraulic Bench)
10. To study flow over weir (by Hydraulic Bench)

Recommended Books:

1. Irrigation and Hydraulic Structures (Theory, Design and Practice by Dr. Iqbal Ali, Institute of Environmental Engineering & Research, NED University of Engineering & Technology, Karachi (Latest Edition).
2. Irrigation Canals by Iqtidar H. Siddiqi (Latest Edition).
3. Fundamentals of Irrigation Engineering by V. B. Piryani (Latest Edition).

CT-393 STEEL STRUCTURES

Objective

1. To develop an understanding of the behavior and design of structural steel members and connections using ASD (Allowable stress design) method.

2. To develop an understanding of the behavior and characteristics of structural steel systems.

Course Outline:
Introduction; Steel properties, design loads and load factors; Types and shapes of structural steel members; specifications and design codes, safety factors
Tension members; Design and analysis of tension member.
Flexural members; Design of lanterally supported and unsupported beams; deflection check
Compression members; Design and analysis of axially and eccentrically loaded short and long columns
Connections; Types of high strength bolts and rivets; Friction and bearing type connections; Continuous beam to beam and beam to column connection.
New Design Codes; Introduction to LRFD method (load resistance factor design)

Practical:
Practical will be based on Design Class.

Recommended Books:

1. LRFD Steel Design by William T. Segui; PWS Publishers. ISBN:053493353X. (Latest Edition)
3. Steel Structures by Z. A. Siddiqi, M. A. Chaudhry and M. Ashraf, Civil Engineering Series Publishers (Latest Edition).
3 RFD Steel Design Aids in SI Units by Z. A. Siddiqi, M. A. Chaudhry & M. Ashraf; Civil Engineering Series Publishers.
4. Structural Steel Design LRFD Method (Second Edition) by Jack C. McCormac; Harper Collins Publishers. ISBN: 0065016270. (Latest Edition)

CT-3103 PROJECT
CT-3113

Objectives:
To develop the ability of exercising the analysis and design of construction / highway projects.

Course Outline: The project involves survey, analysis and design of Civil Engineering project. The student is in close consultation with department faculty will complete the project using Library, Computer or Laboratory facilities. Progress reports and a comprehensive written report are required.

Note:

The student(s) to undertake project during 6th semester and its following summer. 06 credit hours academic work be undertaken as follows:-

- Three credit hours work during 6th Semester under the guidance of departmental faculty. The work that entails supervised work entails problem analysis, timeline & Schedule, Literature Review, conceptual / Actual design, design validation and material selection.
- Three credit hours during summer where student(s) will work independently and may seek guidance from the concerned Faculty / Project Supervisor. The independent working of student(s) entails Manufacturing / Fabrication (Economical Prototype / Model production if required), Assembly, test & Trials and logging of results, Report writing and presentation.

7th Semester

CT-4116	**16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING**	**(Annexure - K)**

8th Semester

CT-4216	**16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING**	**(Annexure - K)**

BSc MECHANICAL ENGINEERING TECHNOLOGY

1st Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	MH-112	Islamic Studies/ Professional Ethics	Humanities	2	0	2	0
2	MS-113	Applied Physics	Natural Science	2	1	2	3
3	MS-123	Applied Mathematics-I	Natural Science	3	0	3	0
4	MS-133	Applied Chemistry	Natural Science	2	1	2	3
5	MS-143	Introduction to Computer Fundamentals	Computer Science	1	2	1	6
6	MT-113	Workshop Technology	Engineering Foundation	1	2	1	6
Total				11	06	**11**	**18**
Grand Total				**11 + 06 = 17**		**11+18 = 29**	

2nd Semester First Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	MS-153	Applied Mathematic - II	Natural Science	3	0	3	0
2	MH-122	Pakistan Studies	Humanities	2	0	2	0
3	MT-124	Technical Drawing and CAD-1	Engineering Foundation	2	2	2	6
4	MT-134	Applied Thermo-dynamics- 1	Engineering Foundation	2	2	2	6
5	MT-144	Basic Electrical & Electronics	Engineering Foundation	2	2	2	6
Total				**11**	**06**	**11**	**18**
Grand Total				**11 + 06 = 17**		**11 + 18 = 29**	

BSc MECHANICAL ENGINEERING TECHNOLOGY

3rd Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	MH-213	Communication Skills	Humanities/ English	3	0	3	0
2	MT-213	CAD - II	Major based Breadth	0	3	0	9
3	MT-223	Industrial Material	Engineering Foundation	2	1	2	3
4	MT-233	Mechanics of Material	Engineering Foundation	2	1	2	3
5	MT-243	Applied Thermo-dynamics - II	Major based Breadth	2	1	2	3
Total				09	06	09	18
Grand Total				**09 + 06 = 15**		**09 + 18 = 27**	

4th Semester Second Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	MT-253	Machine Design	Major based Breadth	3	0	3	0
2	MT-264	Fluid Mechanics	Major based Breadth	2	2	2	6
3	MT-273	Engineering Statics	Major based Breadth	2	1	2	3
4	MS-213	Probability and Statistics	Natural Science	3	0	3	0
5	MM-212	Total Quality Management	Management Science	2	0	2	0
6	MH-223	Technical Report Writing	Humanities / English	3	0	3	0
Total				**15**	**03**	**15**	**09**
Grand Total				**15 + 03 = 18**		**15 + 09 = 24**	

BSc MECHANICAL ENGINEERING TECHNOLOGY

5th Semester Third Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	MT-313	Heat Transfer	Major based Depth	2	1	2	3
2	MT-324	I C Engine	Major based Depth	2	2	2	6
3	MT-333	Dynamics	Major based Depth	2	1	2	3
4	MT-343	Manufacturing Processes	Major based Depth	2	1	2	3
5	MM-313	Project Management	Management Science	3	0	3	0
6	MH-312	Economics	Humanities	2	0	2	0
Total				**13**	**05**	**13**	**15**
Grand Total				**13 + 05 = 18**		**13+ 15 = 28**	

6th Semester Third Year:

S No	Course Code	Subject	Nature	Credit Hours		Weekly Contact Hours	
				Theory	Practical	Theory	Practical
1	MT-353	Instrumentation and Control	Major based Depth	2	1	2	3
2	MT-363	Mechanical Vibration	Major based Depth	2	1	2	3
3	MT-373	Refrigeration & Air Conditioning	Major based Depth	2	1	2	3
4	MT-384	Material Handling and Safety	Major based Depth	3	1	3	3
5	MT-393	Project	Major based Depth	0	3	0	9
Total				09	07	09	21
Grand Total				**09 + 07 = 16**		**09 + 21 = 30**	

BSc MECHANICAL ENGINEERING TECHNOLOGY

6th Semester Third Year Summer Project Work:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	MT-3103	Project (Continue)	0	03	0	09
Grand Total			**00+ 03 = 03**		**00 + 09 = 09**	

7th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	MT-4116	16 Weeks Supervised Industrial / Field Training (8x5=40 Hrs / Week)	0	16	0	40x16 = 640
Total			**0**	**16**	**0**	**640**
Grand Total			**0 + 16 = 16**		**0 + 640 = 640**	

8th Semester Fourth Year:

S. No	Course Code	Subject	Credit Hours		Contact Hours	
			Theory	Practical	Theory	Practical
1	MT-4216	16 Weeks Supervised Industrial / Field Training (8x5=40 Hrs / Week)	0	16	0	40x16 = 640
Total			**0**	**16**	**0**	**640**
Grand Total			**0+ 16 = 16**		**0+ 640 = 640**	

- *Complete guidelines for 32 weeks Continuous Supervised Industrial/ Field Training are available in Annexure-K.*

Summary:

BSc Mechanical Engineering Technology		
Semester	**Credit Hours**	
	Theory	**Practical**
1st	11	6
2nd	11	6
3rd	9	6
4th	15	3
5th	13	5
6th	9	7
6th Summer	0	3
7th	0	16
8th	0	16
Total	**68**	**68**
G. Total	**136**	

DETAILS OF COURSES (MECHANICAL ENGG TECH)

1st Semester

MH-112	**ISLAMIC STUDIES / PROFESSIONAL ETHICS**	**(Annexure-A)**
MS-113	**APPLIED PHYSICS**	**(Annexure-C)**
MS-123	**APPLIED MATHEMATICS- I**	**(Annexure-D)**
MS-133	**APPLIED CHEMISTRY**	**(Annexure-G)**
MS-143	**INTRODUCTION TO COMPUTER FUNDAMENTALS**	**(Annexure- H)**

MT-113 WORKSHOP TECHNOLOGY

Objectives:

After the completion of the course, the student shall be able to
Practice workshop safety rules effectively
Acquire knowledge and use simple hand tools
Acquire knowledge and use simple measuring and gauging instruments
Operate simple drilling machines for producing small holes
Operate various machine tools for producing simple metal components and articles
Acquire knowledge and practice on foundry, forging and welding

Course outlines:

Work Shop

- Workshop Safety precaution for each workshops.
- Introduction to Machining theory & practice.
- Mechanism of Chip Formation & Types.
- Tool Life, Cutting force, Cutting Tool Materials, Cutting Fluids & Machine able Material.
- Lathe & Milling Types Construction & Operation's.
- Parameters, Calculations of MMR, Power and Cutting Time.
- Accessories Index Milling, Gear Manufacturing through milling.
- Planning, Shaping, Broaching & Gear Hobbing Operations.
- Principle, Tools, Applications.
- Machining of Alloys, Super Alloy & high Grade Material.
- Precision Machining.
- Electric Discharge Machine (EDM) (Wire Cut, Die Sinking Machine)
- Capabilities, Capacities, programming & Tools.
- NC CNC & DNC Machines, Coordinate Measuring Machine (CMM).
- Capabilities, Capacities, programming & Tools.

- High Speed Machining, Mass Production through Machining.
- Special Machining Techniques, (chemical Machining, Laser Machining)
- Finishing Operations.
- Grinding, Honing, Lapping, Polishing and Buffing
- Welding Techniques Welding Theory & types.
  Arc welding Tig & Mig Welding, Gas Welding, Spot Welding soldering & brazing. Fusion welding process: Oxy-fuel gas welding, thermit welding, electron beam welding, Pressure Welding Resistance Welding, Solid State welding process: Cold welding, ultrasonic welding, friction, filler, flux & electrode for welding & different Process. Weld quality weld ability, weld design & metals, process selection, adhesive bonding, joining plastics

Lab Outline:

1. Familiarization with types of cutting tools and tool holders used with a standard center lathe machine.
2. To produce external threads on components using different methods
3. Practice of boring operation on the lathe machine
4. To produce internal threads on components using different methods
5. Identification and familiarization of various types of milling cutters
6. Familiarization with the parts and accessories of a universal milling machine.
7. To manufacture a given component for the practice of side milling, end milling, slot milling and engraving on a universal milling machine.
8. Familiarization with the parts, accessories and cutting tools of a shaper
9. Practice of finishing internal cylindrical, external cylindrical and flat surfaces using lapping process.
10. Familiarization with different types of grinding wheels and grinding machines
11. Practice of grinding flat surfaces on a surface grinder
12. Familiarization and practice of honing, buffing and polishing processes
13. Familiarization with the parts, accessories and cutting tools of NC, CNC, DNC Lathe Milling Machines.

Recommended Books:

1. Fundamentals of Modern Manufacturing, 2 nd Edition By M.P. Groover HTJohn Wiley & Sons TH
   Chapman W.A.J. “Workshop Technology (Part I, II & III)
2. Manufacturing Technology By M.L Begeman, Hazel Hurs (Latest Ed)
3. REFERENCE BOOK: Workshop Technology by Hajira Chohdry (Latest Edition)

2nd Semester

MS-153	**APPLIED MATHEMATICS – II**	**(Annexure-E)**
MH-122	**PAKISTAN STUDIES**	**(Annexure-F)**

MT-124 TECHNICAL DRAWING AND CAD-1

Objectives:
The objective of the course is to familiarize the students with drawing of geometrical shapes and drawing standards.

Course outline:
Introduction to Engineering Drawing: covering, Principles of Engineering Graphics and
their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular, Hyperbola , Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;
Technical Drawing Standards General principles of presentation, conventional representation of dimensioning and sectioning, threaded parts, gears, springs and common features. Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding and riveted joints.
Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes, inclined Planes - Auxiliary Planes;
Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views;
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone;
Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions
Fits And Tolerances Tolerance types and representation on the drawing – Fits types and selection for different applications – Basic hole systems - Basic shaft systems – Allowances. Geometric tolerances – Form and positional. Datum and datum

Lab Outline:
1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.

2. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
3. Draw 3D models by extruding simple 2D objects, dimension and name the objects.
4. Draw a spiral by extruding a circle.
5. Construction of inscribes and circumscribes square, triangle and hexagon.
6. Construction of tangent of circle inside and outside
7. Construction of hyperbola curve
8. Construction of involutes and cycloids
9. Orthographic projection 1 and 3rd angle of any Given Block
10. Isometric and orthographic views of hexagonal nut and bolt.
11. Drawing of welding symbols.
12. Draw sectioning symbols for different materials
13. Development of Prism, Cylinder, Cone and Pyramid
14. Development of the truncated Prism, Cylinder, Cone and Pyramid

Recommended Books:

1. Engineering Drawing. by French & Vierck. (Latest Edition)
2. Geometrical Drawing by N.D. Bhatt. (Latest Edition)

MT-134 APPLIED THERMO DYNAMICS - 1

Objectives:

The objective of the course is to familiarize the students with Laws of thermo, thermo cycles, and working of different thermal equipment.

Course outline:

Thermodynamic systems; States, processes, heat and work; Zeroth law; First law; Properties of pure substances and steam, Mollier diagram; Second law, Carnot cycle, entropy, corollaries of the second law; Application of first and second laws to closed and open systems; irreversibility and availability, energy analysis; Thermodynamic relations; Properties of mixtures of ideal gases; Thermodynamic cycles - Otto, Diesel, dual and Joule, Third Law of Thermodynamics.

Lab. Outline:

To measure a regular and irregular shaped area with the help of Planimeter / Mechanical Integrator To measure area of indicated PV diagram; with the help of Planimeter / Mechanical Integrator.
To analyze the thermodynamic systems and its properties
Study of working principle of external combustion engine.
Study of working principle of internal combustion engine.
To study and analyze the erecting, installation, maintenance and working principles of water tube and fire tube boilers.

Recommended Books

1. R E Sonntag, C Borgnakke and G J Van Wylen, Fundamentals of Thermodynamics, 6th Ed., John Wiley, 2003.
2. G F C Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer , 4th Ed., Pearson 2003.

References:

1. J P Howell and P O Buckius, Fundamentals of Engineering Thermodynamics, McGraw-Hill, 1992.
2. Y. A. Cengel and M. A. Boles, Thermodynamics, An Engineering Approach, 4th Ed., Tata McGraw-Hill, 2003

MT-144 BASIC ELECTRICAL & ELECTRONICS

Objectives:

The objective of the course is to familiarize the students with principles of A.C machines, D.C machines, Transformers and its working.

Course outline:

Basic concepts of voltage, current, resistance, capacitance, inductance, series circuits, parallel circuits, series parallel combination, calculations, Ohm law, law of resistance.

Construction and Working principles of DC Machines and their types, speed control of DC motors, working principles and applications of AC machines.

Construction and working principles of single and three phase transformers. Insulators, semiconductors, type of semiconductors, doping, PN-junction diode, Rectifier and their types, construction and working principles of Bipolar junction transistors, Construction and working principles of BJT amplifiers.

Lab Outline:

1. Using ohm meter to find the resistance of an unknown Resistor.
2. By using volt meter the voltage across a resistive load.
3. Using Am-Meter fin the current flowing in a circuit.
4. Verify Ohm's Law in a D.C circuit.
5. Resistor color coding
6. Find the Equivalent resistance of a series , parallel and series-parallel combination of Resistors.
7. To control the speed of D.C motor by using various techniques.
8. Study the basic module of a single phase motor
9. Study the Basic Module of A.C motor.
10. Find the turn ratio of a single phase transformer
11. Biasing modes of PN-junction diode.

12. Construct Half wave and full wave rectifier.
13. Biasing mode of BJT
14. Construction various types of amplifier using BJT.
15. To measure Gain and efficiency of an amplifier.

Recommended Books:

1. B.L. Theraja A text book of Electrical Technology Vol-2(Latest Edition)
2. Edward Huges- Electrical Technology (Latest Edition)
3. Electronics devices By Floyd (Latest Edition)

3rd Semester

MH-213 COMMUNICATION SKILLS (Annexure-B)

MT-213 CAD – II

Objectives:

The objective of the course is to familiarize the students with the solid part and assembly modeling.

Course Outlines:

UNIT 1: Introduction to 2D and 3D CAD

1.1 Modules,1.2 Toolbars,1.3 Units and Dimensions,
1.4 Important Terms and Definitions

UNIT : 2 D Sketch

2.1 Sketch Environment, 2.2 Drawing Display Tools, 2.3 Sketching Entities
2.4 Pattern, 2.5 Tolerance,2.6 Work Feature

UNIT :Dimension and Constraint

3.1 Dimension, 3.2 Geometric Constraint, 3.2.1 Perpendicular Constraint
3.2.2 Parallel Constraint, 3.2.3 Tangent Constraint, 3.2.4 Coincident Constraint
1.2.5 Concentric Constraint, 3.2.6 Collinear Constraint, 3.2.7 Horizontal Constraint
3.2.8 Vertical Constraint, 3.2.9 Equal Constraint, 3.2.10 Fix Constraint
3.2.11 Symmetric Constraint, 3.2.12 Smooth Constraint, 3.3 Measurement

UNIT 4 : 3D Sketch

1.1 Parameter, 4.2 3D Sketching Entities

UNIT 5 : Solid Modeling

5.1 Modeling Tools, 5.1.1 Extrude Feature,5.1.2 Revolve Feature
5.1.3 Holes Feature, 5.1.4 Fillets Feature, 5.1.5 Chamfers Feature

5.1.6 Ribs Feature, 5.1.7 Thicken and Offset Feature
5.2 Concept of Edit Feature, 5.3 Advanced Modeling Tools
5.3.1 Sweep Feature, 5.3.2 Lofted Feature, 5.3.3 Coil Feature
5.3.4 Thread Feature, 5.3.5 Shell Feature, 5.3.6 Face Draft Feature
5.3.7 Replacing Face Feature, 5.3.8 Boundary Patch Feature,
5.3.9 Stitching Surfaces Feature
5.3.10 Sculpt Feature

UNIT 6 : Assembly Modeling

6.1 Types of Assembly,
6.2 Assembly Component
6.2.1 Mate Constraint
6.2.2 Angle Constraint
6.2.3 Tangent Constraint,
6.2.4 Insert Constraint
6.2.5 Rotation Constraint
6.2.6 Rotation-Translation Constraint
6.2.7 Transitional Constraint
6.3 Edit Assembly Constraint

UNIT 7: Drawing View

7.1 Types of Views,7.2 Drawing Standards,7.3 Drawing Sheets
7.4 Dimension Style 7.5 Parts Lists

UNIT 8: Presentation Module

8.1 Presentation View
8.2 Assembly Animation

Recommended books:

1. The CNC Work Shop by Frank Nanfara (Publisher: SDC Publications, 2002)

CAD SOFTWARE

Pro-engineering, power shape, catia, solid works etc.

MT-223 INDUSTRIAL MATERIALS

Course Outline:

- Crystal in Structure of Metals.
  Unit Cells, Dendrite Formation, Grains Boundary and Grain Size, Slip
- Planes Effect of Hot and Cold working.
- Formation of Alloys
  Binary Alloys, Equilibrium Diagram, Cooling Curves, Solid Solution.

- Eutectic Alloy, Intermetallic Compounds.
- Introduction to single and poly-crystal materials.
  Ferrous and Non- Ferrous Metals. Equilibrium Phase Diagrams and their industrial importance. The Fe-Fe3C Equilibrium diagram and Refining.
- Extraction of Common Metals
  Iron and steel, Aluminum, Copper, Magnesium, Lead and Zinc.
- Heat Treatment
  Hardening, Tempering, Annealing, Case Hardening, Heat Treatment Equipment.
- Materials for High Performance Applications.
  Metal Matrix Composites, Titanium Alloys, Reinforce Plastics, Properties and Applications.
- Ferrous Metals, Non-Ferrous Metals.
- Polymers and Composite Materials.
  The Structure, Types, Additives, General Properties, Applications.
- Materials damaging modes during applications, Fracture, Fatigue, Wear etc.
- Material, Testing, Tension Test, Hardness Test, Torsion Test, Fracture Mechanics, Fatigue, Brittle and Impact Testing.
  Testing of Materials, Standard codes; ASTM, BSI, etc.
- Materials naming conventions as per AISI-SAE, ASTM, ISO/BS standards.

Practicals:

1. To prepare steel specimens using appropriate macro etching reagents and to reveal segregation and crystal structure.
2. To prepare steel specimens using appropriate macro etching reagent and to reveal variation in crystal structure.
3. To prepare steel specimens using appropriate macro etching reagents and to reveal deformation lines in steel.
4. To prepare specimens of aluminum using appropriate macro etching reagents and to reveals their crystal structures.
5. To prepare the specimens of brass, bronze and copper using appropriate macro etching reagents and to reveal their crystal structures.
6. To prepare the specimens of steel for micro examination and to conduct the micro examination using metallurgical microscope.
7. To prepare the specimens of cast iron for micro examination using metallurgical microscope.
8. To conduct the micro examinations of austenitic and stainless steel by preparing of their specimens using metallurgical microscope.

9. To conduct the micro examination of aluminum and aluminum alloy by preparing their specimens using metallurgical microscope.
10. To conduct the micro examination of copper and copper alloys by preparing their specimens using metallurgical microscope.
11. To conduct the micro examination of magnesium and magnesium alloys by preparing their specimens using metallurgical microscope.
12. To conduct the micro examination of PVC and bake lite by preparing their specimens using metallurgical microscope.
13. To determine the Brinell hardness number of the given specimens of ferrous, non-ferrous and non-metallic materials.
14. To determine the Rockwell hardness number of the given specimens of ferrous, non-ferrous and non-metallic materials.
15. To perform the induction hardening process on the given part.
16. To perform the flame hardening process on the given part.
17. To perform the tempering process on the given part.

Recommended Text Book

1. Kempster MHA. Materials fo engineers. English Language Book Society, UK.
2. HIGGINS R.A. engineering metallurgy: part 1, Applied Physical Metallurgy, Hodder and Stoughton, London.
3. Material Science and engineering an introduction (seventh edition) by William D. Callister, Jr.

Reference Books:

1. Neely JE. Practical metallurgy. Prentice Hall, USA
2. Avner mechanical metallurgy. McGraw-Hill Book Company, U.K
3. Essentials of material science and engineering by Donald R. Askeland.

MT-233 MECHANICS OF MATERIAL

Objective: To enable the students to understand the internal effect of forces on various mechanical and structural members

Course Outlines:

- Mechanical properties of Materials
- Elastic constants and their relationships
- Tensile stress, Compressive stress, Shear stress
- Strain (Longitudinal, Lateral and volumetric)
- Compound bars
- Thermal stress
- Moment of inertia

- Shear force and Bending moment of beams
- Shear stress and deflection of beams
- Torsion of circular bars, hollow and compound shafts
- Strain energy
- Thin and thick pressure vessels
- Plain stress and strain principal stress and strain, Mohr's circle
- Theories of failure
- Virtual work and associated energy theorems
- Photo elasticity and strain gauges

Lab Outlines:

1. Study of Material testing lab
2. Study of Universal Testing Machine
3. Tensile test of mild steel specimen on UTM
4. Compression test on cement mortar cube
5. Shear test on mild steel specimen
6. Torsion test on mild steel, cast iron and brass

Recommended Books:

1. Mechanic of Materials by F.P. Beer and E.R. Johnston
2. Mechanics of Engg Materials by F.V. Warnock P.P. Benham and R.J Crawford
3. Strength of Materials by F. Singer

MT-243 APPLIED THERMODYNAMICS – II

Objectives:

The objective of the course is to familiarize the students with the construction and working of Engines, Turbines and compressors.

Course Outlines: I C. Engines: Classification - SI, CI, two-stroke, four-stroke etc., operating characteristics – mean effective pressure, torque and power, efficiencies, specific fuel consumption etc., air standard cycles – Otto, Diesel and dual, real air-fuel engine cycles, Thermochemistry of fuels – S.I. and C.I. engine fuels, self-ignition, octane number, cetane number, alternate fuels etc., combustion – combustion in S.I. and C.I. engines, pressure-crank angle diagram, air-fuel ratio, chemical equation and conservation of mass in a combustion process etc., Air and fuel injection – injector and carburetor, MPFI etc., ignition, lubrication, heat transfer and cooling; Gas Power Cycles: Simple gas turbine cycle – single and twin shaft arrangements, intercooling, reheating, regeneration, closed cycles, optimal performance of various cycles, combined gas and steam cycles; Introduction to Axial-Flow Gas

Turbine; Introduction to Centrifugal and Axial Flow Compressors; Combustion Chambers; Jet Propulsion: turbojet, turboprop, turbofan, ramjet, thrust and propulsive efficiency; Rocket Propulsion; Direct Energy Conversion: thermionic and the of working permoelectric converters, photovoltaic generators, MHD generators, fuel cells.

Lab Outlines:
Study of working principal of external combustion engine
Study of working principal of internal combustion engine
To measure indicated and brake horse power
Study of working principal of water tube and fire tube boilers

Recommended Books:
1. G. F. C. Rogers and Y. R. Mayhew, Engineering Thermodynamics Work and Heat Transfer, 4 th Ed., Pearson, 2001.
2. H. I. H Saravanamuttoo, G. F. C. Rogers and H. Cohen, Gas Turbine Theory, 4 th Ed., Pearson, 2003.

References:
1. T. D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, 5th Ed., Pearson, 1999.
2. W. W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, PHI, 2002.
3. C. R. Fergusan and A. T. Kirkpatrick, Internal Combustion Engines, John Wiley & Sons, 2001.

4th Semester

MT-253 MACHINE DESIGN

Objectives:
- To apply the engineering constraints and calculation on the components of machines.

Course outline:
Introduction:
Definition, Understanding the Fits And Forms, Design Requirements of Machine Elements, Design Procedure, Standards in Design, Selection of Preferred Sizes, Selection of Materials for Static and Fatigue Loads. Design methodology; Design criterion based on fracture; Deformation and elastic stability design stresses; Factor of safety; Significant stress and significant strength; Stresses-concentration; Causes and mitigation; Endurance limit; Effect of concentration; Notch sensitivity; Size and surface finish; Goodman diagram; Gerber's parabola and Soderberg line.

Manufacturing Consideration in Design: Statistical Considerations, Selective Assembly, Design Consideration in Machining, Castings, Forgings, Welding.

Design Against Static Load: Modes of Failure, Factor of Safety, Principal Stresses, Stresses Due to Bending and Torsion, Theories of Failure.

Design Against Fluctuating Loads: Cyclic Stresses, Fatigue and Endurance Limit, Stress Concentration Factor, Stress Concentration Factor for Various Machine Parts, Notch Sensitivity, Design for Finite and Infinite Life, Soderberg, Goodman Criteria.

Design of Riveted Joints: Types of Riveted Joints, Failure of Riveted Joint, Efficiency of Riveted Joint, Design of Boiler Joints, Eccentric Loaded Riveted Joint.

Design of Threaded Joint: Design of Bolted Joint, Eccentrically Loaded Bolted Joint.

Power Screws: Forms of Threads, Multiple Threads, Efficiency of Square Threads, Trapezoidal Threads, Stresses in Screws, Design of Screw Jack.

Sliding Contact Bearing: Types, Selection of Bearing, Plain Journal Bearing, Hydrodynamic Lubrication, Properties and Materials, Lubricants and Lubrication, Hydrodynamic Journal Bearing, Heat Generation, Design of Journal Bearing, Thrust Bearing-Pivot and Collar Bearing, Hydrodynamic Thrust Bearing.

Rolling Contact Bearing: Advantages and Disadvantages, Types of Ball Bearing, Thrust Ball Bearing, Types of Roller Bearing, Selection of Radial Ball Bearing, Bearing Life, Selection of Roller Bearings, Dynamic Equivalent Load for Roller Contact Bearing Under Constant and Variable Loading, Reliability of Bearing, Selection of Rolling Contact Bearing, Lubrication of Ball and Roller Bearing, Mounting of Bearing.

Assembly Drawing Of Machine Elements:

Preparation of assembled views using parts details - Lathe tail stock - Lathe chuck - Connecting rod – Screw jack - Machine vice - Tool head of shaper.

Drawing shall be Made Wherever Necessary (Using CAD-Software Such as AutoCAD).

1. To Draw Orthographic projection Drawings (Front, Top and side) of boiler safety valve giving name the various components of the valve.
2. Make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap. Draw quarter sectional isometric view of a cotter joint
3. Design & Drawing of Knuckle Joint.
4. Design of Machine Components Subjected to Combined Steady and Variable Loads.
5. Design & Drawing of Eccentrically Loaded Riveted Joint.

6. Design & Drawing of Boiler Riveted Joint.
7. Design of Shaft Subjected to Fluctuating Loads.
8. Design of Screw Jack.
9. Design of Eccentrically Loaded Threaded Joint.
10. Design of Antifriction Bearing Assembly
11. Design of Journal Bearing
12. Design of Project Report Consists of Different Types of Bearings
13. Design of Cylinder and Cylinder Head.
14. Design of Piston, Piston Ring and Gudgeon Pin.
15. Design of Connecting Rod.
16. Design of Crankshafts.

Recommended Books:

1. Shigely Joseph E., "Mechanical Engineering Design", McGraw-Hill Publications. (Latest Edition)
2. Valance Alex and Doughtie VI, "Design of Machine Members", McGraw-Hill Co. (Latest Edition)
3. Spott M.F., "Machine design", Prentice Hall India. (Latest Edition)
4. Maleev and Hartman, "Machine Design", CBS Publications. (Latest Edition)
5. Black & Adams, "Machine design", McGraw-Hill. (Latest Edition)
6. Sharma and Agrawal, "Machine Design", S.K. Katara& Sons.
7. Bhandari V.B., "Design of Machine Elements", Tata McGraw- Hill Co (Latest Edition)

MT-264 FLUID MECHANICS

Objectives:

To enable the students to understand different properties of fluids in statics and kinematics and also will be familiar with flow and pressure measuring instruments.

Course Outline:

Introduction:

Development of fluid dynamics, distinction between solid and fluid, gas and liquid, properties of fluids, Density, specific weight, specific volume, specific gravity, compressible and incompressible fluids, ideal fluids, viscosity and its units, surface tensions, vapor pressure of liquids etc.

Fluid Statics:

Pressure, variation of pressure in a static fluid, pressure head, review of types of pressures, pressure measurement gauges, Force on plane area, center of pressure, force on curved surface, Buoyancy and stability of submerged and floating bodies.

Kinematics of Fluid Flow:
Types of flow, flow rate and mean velocity, equation of continuity, flow net, velocity and acceleration in steady and unsteady flow.
Measurement of flow rate velocity:
Energy Consideration in Steady Flow: Kinetic energy of a flowing fluid, potential energy, internal energy, general equation for steady flow of any fluid, energy equation for steady flow of incompressible fluids. Bernoulli's theorem, Head, Power consideration in fluid flow cavitation's, energy equation for steady flow of compressed fluids, equation of steady motion along a steam line for ideal fluid and Euler's equation, equation of steady motion along a stream line for real fluid, Hydraulic gradient, energy line, problems, Pressure in fluid flow and its measurement, set trajectory, flow in a curved path, vortex, types of vortex.
Similitude and Dimensional analysis:
Definition and importance, geometrical, kinematic and dynamic similarity, dimensionless ratios, scale ratios, dimensional analysis.
Steady & Incompressible Flow in Pressure conduits:
Laminar and Turbulent flow, critical Reynolds number, hydraulic radius, general equation for friction, Darcy-Weisbach pipe friction equation, laminar flow in circular pipes, turbulent flow in circular pipes, pipe roughness, chart for friction factor, fluid friction in non-circular conduits, empirical equations for pipe flow. Flow measurements, Pitot tubes, venturimeter, orifices, nozzles.

Lab Outline:
1. Study of Hydraulic Bench
2. To determine the co-efficient of Venturimeter & discuss its application.
3. To calibrate the given rectangular notch and discuss its application.
4. To calibrate a triangular notch and discuss its application.
5. To find the co-efficient of discharge
6. To calibrate the given pressure gauge & discuss its application.

Recommended Books:
1. Fluid Mechanics with Engg. Application by Daugherty and Franzini.(Latest Edition)
2. Fluid Mechanics by Victor L. Strecter. McGraw Hill (Latest Edition)
3. Fluid Mechanics and Hydraulic Machinery by K R Arora, Standard Publisher (Latest Edition)

MT-273 ENGINEERING STATICS

Course Outlines:
a. General Principles a. Introduction to the basic quantities and idealizations of mechanics.
b. Newton's laws of motion and gravitation

c. SI system of units.
d. Standard procedures for performing numerical calculations
e. General guide for solving problems

Force Vectors

a. Add forces and resolve them into components using the Parallelogram Law,
b. Express force and position in Cartesian vector form and determine vector's magnitude and direction
c. Introduce dot product to determine the angle between two vectors or projection of one vector onto another

Equilibrium of a Particle

a. Introduce concept of a particle free body diagram, solve particle equilibrium problems.
b. Force System Resultants a. Calculate moment of a force in two and three dimensions.
c. Find the moment of a about a specified axis, Define the moment of a couple.
d. Determine the resultants of nonconcurring force systems.
e. Reduce a simple distributed loading to a resultant force.

Equilibrium of a Rigid Body

a. Develop equations of equilibrium for a rigid body
b. Introduce the free-body diagram for a rigid body
c. Solve rigid-body equilibrium problems.

Structural Analysis

a. Determine forces in the members of a truss.
b. Analyze forces acting on pin-connected members of frames and machines.

Internal Forces

a. Determine the internal loadings in a member using the method of sections
b. Formulate equations that describe internal shear and moment throughout a member
c. Analyze forces and geometry of cables supporting a load

Friction

a. Analyze the equilibrium of rigid bodies subjected to dry friction
b. Present applications of frictional force analysis on wedges, screws, belts, and bearings
c. Investigate the concept of rolling friction

Center of Gravity and Centroid

a. Discuss the concept of center of gravity, center of mass, and the centroid
b. Determine the location of the center of gravity and centroid for a system of discrete particles

c. Find the area and volume for a body having axial symmetry using the Pappus and Guidinus theorems
d. Find the resultant of a general distributed loading and apply it to finding the resultant force of a pressure loading from a fluid

Moments of Inertia

a. Determine the moment of inertia for an area
b. Determine the minimum and maximum moments of inertia for an area using the product of inertia
c. Discuss the mass moment of inertia

Recommended Books

1. Engineering Mechanics: Statics, 12th Edition, Russell C.
2. Engineering Mechanics: Statics, 12th Edition, Hibbeler,
3. Engineering Mechanics: Statics, 12th Edition, Prentice Hall;

MS-213 PROBABILITY AND STATISTICS

Objectives:

The objective of the course is to familiarize the students with probability and different statistical terms and analysis.

Course Outline:

- Basic concept of probability, conditional probability, independent events, Baye's formula.
- Concept of random variables, discrete and continuous one and two dimensional random
- Variables, probability distributions, marginal and joint distributions and density functions.
- Important probability distributions (Binomial, Poisson, Uniform, Normal, Exponentials and Hyper-geometric). Mean, variance, moments and moment generating functions, linear regression and curve fitting. Central limit theorem, autocorrelation and cross-correlations, power spectral density functions and stochastic processes.

Recommended Books:

1. J. Devore, Probability and Statistics, Latest Edition, John Wiley & Sons. (Latest Edition)
2. Ronal Walpole, Probability methods for engineering and scientists, Latest Edition, McGraw-Hill. (Latest Edition)
3. A. Popoulis and U, Pillai, Probability, Random Variable and Stochastic Processes, Latest Edition, McGraw-Hill, ISBN: 0071199810(Latest Edition)

MM-212 TOTAL QUALITY MANAGEMENT (TQM)

Objectives:

1. To enable the students understand the principles of Quality Management
2. To provide students details of quality planning and TQM techniques
3. To provide in depth knowledge of reliability and maintainability

Course Outline:

Unit I Principle of Quality Management

Definition of quality – Deming, Miller – Crosby Theories – Service and Product quality – Customer orientation. Evaluation of Total quality Management – Inspection – Quality Control – TQM System – Human component, Introduction to Six Sigma concepts.

Unit II Quality Planning

Planning – SMART Goal setting – Designing for Quality – Manufacturing for Quality – Process control – CPK – Process capability. Scientific Approach to TQM – Data based approach – Quantification – Statistical tools – Quality control tools – New 7 tools, Sampling and Control Charts.

Unit III TQM Techniques Benchmarking

Definition – Types – Steps – Metrics – Case studies – Quality Function Deployment – Definition – steps – Case studies – Corrective Techniques – Preventive techniques – Failure Mode and Effect Analysis – 5S. Continuous Improvement Techniques – Different techniques such as POKA YOKE etc. – Deming wheel – Case studies

Unit IV Reliability Definition

Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Charts Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart. Unit-IV Defects Diagnosis and Prevention Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Recommended Books

1. Dale H Besterfield, (2008), Total Quality Management, Pearson Education
2. L.S. Srinath, (2005) Reliability Engineering, Affiliated East West Press, New Delhi.

Reference:

1. Samuel K Ho, (1996), TQM – An Integrated Approach, II Edition, Kogan Page Ltd., USA.

2. Joel E. Rose, (1993), Total Quality Management, II Edition,
Kogan Page Ltd., USA.

MH-223 TECHNICAL REPORT WRITING (Annexure-J)

5th Semester

MT-313 HEAT TRANSFER

Objectives:
The objective of the course is to familiarize the students with different modes of heat transfer.

Course Outline:
UNIT 1: Introduction
- a. Conduction Heat Transfer
- b. Thermal Conductivity
- c. Convection Heat Transfer
- d. Radiation Heat Transfer
- e. Dimensions and Units

UNIT 2: Steady-State Conduction (One Dimension)
- a. Introduction
- b. The Plane Wall
- c. Insulation and R- Values
- d. Radial Systems
- e. The Overall Heat-Transfer Coefficient
- f. Critical Thickness of Insulation
- g. Heat-Source Systems
- h. Cylinder with Heat Sources
- i. Conduction-Convection Systems
- j. Fins
- k. Thermal Contact Resistance

UNIT 3: Principles of Convection
- a. Introduction
- b. Viscous Flow
- c. In viscid Flow
- d. Laminar Boundary Layer on a Flat Plate
- e. Energy Equation of the Boundary Layer
- f. The Thermal Boundary Layer
- g. The Relation Between Fluid Friction and Heat Transfer

UNIT 4: Radiation Heat Transfer
- a. Introduction
- b. Physical Mechanism

c. Radiation Properties
d. Radiation Shape Factor
e. Relations Between Shape Factors
f. Heat Exchange between Nonblack bodies
g. Infinite Parallel Surfaces
h. Radiation Shields
i. Gas Radiation
j. Radiation Network for an Absorbing and Transmitting Medium
k. Radiation Exchange with Specular Surfaces
l. Radiation Exchange with Transmitting, Reflecting, and Absorbing Media
m. Formulation for Numerical Solution
n. Solar Radiation
o. Radiation Properties of the Environment
p. Effect of Radiation on Temperature Measurement
q. The Radiation Heat-Transfer Coefficient

UNIT 5: Heat Exchangers

a. Introduction
b. The Overall Heat-Transfer Coefficient
c. Fouling Factors
d. Types of Heat Exchangers
e. The Log Mean Temperature Difference
f. Effectiveness-NTU Method
g. Compact Heat Exchangers
h. Analysis for Variable Properties
i. Heat-Exchanger Design Consideration

Recommended Books:

1. Heat transfer by j.p holman (latest edition)
2. Heat and mass transfer by frank p.incropera, david p. dewitt (latest edition)

MT-324 I. C. ENGINE

Objectives:

The objective of the course is to familiarize the students with the construction and working of different sub systems of I.C. engine

Course Outline:

Thermodynamics of actual working fluids: Working fluid before combustion, valve and port timing diagrams. Thermodynamic properties of fuel-air mixture before combustion. Use of combustion charts for unburned mixture. Use of combustion charts for burned mixture. Appropriate treatment of fuel air mixtures. Fuel air cycles: Definition,

constants, volume fuel air cycle, limited pressure cycle, characteristics of fuel-air cycles, comparison of real and fuel cycles.
Air capacity of four stroke engines: Ideal air capacity, Volumetric efficiency, ideal induction process , actual induction process, Effect of operating conditions on volumetric efficiency, Effect of design on volumetric efficiency , estimating air capacity.
Two stroke engines: Scavenging process, ideal scavenging process, relationship of scavenging ratio and scavenging efficiency, power to scavenger, supercharged two stroke engines. chemistry of combustion, normal combustion in S.I engines , pre-ignition and auto-ignition comparison, detonation in S.I engines, combustion in C.I engines, detonation in C.I engines, Methods of reducing detonation , preliminary detonation, preliminary facts about fuel and dopes, octane and cetane numbers, effect of design on detonation.
Mixture requirements: Steady running, mixture requirements, transient mixture requirements, mixtures requirements for fuel injection engines, mixture requirements for S.I engines.
Performance of supercharged engines: engine performance measures, commercial engine ratings, basic performance equations for un-supercharged engines, effect of atmospheric conditions, altitude and compression ratio on performance characteristics, performance curves.
Supercharged engines: definitions, reasons for supercharging, supercharging of S.I engines, Supercharging of diesel engines.
Heat losses and cooling: Area of heat flow engines, temperature profile, Engine cooling system, Numerical on heat transfer in I.C engines.
Engine design: selection of type, engine speed and principles of similitude. Numerical on alternative fuels, Numerical on diesel fuel injection system, Numericals on engine specification and verification, Numerical on two stroke engines.
General design of petrol and diesel engine: Numericals on engine design, determination of main dimensions, Comparative Numerical on two stroke engines and four stroke engines.

I.C. ENGINES LAB.

1. Study of two stroke spark ignition engine model.
2. Study of four stroke spark ignition engine model.
3. Study of four stroke diesel engine model.
4. Study of rotary wankel engine.
5. Study of models of gas turbine engines.
6. Study of single cylinder four stroke direct injection diesel engine. (cut section)
7. Study of multi-cylinder optical spark ignition engine.
8. Experimental study of characteristic performance curves of spark ignition engine using gasoline as fuel.

1. Experimental study of characteristic performance curves of compression ignition engine using diesel as fuel.
2. Experimental study of characteristic performance curves of compression ignition engine using biodiesel blends, with diesel as fuel.

11. Study of engine components. (like cylinder block , crank shaft etc).
12. Study of components of ignition system of S.I. Engines.

Recommended Books:

1. Domkundvar V.M., "A course in internal combustion engines", Dhanpat Rai and company, New Delhi, 1999.

MT-333 DYNAMICS

Objectives:

To gain fundamental concepts of bodies under dynamic conditions
To implement laws of motions to components/structures under the influence of forces.

Course Outline:

Kinematics of Particles. Rectilinear motion, plane curvilinear motion, rectangular coordinates, normal and tangential coordinates polar coordinates. Kinetics of Particles. Force, mass, and acceleration, Newton's second law of motion, equations of motion, kinetic diagrams, rectilinear motion, curvilinear motion. Work and energy, potential energy. Impulse and momentum, conservation of momentum. Plane Kinematics of Rigid Bodies. Angular motion relations, absolute motion, relative velocity, instantaneous centre of zero velocity, relative acceleration. Plane Kinetics of Rigid Bodies: Force, mass, and acceleration, equation of motion, translation, fixed axis rotation, general plane motion, work and energy relationship, impulse and momentum equation.

Lab Outline: Experiments related to the course outline of Engineering Mechanics-I & II will be covered in the Lab class.

Recommended Books:

1. Vector Mechanics for Engineers (Dynamics) by Beer and Johnston (Latest Edition)
2. Engineering Mechanics (Dynamics) by J. L. Meriam (Latest Edition)
3. Engineering Mechanics (Dynamics) by R. C. Hibbler (Latest Edition)

MT-343 MANUFACTURING PROCESSES

Course Objectives
Enable the student to know about different types of machine tools & processes used in production/manufacturing.

Course Outline
Introduction:
Introduction to Manufacturing Processes and their Classification,
Industrial Safety; Introduction, Types of Accidents, Causes and Common Sources of Accidents, Methods of Safety, First Aid.
Material Removal:
Mechanics of chips formation, Types of chips produced, Chip breakers, Orthogonal & Oblique cutting, Cutting forces in conventional turning, Friction & heat sources in cutting, surface finishing processes, Lapping, Honing, Super finishing, Polishing, Buffing, Electroplating, Galvanizing, Metal spraying
Foundry:
Introduction to Casting Processes, Basic Steps in Casting Process, Pattern, Types of Patterns, Pattern Allowances, Risers, Runners, Gates, Moulding Sand and its composition, Sand Preparation, Molding Methods, Core Sands and Core Making, Core Assembly, Mold Assembly, Melting (Cupola) and Pouring, Fettling, Casting Defects and Remedies.
Cold Working& Hot Working processes:
Sheet Metal Operations, Measuring, Layout Marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining Advantages and Limitations. Hot Working Processes: Introduction to Hot Working, Principles of Hot Working Processes, Forging, Rolling, Extrusion, Wire Drawing,
Introduction to Machine Tools& Processes:
Specifications and Uses of commonly used Machine Tools in a Workshop such as Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting. Nomenclature of a Single Points Cutting Tool and Tool Wear. Mechanics of Chips Formations, Type of Chips , Use of Coolants in machining. Broaching & broaching machines, Press machine, Types of Press machines, Press work operations.
Jigs & Fixtures: General Design principle, Elements of Jig, Locating Devices & Clamping Devices

Lab Outline:
Study of lathe, milling, boring and drilling machine.
Practice on press machines.
Chips formations and their types .
Basic casting and its types, making patterns and moulds

Study about die casting and core molding .
Bending sheet metals of different thickness.
Practice on making of simple jigs, clamping and locating devices.
Forging and rolling extrusion process.

Reference:

1. Manufacturing Science – Amitabh Ghosh& Ashok Kumar Malik, - East-West Press. (Latest Edition)
1. Manufacturing Process and Systems - Ostwald, Munoz, John Wiley.
3. Workshop Technology, Vol. 1, 2 & 3 – Chapman, WAJ, Edward Arnold (Latest Edition)

Recommended Books:

1. Workshop Technology Vol. I & II – Hazra & Chaudhary, Asian Book Comp., New Delhi. (Latest Edition).
Process and Materials of Manufacture -- Lindberg,
2. R.A. Prentice Hall of India, New Delhi. (Latest Edition)
3. Principles of Manufacturing Materials and Processes - Campbell, J.S. – Mc Graw-Hill. (Latest Edition)

MM 313 PROJECT MANAGEMENT (Annexure- I)

MH 312 ECONOMICS

Objectives:

- To familiarize students with the basic Concepts of Economics in engineering.
- To enable the students to make better decisions in their course of action.

Course Outline:

Basic Economics Concept:

Meaning, Nature and Scope of Economics, Methodology of Economics: - Deductive V/S Inductive, Economics - Statics & Dynamics, Basic Economic Problems: - Scarcity & Choice, Relation Between Science, Engineering, Technology and Economics.

The Economic Environment:

Consumer and producer goods; Measures of economic worth; Price, Supply, & Demand relationship; Production; Factors of production; Laws of return.

Cost Concepts Analysis:

Sunk & opportunity costs; Fixed, variable, and incremental costs;

Recurring & nonrecurring costs; Direct, indirect, and overhead costs; Standard costs; Breakeven analysis; Unit cost of production; Cost-Benefit analysis; Feasibility studies; Value analysis in designing & purchasing., Taxation details

Depreciation and Depletion:

Purpose of depreciation; Types of depreciation; Economic life. What can be depreciated?

Comparing Alternatives:

Present economy; Selection among machines, materials, processes, and designs, Payback period method; Present worth method; Uniform annual cost method; Rate of return method; Alternatives having identical lives. Alternatives having different lives.

Production Concepts & Mathematical Models:

Manufacturing lead time, Production rate; Capacity; Utilization; Availability; Work in process; WIP and TIP ratios.

Industrial Relations:

Labor problems; Labor organizations; Prevention & Settlement of disputes.

Recommended books:

1. What every Engineer should know about accounting and finance, by Jae k shim, Norman Henteleff Geetika G., GhoshPiyali., & Choudhray Purba, (2008), "Managerial Economics", TMH. Dwivedi D, N. (2005), "Managerial Economics", New Delhi, Vikas Publishing House. (Latest Edition)
2. Peterson Craig, Lewis H., Cris W. & Jain Sudhir K., (2008), "Managerial Economics" New Delhi, Pearson Education. (Latest Edition)

6th Semester

MT-353 INSTRUMENTATION AND CONTROL

Objectives: Enable the students to know about basics of control system & measuring instruments.

Course Outline:

Introduction to control system, input & output, open loop, closed loop control system & feedback control system, Elements of a general control system &their examples, transfer function.

Transducers, classification of Transducers.

Study of different indicating, measuring & recording instruments for length force, torque, frequency, pressure, flow & temperature.

Free body Diagram and Newton's law of motion, operational notation, grounded chair representation, series & parallel laws. Equation of motion for a spring mass & damper system, Electrical & Mechanical analogous circuits.

Stability:-

Concept, routh criterion & root locus method for stability measurements.

Lab outline:

1. Experimental Determination of Transfer function of a given mech system.
2. Experimental study of different types of pressure measuring devices
3. Experimental study of different types of temperature measuring devices
4 Use of oscilloscopes.

Recommended Books:

1. Automatic control by Francis H Raven (Latest Edition)
2. Modern control system by Richard C dorf (Latest Edition)
3. Automatic control by J.J Distofanoelef. (Latest Edition)

MT-363 MECHANICAL VIBRATION

Objectives

- Fully understand and appreciate the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions,
- Be able to make free and forced (harmonic, periodic, non-periodic vibration analysis of single and multi-degree of freedom linear systems
- Be able to write the differential equation of motion of vibratory systems.
- Be able to obtain linear vibratory models of dynamic systems with changing complexities (SDOF,MDOF)

Course Outline:

Fundamental concepts in vibration and modeling: Introduction to modeling and analysis Introduction to mechanical vibration. Free vibration of single degree of freedom systems: Un-damped vibration; Simple harmonic motion; Damped vibration; Modeling: Energy and Newton's methods; Measurement of vibration components; Design Consideration; Stability Forced harmonic excitation of single degree of freedom systems: Un-damped vibration; Damped vibration; Base excitation; Rotating unbalance; Coulomb damping Vibration of single degree of freedom systems under general forcing

conditions: Impulsive inputs; Arbitrary non-periodic inputs; Arbitrary periodic inputs; Stability Vibration of multi degree of freedom systems: Modeling, Free un-damped vibration; Eigenvalue problem; Modal analysis; Free damped vibration; Forced vibration Dynamic vibration absorbers; Isolators for shock and harmonic loading.

Recommended Books:

1. Thomson W.T., and Dahleh M.D., Theory of Vibrations with Applications, Pearson Education. (Latest Edition)
2. Palm W.J., Mechanical Vibration, Wiley Publishers. (Latest Edition)
3. Tongue B.H., Principles of Vibration, Oxford University Press. (Latest Edition)
4. Meirovitch L., Fundamentals of Vibrations, McGraw-Hill. (Latest Edition)
5. Kelly G.S., Mechanical Vibrations: Theory and Applications, CL-Engineering Publication. (Latest Edition)
6. Rao S.S., Mechanical Vibration, Prentice Hall. (Latest Edition)
7. Rao J.S., Advanced Theory of Vibration, New Age International. (Latest Edition)
8. Mukhopadhyay M., Structural Dynamics: Vibrations and Systems, ANE Books. (Latest Edition)
9. McConnell K.G., and Varoto P.S., Vibration Testing: Theory and Practice, Wiley. (Latest Edition)
10. Timoshenko S., Vibration problems in engineering, Oxford University Press. (Latest Edition)

MT-373 REFRIGERATION & AIR CONDITIONING

Objectives:

The objective of the course is to familiarize the students with the refrigeration and air-conditioning cycles and its construction and working.

Course Outline:

UNIT 1: Introduction

Introduction to refrigeration, History of refrigeration, thermodynamic system, path and point functions, thermodynamic process, cycle, heat, work , State the four fundamental laws of thermodynamics , Apply first law of thermodynamics to closed and open systems and develop relevant equations , internal energy and enthalpy

Discuss the importance of second law of thermodynamics and state Carnot theorems. Define and distinguish the differences between heat engine, refrigerator and heat pump ,

Obtain expressions for Carnot efficiency of heat engine, refrigerator and

heat pump, State Claudius inequality and introduce the property 'entropy'

UNIT 2: Refrigeration Machines and reversed Carnot cycle

Refrigeration machine, The Carnot cycle, Vapor as refrigerant in Reversed Carnot cycle, Gas as refrigerant in Reversed Carnot cycle, Limitation of Reversed Carnot cycle, COP

UNIT 3: Vapor compression System

Modification in Reversed Carnot cycle with Vapor as a refrigerant, Vapor compression cycle, Wet and Dry compression, Actual Vapor compression cycle, Pressure-Enthalpy diagram, Simple saturated cycle on P-H diagram, Co-Efficient of performance and Energy Efficiency Ratio,(EER),Heat of compression, Work of compression and the heat of rejection

UNIT 5: Vapor Absorption System

Simple Vapor Absorption system, Maximum Coefficient of performance of a heat operated Refrigeration machine, Common Refrigeration-Absorption systems, water and lithium bromide absorption system, Single effect and double effect absorption cycle

UNIT 6: Psychrometry

Psychrometry, Properties of Air, water vapor in the air, Relationship between pressure of air and pressure of water vapor, Humidity, Temperature, Dew point and Wet bulb Depression, Enthalpy of Moist air, Adiabatic saturation of air, Relationship between humidity ratio and dry bulb and wet bulb temperature, specific volume of moist air, Specific heat of moist air, Psychometric chart, Sensible heating and cooling, Heating with humidification, cooling with dehumidification, By Pass factor, Sensible Heat factor

UNIT 7: Refrigerant

Introduction of refrigerant, Development of refrigerant .Classification of refrigerant, Designation of refrigerant, Requirement of selection of refrigerant, Safety procedure, common refrigerant

UNIT 8: Application of Refrigeration and Air condition

Cold storage, Ice Making, Window type AC, Split AC, Package Type, Cooling Towers, Air washers, Chiller

Lab outline:

1. Find the C.O.P. of refrigerator.
2. Effect of condensing temperature on the performance of refrigerator.
3. Efficiency of a refrigerator
4. Construction of pressure enthalpy diagram for a vapor compression System refrigeration and its performance measurement.
5. To check the performance of a vapor compression system refrigerator by Varying the heat input to the evaporator.
6. Representation of Properties of air on Psychometric charts

7. Air conditioning cycle on charts.
8. Demonstration of domestic refrigerator
9. Demonstration of cooling tower
10. Demonstration of window type air conditioner
11. Demonstration of chiller AC plant.

Reference:

1. ASHRAE Guide.

Recommended Books:

1. Principles of Refrigeration by R. J. Dosset (Latest Edition)
2. Refrigeration and Air Conditioning by Jordan and Priester (Latest Edition)
3. Refrigeration and Air Conditioning by W.F. Stocker. (Latest Edition)
4. Refrigeration and Air Conditioning by CP Arora (Latest Edition)

MT-384 MATERIAL HANDLING AND SAFETY

Objectives:

After going through this subject the student will be able to know about the various types of conventional material handling equipment's along with modern and latest equipment and devices e.g: AGVs, Robots, Pallet trucks, different types of electronic sensor using devices etc.

Course Outline:

- **The material-handling problem**
- Introduction, Material Handling Equipment Marketing, Principles of material handling, factors affecting material handling
- **Bulk-Material-Handling Equipment**
- Belt Conveyers, Bucket Elevators and Bucket Conveyers, Screw Conveyers, Vibratory Conveyers, Feeders and Screws, Vehicle Bulk-Handling Systems, Marine Bulk-Material Handling.
- **Packaged-Material-Handling Equipment**
- Pallets and Palletizing Operations, Package and Unit Conveyer Systems, Belt Package Conveyer
- Power Roller conveyer, Conveyer Turns and Switches, Conveyer Sortation and Accumulation Systems, Pallet Conveyers.
- **Monorail conveyer Systems**
- Light Duty Chain and Cable System, Heavy Duty Systems, Power-and-Free Systems, Powered-Carrier Monorail Systems
- **Counterbalanced Forklift Trucks.**
- Reach-Type Non-Aisle Forklift Trucks, Narrow-Aisle Turret-Type Forklift Trucks, Side-Loading Forklift Trucks,

- **Miscellaneous Material Handling Equipment**
- Vehicular Unit Handling equipment, Pallet Transporters and Material Handling Tools. Towline Systems, Tractor-Trailer Trains.
- **Integrated Material Handling Systems**
- Automated Guided Vehicles and Their Applications, Use of Robots
- Classification of Health hazards. Physical, chemical, biological. Sources of risk
- Machinery Noise, Electrical failure, ventilation, lighting, radiation
- Dangerous substances
- Classification, Entry & Exit routes, safe handling, Health & safety regulation & policy.
- Safety Machining & Guarding,
- Preventing Machining accidents, Machine guarding
- Equipment & Machine handling
- Mechanical & Manual Handling, Access Equipment, Transport, Electricity & Electrical Equipment.
- Fire :-Classification, fire protection, means of Escape, Actions to be taken. Chemical safety Personal protection.
  Safety Management Accident prevention, health & safety training, communicating safety measures.

Reference:

1. Langford J. W. “LOGISTICS PRINCIPLES AND APPLICATIONS”. McGraw Hill, UK. (Latest Edition)

Recommended Book:

1 Sims Jr. E.R. “planning and managing industrial logistics systems” Elseveir, Amsterdam. (Latest Edition)
2. Maynard‟s „industrial engineering handbook” McGraw Hill, (Latest Edition)
3. Holt A.S.J Principle of Health & safety at work. The institution of occupational safety & health. The caverdisk press Limited. UK 1999.
4. Patty F.A "Industrial Hygiene & Toxicology Vol-1 General Principles" Inter science Publishers New York. (Latest Edition)

MT-393 PROJECT
MT-3103

Objectives:

To develop the ability of exercising the problem analysis, design & its validation, prototype production on economical scale.

Course Outline: Project work is basically to complement Engineering Technology study. The student is in close consultation with department faculty will complete the project using Library,

Computer or Laboratory facilities. It shall be considered as Engineering Technology Subject to a minimum of 06 Credit Hours work that entails the following activities in general:-

i. Detailed problem analysis
ii. Project timeline Schedule
iii. Literature Review
iv. Conceptual and actual Design
v. Design validation
vi. Material selection
vii. Manufacturing / Fabrication (Economical Prototype / Model production if required)
viii. Assembly, test & Trials and logging of results
ix. Report writing and presentation

Note:

The student(s) to undertake project during 6th semester and its following summer. Six credit hours academic work be undertaken as follows:-

- Three credit hours work during 6th Semester under the guidance of departmental faculty. The work that entails supervised work entails problem analysis, timeline & Schedule, Literature Review, conceptual / Actual design, design validation and material selection.
- Three credit hours during summer where student(s) will work independently and may seek guidance from the concerned Faculty / Project Supervisor. The independent working of student(s) entails Manufacturing / Fabrication (Economical Prototype / Model production if required), Assembly, test & Trials and logging of results, Report writing and presentation.

7th Semester

MT-4116	**16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING**	**(Annexure - K)**

8th Semester

MT-4216	**16 WEEKS SUPERVISED INDUSTRIAL / FIELD TRAINING**	**(Annexure - K)**

(ANNEXURE-A)

ISLAMIC STUDIES

Objectives:

This course is aimed at:

1 To provide Basic information about Islamic Studies
2 To enhance understanding of the students regarding Islamic Civilization
3 To improve Students skill to perform prayers and other worships
4 To enhance the skill of the students for understanding of issues related to faith and religious life.

Course Outline:

Introduction to Quranic Studies

1) Basic Concepts of Quran
2) History of Quran
3) Uloom-ul -Quran

Study of Selected Text of Holy Quran

1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

Study of Selected Text of Holly Quran

1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
3) Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

Seerat of Holy Prophet (S.A.W) I

1) Life of Muhammad Bin Abdullah (Before Prophet Hood)
2) Life of Holy Prophet (S.A.W) in Makkah
3) Important Lessons Derived from the life of Holy Prophet in Makkah

Seerat of Holy Prophet (S.A.W) II

1) Life of Holy Prophet (S.A.W) in Madina
2) Important Events of Life Holy Prophet in Madina
3) Important Lessons Derived from the life of Holy Prophet in Madina

Introduction to Sunnah

1) Basic Concepts of Hadith
2) History of Hadith
3) Kinds of Hadith
4) Uloom –ul-Hadith
5) Sunnah & Hadith
6) Legal Position of Sunnah

Selected Study from Text of Hadith

Introduction To Islamic Law & Jurisprudence

1) Basic Concepts of Islamic Law & Jurisprudence
2) History & Importance of Islamic Law & Jurisprudence
3) Sources of Islamic Law & Jurisprudence
4) Nature of Differences in Islamic Law
5) Islam and Sectarianism

Islamic Culture & Civilization

1) Basic Concepts of Islamic Culture & Civilization
2) Historical Development of Islamic Culture & Civilization
3) Characteristics of Islamic Culture & Civilization
4) Islamic Culture & Civilization and Contemporary Issues

Islam & Science

1) Basic Concepts of Islam & Science
2) Contributions of Muslims in the Development of Science
3) Quranic & Science

Islamic Economic System

1) Basic Concepts of Islamic Economic System
2) Means of Distribution of wealth in Islamic Economics
3) Islamic Concept of Riba
4) Islamic Ways of Trade & Commerce

Political System of Islam

1) Basic Concepts of Islamic Political System
2) Islamic Concept of Sovereignty
3) Basic Institutions of Govt. in Islam

Islamic History

1) Period of Khlaft-E-Rashida
2) Period of Ummayyads
3) Period of Abbasids

Social System of Islam

1) Basic Concepts of Social System of Islam
2) Elements of Family,
3) Ethical Values of Islam

Recommended Books:

1) Hameed ullah Muhammad, "Emergence of Islam" , IRI, Islamabad
2) Hameed ullah Muhammad, "Muslim Conduct of State"
3) Hameed ullah Muhammad, „Introduction to Islam
4) Mulana Muhammad Yousaf Islahi,"
5) Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.
6) Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)
7) Mir Waliullah, "Muslim Jrisprudence and the Quranic Law of Crimes"Islamic Book Service (1982)
8) H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989)
9) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

PROFESSIONAL ETHICS

Objectives:

The objective of the course is to familiarize the students to:

1. Identify the nature of Professional Ethics in terms of Legal, Historical and Personal definitions
2. Understanding the value of professional ethics
3. Resolving the ethical dilemmas using common ethical values and identifying possible actions to be taken in response
4. Assessing the probable consequences

Course Outline:

Introduction:

- Definitions/Importance/Kinds
- Factors/Sources of Islamic Ethics
- Islamic Ethical System

Ethics in Business:

- Enforcement of Ethical environment/factors

- Principles & Decision Making
- Islamic rules for business
- Lawful and unlawful behavior in Islam

Engineering Ethics:

- Scope & Aims, Theories, responsibilities
- IEEE code of Ethics
- Ethical code for Engineers
- Ethical code for software Engineers

Moral Courage

- Moral courage, its importance and how to improve?
- Attributes of morally courageous leaders

Relevant Case Studies:

To be decided by the Teacher/Instructor.

(ANNEXURE-B)

COMMUNICATION SKILLS

Objectives:

- To understand the importance and basic concepts of communications.
- Recognize the importance of communicating effectively in technical writing and presentation.

Course Outline:

Characteristics of Writing at Work. Writing for your Readers, Understand and apply the purpose, problems, and processes of written technical communications in the Workplace, Writing Ethically, Achieving a Readable Style, Analyze and adapt to various technical writing situations, Designing Documents, Designing Illustrations, Understand and apply the key phases of project management communication, Create documents that are grammatically and stylistically correct and effectively anticipate the audience's, information needs, Use the concepts of technical writing to self-assess your documents and critically evaluate others' work, Meet deadlines similar to those found in technical workplaces, Create and present professional presentations, including PowerPoint slides.

Recommended Books:

1. Elizabeth Tebeaux and Sam Dragga- The Essentials of Technical Communication. 2nd Edition, Oxford University Press.
2. Ron White- Writing. Advanced. Oxford Press.
3. John Langan- College Writing Skills. 9th Edition Connect Writing.

(ANNEXURE- C)

APPLIED PHYSICS

Objectives: The main objective of the course is to provide basic information about Electricity, Magnetism, Electromagnetism, waves and oscillations, optics, Electronics and Mechanics to the students.

Course Outline:

Waves & Oscillations : Periodic motion & Simple Harmonic Oscillation (SHO), Simple Pendulum, Transverse & Longitudinal Waves, Speed of a traveling Wave, Damped Harmonic Oscillator, EM waves.

Electricity: Basic terms & definitions; Electric Forces and Fields, Electric Flux, Coulomb's Law, Electric field due to the Point and Various Charges, Gauss's Law and its Applications, , Conductors in Electric Fields, Parallel Metal Plates ,Capacitance , Resistance, Electric Potential and Potential Energy, Ohms' Law, practice problems

Magnetism: Magnetic Field, Flux and Flux density (B), B-H loop, Hysteresis, Retentively, Magnetic Force on moving charges, Torque on Current Loop, Ampere's Law, Magnetic Dipole Moment. Earth's Magnetic Field, practice problems,

Electromagnetic Induction: Induced Current and EMF, Faraday's Law of Electromagnetic induction, Lenz's Law, Mutual and self-Inductance, Motional EMF, Inductor and Inductance, RL circuits

Electronics: Semiconductor materials, conduction in conductors, insulator and semiconductors, doping, N-type and P-type semiconductors, energy band diagrams of conductors, insulators, intrinsic and extrinsic Semiconductors, PN junction, basic diode operation, forward and reverse operating modes, Diode applications. Light and Optics. Oscillating Electric and Magnetic Fields, Light as EM Wave, Reflection, Refraction, Interference, Young's Double Slit Experiment, Equivalent Optical Path, Diffraction,

Mechanics: Definitions of Work, Energy & Power, Work – Energy Theorem and its applications, Mechanical Energy of System, Conservation of Mechanical Energy, practice problems, Gravitational potential energy, Hook's Law & Restoring force. Review of Angular Variables, K.E. Energy of Rotation and moment of Inertia, Torque and Newton's Second Law of Rotation, Work and Rotational K.E., Angular momentum, Angular Momentum for System of Particles.

Lab Outline:

1. Measuring magnitude and direction of Earth's a) magnetic field. b) To measure Dip angle.
2. Examining Lenz's and Faraday's Law. Studying the production of EMF using fix coil or fix magnet
3. Measurement of Current, Voltage drop and Power in a Resistance circuit
4. Diode; identification of Diode terminals using Ohm meter series circuits, Diode series circuit, Diode Parallel circuits
5. Half Wave rectification and Full Wave rectification
6. Measurement of wavelength of sodium light using diffraction Grating and Spectrometer
7. Study of diffraction minima and maxima using single and multi-slits.
8. Verification of Law of Conservation of Energy by measuring potential and kinetic energies in various arrangements a) Determine relationship between force and spring deformation using Hook's law. b) Investigating both spring compression and extension.

Recommended Books:

1. Halliday, Resnick and Walker, "Fundamental of Physics" (Latest Ed.)
2. Electrical Technology, Edward Hughes ,Longman Latest edition,
3. Principles of Electrical Engg.,B.R Gupta ,S. Chand and Company Ltd. India

(ANNEXURE- D)

APPLIED MATHEMATICS – I

Objectives:

Course Outline:

Complex numbers, Argand diagram, De Moivre‟s theorem, hyperbolic and inverse hyperbolic functions. Algebra of vectors and matrices, systems of linear equations. Derivative as slope, as rate of change (graphical representation). Extreme values, tangents and normals, curvature and radius of curvature. Differentiation as approximation. Partial derivatives and their application to extreme values and approximation. Integration by substitution and by parts, integration and definite integration as area under curve (graphical representation). Reduction formulae. Double integration and its applications. Polar and Cartesian coordinates, polar curves, radius of curvature, cycloid, hypocycloid, epicycloids and involutes of a circle.

Recommended Books:

1. Calculus and analytical Geometry, 11th **Edition** *By Thomas Finney* John Wiley & Sons.
2. Advanced Engineering Mathematics 5th **Edition** *By C. R. Wylie* McGraw-Hill Education.
3. Advanced Engineering Mathematics, 8th **Edition** *By* HT*Erwin Kreyszig* TH John Wiley & Sons.

(ANNEXURE- E)

APPLIED MATHEMATICS – II

Objectives:

Course Outline:

Differential equation; basic concepts and ideas; geometrical interpretation of first and second order differential equations; separable equations, equations reducible to separable form, exact differential equations, integrated factors. Linear first order differential equations, Bernoulli‟s differential equation.

Families of curves, orthogonal trajectories and applications of differential equations of first order to relevant engineering systems. Homogeneous linear differential equations of second order, homogeneous equations with constant coefficients, the general solutions, initial and boundary value problems, D-operator, complementary functions and particular integrals. Real, complex and repeated roots of characteristics equations. Cauchy equation, non-homogeneous linear equations. Applications of higher order linear differential equations. Ordinary and regular points and corresponding series solutions; introduction to Laplace transformation

Recommended Books:

1. Advanced Engineering Mathematics **5th Edition** *By C.R. Wylie* McGraw-Hill Education
2. Advanced Engineering Mathematics,**8th Edition** *By* HT*Erwin Kreyszig*TH John Wiley & Sons.

(ANNEXURE- F)

PAKISTAN STUDIES

Objectives:

1. Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
2. Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline:

1. **Historical Perspective**
   a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
   b. Factors leading to Muslim separatism
   c. People and Land
      i. Indus Civilization
      ii. Muslim advent
      iii. Location and geo-physical features.

2. **Government and Politics in Pakistan**
   Political and constitutional phases:
   a. 1947-58
   b. 1958-71
   c. 1971-77
   d. 1977-88
   e. 1988-99
   f. 1999 onward

3. **Contemporary Pakistan**
   a. Economic institutions and issues
   b. Society and social structure
   c. Ethnicity
   d. Foreign policy of Pakistan and challenges
   e. Futuristic outlook of Pakistan

Recommended Books:

1. Burki, Shahid Javed. *State & Society in Pakistan,* The Macmillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy.* Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. Pakistan‟s Foreign policy: An

Historical analysis. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development.* Lahore, 1994.
5. Wilcox, Wayne.*The Emergence of Banglades.,* Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota,* Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.

(ANNEXURE- G)

APPLIED CHEMISTRY

Objective:

The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.

Course outlines:

Chemical kinematics and catalysis: Introduction to rate equation and reaction order, reaction mechanism, relation between rate equation and reaction mechanism, First order & Second order. Dependence of temperature on reaction rates. Arrhenius theory, collision theory, Transition – state theory, Physical adsorption, chemisorption, Freundlich's expression, Langmuir adsorption isotherm, Heterogeneous catalysis, examples of heterogeneously catalysed reactions.

Features of Coordination Chemistry & Organic Reaction Mechanism: Coordination chemistry, coordination number, chelate effect, coordination complexes and their applications. Electrophilic substitution reactions in aromatic systems. Some Name reactions viz. Hoffman's rearrangement, Beckman's reaction, Riemer-Tiemann reaction, Skraup synthesis, etc.

Thermodynamics and electrochemical Phenomenon: Heat, work and energy, reversible and irreversible processes, work done in an isothermal reversible expansion of ideal gas. Enthalpy. Entropy. Electrochemical and galvanic series, polarization, decomposition potential, over voltage. Theories of corrosion. Differential aeration theory. Factors influencing corrosion. Types of corrosion Control of corrosion: Design and material selection, anodic and cathodic protection, protective coatings, corrosion inhibitors. Fuel Cells.

Analytical aspects of water: Sources, conservation of water, impurities in water and their effects. WHO guideline and BIS guideline for drinking water. Chemistry involved in sedimentation, coagulation and sterilization. Softening of water, lime-soda, ion-exchange process and numerical problem. Boiler troubles, causes and effects, methods of prevention.

Engineering Materials: Glass, ceramics, refractory, composites, magnetic materials, Polymers & structure property relationship. Thermoplastic & thermosetting plastics. Preparation, properties & applications of some commodity and engineering polymers. Conducting polymers.

Interaction of radiation with matter: Molecular spectroscopy, vibrational, rotational, absorption, emission and light scattering phenomenon.

Recommended Books:

1. Dara, S.S.; A Text Book of Engineering Chemistry (Tenth edition); S. Chand, 2003.
2. Kuriacose, J.C., Rajaram, J.; Chemistry in Engineering and Technology (Vol. 1&2); McGraw Hill, 1984.
3. Barrow, M. Gordon; Physical Chemistry (Fifth edition); McGraw-Hill, 1992.
4. March, Jerry.; Advance Organic Chemistry Reaction Mechanism and Structure (Fourth edition); John Wiley & Sons New York, 2004.
5. W. Kemp; Organic spectroscopy (III Edition) PALGRAVE, 2002.
6. Puri B.R., Sharma L.R., Pathania M.S; Principles of Physical Chemistry; Vishal Publishing Co. (42nd Edition).

(ANNEXURE - H)

INTRODUCTION TO COMPUTER FUNDAMENTALS

Objectives:
To assemble or disassemble computers and plug-in devices. Enable students to design an optimal computer system environment as per need of customer. Pros and cons of computer business and applications.

Course Outline:
Basic terminology: computer, user, hardware, software, chip, program, Input: data, instructions (programs, commands, user responses), Output: text, graphics, video, audio, Types of computers: personal, notebook, handheld, PDA, internet appliance, server, mainframe, supercomputer, Programming languages, Machine, assembly, High-level, Key terms: VLSI, microprocessor, microcomputer, Computer Software: Terms: file, menu, font, voice recognition, FAQ, online help, wizard, software suite, single-user license, site license, application window, dialog box, clip art, cross-platform application, Application software, Word processing, Spreadsheet: cell, function, recalculation, charting, Database: record, field, query, Other: accounting software, Computer Aided Design (CAD), desktop publishing, paint/image, multimedia, web authoring, System software, Operating System (OS), Booting (startup), Cold vs. warm, BIOS, Steps in booting, Utility programs: file viewer, file compression, backup, screen saver, disk scanner, disk defragmenter, Computer hardware, System unit Terms: motherboard, chip, memory, storage, expansion slot (plug and play), port (serial vs parallel), bus (expansion bus), power supply, Central Processing Unit (CPU), Machine cycle (fetch, decode, execute, store), Memory, Volatile vs. nonvolatile, RAM vs ROM, Cache, Hard disk, Tracks, sectors, platters, RAID (mirroring and striping), Internet hard drive, Compact disks (and drives), PC Cards, Miniature mobile storage (Compact Flash, Memory Stick, Microdrive, Smart Media), Input Devices: Keyboard, Pointing Devices, Others: trackball, touchpad, pointing stick, light pen, touch screen, stylus, Handwriting recognition software, Sound, Image: Digital camera, Scanners (flatbed, optical readers), Optical readers, Optical character recognition (OCR), bar code scanner, Optical Mark Recognition (OMR), Video: Web cam, PC Video camera, Output Devices, Display device, CRT monitor, Liquid Crystal Display (LCD) – passive versus active matrix, Gas plasma monitor, Printer and its types: Impact printers, Dot-matrix printer, Line printer, Plotter, Non-impact printers, Ink-jet, Laser, data projector, fax machine (fax modem), Internet, E-commerce, Ethics and social issues, Privacy and security

Lab Outline:

1. Basic machines organization including motherboard, memory, I/O cards, networking devices
2. Use of flow charts
3. Computer peripheral devices
4. Operating Systems
5. Microsoft Windows
6. Microsoft Office i.e. MS Word, MS PowerPoint, MS Excel
7. Office Tools & Overview of different browsers with emphasis on power point
8. Microsoft Visio

Recommended Books:

1. Peter Norton, “Introduction to Computers”, Latest Edition
2. Misty E. Vermaat, “Discovering Computers”, Shelly Cashman Series, Latest edition.

(ANNEXURE - I)

PROJECT MANAGEMENT

Objective:
To enable students to learn necessary managerial skills related to industrial requirement.

Course Outline:

1. Introduction to management: History of management, management functions, organizational structure, types of organizations, organizational hierarchy, properties of narrow and wide organizations
2. Production Processes: Types of production, scale of production, selection of technology, input requirements, capacity utilization, productivity basic concepts, classification, quantitative measurement, productivity improvement.
3. Project Management: Properties of projects, project life cycle, project network analysis, resource requirements, monitoring and control, computer tools.
4. Inventory Management: Inventory replenishment, economic lot size, re-order point, safety stock level, JIT, computer tools.
5. Human Resource Management: Management styles, psychological types, recruitment and training, job evaluation, performance appraisal, motivation and incentives.

Recommended books:

1. Babcock d. L. Managing engineering and Technology, Prentice Hall, UK.
2. Zuberi M. H. Industrial management, Rabbani Printing Press, Lahore.
3. Bateman T. S. and Snell S. A. Management: building competitive advantage. Times Mirror Higher Education Group, USA.
4. Spinner M. Elements of project management. Prentice Hall, UK.

(ANNEXURE – J)

TECHNICAL REPORT WRITING

Objectives: The main objective of the course is to help students learn the basic concepts in technical writing and familiarize students with standard templates used in modern technical documents.

Course Outline:

Essay writing: Descriptive, narrative, discursive, argumentative. Academic writing: How to write a proposal for research paper/term paper. How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency). Technical Report writing. Progress report writing. Technical document creation with tools and technique to improve quality. Structure, layout and writing style for various technical documents for both print and digital media. Document review process and assessment of written report and documents. Technical Communication Basics, A General Definition of Technical Communication, Major Traits of Technical Communication, Globalization and Cultural Awareness. The Technical Communication Process. An Overview of the Process, Planning Document, Drafting and Finishing Document, Editing. The Uses of Visual Aids, Planning the Mechanism Description, Writing the Mechanism Description. The Elements of a Formal Report, Planning the Recommendation Report, Drafting the Recommendation Report, Planning the Feasibility Report, Writing the Feasibility Report, Ethics and Proposals. Writing the Internal Proposal, Planning the Manual, Writing the Manual, Making an Effective Presentation.

Recommended Books:

1. "Technical Report Writing Today" by Daniel Riordan, 10th Edition
2. "Technical Writing and Professional Communication", Leslie Olsen and Thomas Huckin, 2nd Edition

(ANNEXURE-K)

SUPERVISED INDUSTRIAL / FIELD TRAINING 7TH AND 8TH SEMESTER

Background:
Industrial Training refers to students' work experience in an engineering-practice environment to familiarize themselves with professional engineering practices prior to graduation as BSc engineering Technologist. The training curriculum consists of **32 weeks of continuous industrial/field training @ 8 hours working / day and 5 working days a week.** BSc Engineering Technology Student shall undergo this Industrial Training during the 7th and 8th semester after he/ she **has passed all subjects up to 6th semester.** This Training covers a range of activities, such as design implementation, production processes, laboratory, on-site field works and maintenance. It also serves as a mechanism to integrate engineering practices and the curriculum to achieve the overall Program Outcomes and Graduate technologists attributes. Whereas, it provides exposure to engineering processes at a practical level; helps developing professional skills required by an undergraduate technologists it also offers opportunity to the prospective employer to assess potential of the probable future employee.

Credit Hour: The term "Credit Hour (Cr.Hr)" refers to a unit of academic credit during a semester. Each credit hours defined as "one contact hour per week" for the theory class and "3 contact hours per week" for the laboratory work.

Contact Hours: (Theory / Lecture): One (1) contact hour per week for each credit hour of Theory/Lecture. Contact Hours (Practical): Three (3) contact hours per week for each credit hour of laboratory work.

Objectives
Through the Industrial Training, students will be able:-

a) To apply engineering knowledge learned in classroom environment in real industrial situations;
b) To expose to professional engineering practices in the industries.
c) To understand the role and responsibilities and code of ethics that BSc Engineering Technologists should uphold.
d) To develop awareness about general workplace behaviors and build interpersonal skills.
e) To prepare professional work records and reports.
f) To build rapport and network with probable future employers to increase employability.

Obtaining Industrial Placement

During 7th and 8th semester BSc Technology students will be undergoing continuous Industrial Training of 32 weeks. This training will be arranged by HEI's, mainly in the leading Industry and must have MOU on training of Technologists. The designated Training Administrator of HEI may complete all necessary documentation within 12 weeks prior to the commencement of the training and subsequently issue Training Schedule of 32 Weeks to help students undergo training in 7th and 8th semester on due time.

Student's Responsibility

a. BSc Engineering. Technology Students MUST get enrolled for the Industrial Training during 6th semester and before commencement of 7th semester.
b. The students will have to undergo continuous training of 32 credit hours. *One week's training @ 8 hours daily for 5 days per week will be counted as 1 credit hour*. Accordingly 16 weeks/semester x 5 working days / week x 8 hours/ Day = 640 Contact hours/ semester 0r 1280 contact hours in 7th and 8th semester.
c. Trainees will maintain a daily Log Book, duly signed by the Training supervisor at site, Training Administrator appointed by HEI and the Student himself.
d. Students must observe safety & security rules of the Organization where they receive Training.
e. Student must wear specified working dress during training.
f. All rules and regulations of the organization will be observed.
g. Trainees must observe working Timings of the Training Organization.

   Trainees are allowed to avail 10 days leave during Training period of 32 weeks in total and only 1 day leave will be granted at a time. The leave shall only be availed to cater for any emergency, with prior sanction from the training Administrator. Leave will be treated as loss of training hours and required to recoup in any case .And any leave availed on discretion will be treated as absent, liable to disciplinary action. Public holiday and leaves should not be counted as working hours.

HEI's Training Administrator Visit

HEI's Training Administrator will pay off and on visits throughout the industrial training period. The students and the training organization will be informed about the date and time of the visit. Discussions will be held with the onsite training supervisor(s) as well as the students during the visits.

The purposes of the Training Administrator's visit to the training places

are as follows:-

a) To ensure that the training organization is providing suitable training to the students that they need.
b) To obtain feedback on training program, students' performance and training progress through discussion with training supervisor(s).
c) To make courtesy visits and establish industrial relations between the HEI and the industries/ Fields where would be Technologists receive training.
d) To discuss the possibility of students' job placement with the training organization.
e) To survey for new industries as potential training placement in the future.

IMPORTANT NOTE!

*a) Students are **NOT ALLOWED** to change placement during the training period with particular organization. However, written permission may be sought from training Administrator, if prior confirmation of newer placement of the student is available .And the student does not suffer loss of training hours due to this changeover.*
b) After getting a written permission from the Training Administrator, a fresh approval should be applied for the new placement.

Daily Training Logbook

All the training activities need to be recorded on daily basis. This logbook is to portray **:-**

a) A reflection of the student's learning and experience during the industrial training;
b) Training records and evidences of supervised training and reference of participation of Student, On the job Trainer and HEI's training Administrator.
c) Part of professional practice in engineering profession where incidence and evidence are recorded in proper documentation.
d) Source of reference to prepare the Industrial Training Report. The log book must be submitted together with the Industrial Training Report.
e) Students must get it signed, on daily basis, by the On the Job Trainer.

Industrial Training Report

An industrial training report will be submitted upon completion of training. The report must describe student's learning and development in technical knowledge, engineering practices and professional skills

acquired through the practical experience. The industrial training report should also reflect student's ability in communicating skills understanding of engineering practices.
Students should seek advice from their "On the job Trainer" at site, to ensure that no confidential materials are included in the report. The report shall be submitted to the Training Administrator. The student should be able to present a copy of the report to the prospective employer, as a complement for their Cooperation. Any references made in preparation of the report should be recognized using standard referencing formats.
Student should refer to the Industrial Training Report Template as given in Appendix A and guideline given here under in preparing the report. The Daily Training Logbook should be submitted together with the report.

Guideline for Preparation of Industrial Training Report
Students, under the guidance of supervisor, need to properly document their experience and learning during the industrial training in the form of report. A properly prepared report can portray their practical experience precisely in an orderly manner.

The report has to be prepared according to the format and the guidelines below :-

1. **Contents and Format of the Report**

a) <u>Table of Content</u>

This section of the report should consist of:

b) Headings
c) Sub-headings
d) Page numbers

Every appendix requires a title and each page need to be numbered accordingly.

b) <u>Background/Profile of the Training Organization</u>

Brief and concise description of the organization in which the student is undertaking the industrial training. The main items are:

1. Backgrounds/profile of the organization
2. Vision and Mission
3. Organogram.
4. Title and position of the supervisor in charge
5. Other necessary information only (not more than three pages)

c) <u>Schedule of duties performed as Trainee</u>

This section should be a brief description of the time, duration and types of duties performed during the training. The description must follow the schedule of the training i.e. in chronological order (for 32 weeks). The days when the

student was not on duty must be properly recorded with cogent reasons.

d) Working Experience

In this section, the student must fully describe the industrial training experience gained. Some suggested areas to be discussed include but not limited to:

a. Project (s) carried out, if any .
b. Supervisory works
c. Problems encountered
d. Problems solving process or approach
e. Hands on skill acquired.
f. How productivity can be further enhanced.
g. Quality Management system in place.
h. Safety at work.

e) **Conclusion**

Student should provide an overall discussion in this section and arrive at a conclusion with regards to the industrial training undergone. Contents may include:

1. Types of major work performed
2. Comments on whether the training objectives are met
3. Suggestions / Recommendations

f) References

A complete list of the references used in the report must be included according to standard referencing format.

g) Appendix

Appendixes are additional information considered appropriate to support the main text. A copy of the letter of permission from the Training organisation must be attached in the appendix. Other suggested appendixes are:

1. Investigation/project report during the industrial training
2. Technical drawings, so far these are not secret documents or proprietary etc.

2. Others

a. Figures /Tables

All figures, tables and similar contents must be captioned / labeled and mentioned in the main text.

b. List of Notations and Symbols

If the report contains notations and symbols, the full definition must be given when each notation or symbol first appeared in the main text. The list of notations and symbols with the full definitions can be placed after 'Tables of Contents'.

Every appendix must have a title and be mentioned in the main text

where appropriate. All page numbers for appendixes must be continual from the main text.

DO NOT include irrelevant materials, e.g. brochures from the organizations, or any publicity materials in the report.

Note on Good Practice: Students are advised to start writing the industrial training report soonest, after beginning of the training period to ensure a timely completion and submission of the report.

a. General Report Format

The report has to be typewritten on white A4 size paper, with 12-point font size, Times New Roman font type and line spacing of 1.5 throughout the report. The report has to be properly ring-bound with transparent plastic sheets attached to the front cover. A sample of report template is available in Appendix A.

The format for the front cover should be as shown in Appendix A.

IMPORTANT NOTE!

- *Students are **NOT ALLOWED** to change the form / template in any way.*

b. Abstract/Preface

This section of the report should consist of brief description of the following.

1. Activities of the Organization
2. Summary of the report
3. Acknowledgement

An abstract should be limited to a maximum of two (2) pages only.

Industrial Training Assessment

The industrial training performance assessment will be based on

1. On the Job Trainer' Report (20%)
2. Training Advisor report through visit or survey (10%)
3. Industrial Training Report (50%)
4. Viva voce (20%)

A total of minimal 50% marks must be achieved in order to be considered passing the industrial training during 7th & 8th semesters.

Students are advised to give a serious consideration in writing their report. The report must be in good quality and portray all industrial experience and knowledge gained. The report MUST NOT be *in the form of short note and figurative form.* ***If the report is not satisfactory, the students may be advised to rewrite the report until it is deemed satisfactory*.**

Completion of Industrial Training

Upon completion of a 32 weeks continuous training period, a confirmation letter to this effect MUST be obtained from the training

organization / probable employer. The confirmation letter needs to be submitted to the Industrial Training Administrator, together with the On the Job Trainer's Report form, Student Feedback form and Industrial Training Report for grading.

Student should submit hard copy to the Industrial Training Administrator for evaluation

Upon approval and evaluation of Industrial Training report of the students, the Training Administrator, must organize viva voce examination of the students ,carrying 20 marks weightage, as under **: -**

i) Non-technical Subjects	:	30 %
ii) Technological subjects	:	70 %
Breadth	:	30%
Depth	:	40 %

Subsequent upon successful completion of the Industrial Training of 32 weeks, a confirmation letter will be included in student's file, as evidence of a successfully completed industrial experience. And to this effect a Training Certificate will also be issued by the Training Organization and countersigned by the HEI's Training Administrator.

Administration

All Administrative matters regarding BSc Technologists placement for Training in various industrial units offering free of cost training facilities, will be handled by the Administrator Industrial Training and maintain records of placement, approvals and training programs devised by respective units & others. All Training reports submitted by the students and given by the respective Training Advisors of training units, will be evaluated and maintained as well, and grades communicated to the relevant Technology Department.

Page - 1

INDUSTRIAL TRAINING REPORT

Name: _____

Student Roll No: _____

Industrial Training Course: _____

Training Period: _____

Training Organization: _____

Page - 2

Abstract to be written after the completion of the Report.

Page - 3

Table of Contents

INDUSTRIAL TRAINING LOG BOOK

TRAINING INFORMATION

Personal Details

Student Name : _____

Student Roll : _____

Address : _____

Email : _____

Course of Study : _____

Year/Semester of Study : _____

Training Start Date : _____

Training End Date : _____

Training Organization

Name : _____

Address : _____

Contact Person : _____

Contact Number : _____

Daily Training Log

Training Week: _____

(please specify training information by descriptive statement, tables, sketches, figures and etc)

Date	***Time***	***Entry***

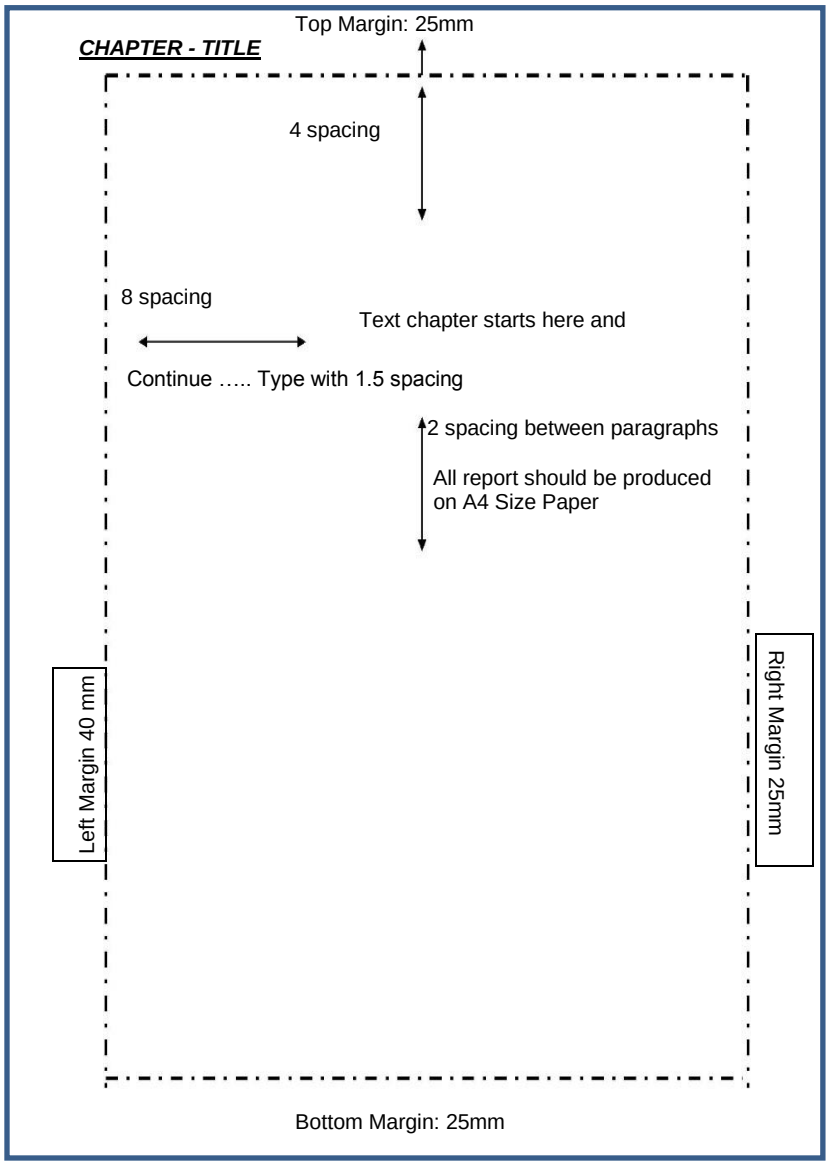
Note: Please include attachment whenever necessary

Declaration

I hereby declare that all information provided above is true.

_____ _____ _____

Signed by Trainee Date Signed by Supervisor


Top Margin: 25mm
CHAPTER - TITLE
4 spacing
8 spacing
Text chapter starts here and
Continue ….. Type with 1.5 spacing
2 spacing between paragraphs
All report should be produced on A4 Size Paper
Left Margin 40 mm
Right Margin 25mm
Bottom Margin: 25mm

(ANNEXURE – L)

GENERALIZED SEMESTER RULES ADOPTED BY UNIVERSITIES

1.0) Introduction

The following regulations govern the Semester System of teaching and examination for the Undergraduate degrees awarded by Universities

a) The Undergraduate degrees offered at the University under Semester System are classified as Bachelor of Science (B.Sc.) and Bachelor of Technology degrees offered

b) Masculine gender used in the following regulations implies male students as well as female students.

c) The medium of instructions and examinations shall be English for all subjects except Islamic Studies and Pakistan Studies for which the medium of instructions and examinations may be either Urdu or English.

d) The term "Academic Year" refers to the period of study at the university spread over one calendar year period. Academic year is further divided into semesters.

e) The term "Contact Hour" refers to a 60 minutes period of contact with the students.

f) One hour Theory period per week = 1 Credit Hour
One practical of 3 hours per week = 1 Credit Hour
One week Training @ 8 Hours
Daily x 5days per week = 1 Credit Hour of Training

g) The term "Pre-requisites" refers to subjects that must be successfully completed prior to registration in a subject

2.0 Degree Duration and Credit Hours

a) The minimum duration of the undergraduate degree programs shall not be less than four academic years in case of Engineering, Engineering Technology.

b) The maximum duration of the degree program shall not be more than seven academic years for programs with a minimum duration of four academic years and seven academic years for programs with a minimum duration of five academic years.

c) The credit hours required for the award of degree may range from minimum of 130 to a maximum of 140 credit hours for degree programs with minimum duration of four academic years. The credit hours shall be made up as follows

Practical = 70%
Theory = 30%.

List of Allied / Related Subjects:

- Islamic Studies / Pakistan Studies
- Occupational Health and Safety and Environment
- Communication Skill
- Report Writing
- Professional Ethics
- Industrial Management
- Industrial Organizational Psychology (IOP)
- Material Handling and Safety

Semester Duration

There shall be two regular semesters, namely Fall and Spring semesters, and an optional summer semester during each academic year.

a) Fall and spring semesters will be spread over 16 to 18 weeks including examinations with at least 15 study weeks during the semester. The duration of summer semester will be 8 weeks including examinations with weekly contact hours being double from those of fall and spring semesters.
b) The maximum and minimum permissible number of students to be allowed registration in a subject section will be decided by NTC – Accreditation Inspection Committee (AIC / TAB).
c) Students may consult their tutors for registration guidelines.
d) Registration will only be allowed in a subject if the prerequisites, if any, of this subject have been completed successfully.

e) Registration in a subject section will be closed if the maximum permitted number of students has registered in it.
f) A subject section will be closed if less than the minimum numbers of students register in that section. Such students who have been denied registration due to a closure of a section may add some alternate subject(s) during add and drop period.
g) During summer semester, selected subjects will be offered in accordance with departmental policy for summer semester.

Subject and curriculum Classification

Type A-Theory Evaluation: In Type-A subjects, there shall be a mid-term examination of one hour duration and a comprehensive final examination of at least one and a half hour duration. The examinations shall carry 30 and 40 percent weight respectively. The teacher shall schedule additional assessment instruments such as quizzes, assignments, presentations, seminars, group discussions, field study reports etc. as specified in the syllabus or as determined by the teacher. These assessment instruments shall carry the remaining 30% weight of the subject.

Type B-Practical Evaluation: In Type-B subjects, each Experiment, Studio work, Jury Presentation, Design, Drawing, Project or Assignment shall be considered as an independent assessment instrument. Cumulative performance in all independent assessment instruments shall form the basis for evaluating a student.

Award of Letter Grades

a) The subject teacher, having interacted with the students, taught them and having assessed them over the semester, shall award letter grades to the students. Chairman of the concerned degree awarding department will be consulted while finalizing the letter grades. Letter grade in each Type-A subject shall be awarded on a Relative Scale whereas, letter grade in Type-B and Type-C subjects may be awarded on an absolute scale if deemed fit by the subject teacher.
b) Following steps in awarding letter grades on a relative scale may be followed:

    i. Minimum marks threshold linked to content mastery shall be established for award of a passing letter grade. Students earning marks below this threshold shall be awarded "F" grade;

ii. Expected maximum marks threshold shall also be established. Student(s) crossing the maximum threshold, if any, will be awarded “A+” grade. The grade points of “A+” and “A” are same. As such, it is expected that only exceptional students demonstrating outstanding results are given recognition by award of this grade.

iii. Students earning marks between the maximum and minimum thresholds are listed in descending order of merit and the average and standard deviation is computed;

iv. Passing letter grades are awarded according to the table given below, with "A" being the highest passing grade and "D" being the lowest passing grade.

c) The letter grades and their corresponding grade points (GP) are given in the table below.

TABLE
LETTER GRADES & CORRESPONDING GRADE POINTS

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F	W	WF	I	IP
4.0	4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	1.0	0	-	-	-	

d) Subjects repeated to improve grades, excluding "W" or "WF" grades, will be shown on the transcript with a suffix "R".

e) The subject teacher may award an “F” grade to a student if he is convinced, while checking the answer script of midterm or final examination that the student has cheated. The subject teacher will give opportunity to the student to defend himself before award of this “F” grade.

Award of "W", "WF", “I” and "IP" Grades

2.1 Withdrawal (“W” Grade)

A student may be allowed to withdraw from a subject in which he is registered. Applications (Form 1) to withdraw from a subject shall be entertained latest up to the 6th study week of the semester. Withdrawn subjects shall appear in the transcript with a letter grade "W", and shall not be used in computation of GPA. In the transcript, subjects repeated after withdrawal will not be suffixed with a "R".

2.2 Forced Withdrawal (“WF” Grade)

A student registered in a subject may not be permitted to continue due to shortage of attendance or other disciplinary action. Such students shall

be awarded a “WF” (Forced Withdrawal) grade. It shall appear in the transcript as such, and shall not be used in computation of GPA. Subjects repeated after forced withdrawal will not be suffixed with “R”. A student who does not drop a subject nor appear in any assessment instrument will not be eligible for “WF” grade and will be awarded a “F” grade.

2.3 Incomplete “I” Grade

A student, who because of illness or any other acceptable fails to complete the required instruments in any subject may be awarded an "I" (Incomplete) grade as an interim grade. Students having less than 50% attendance will not be eligible for award of this grade. This grade shall appear in the transcript temporarily until it is replaced by the actual grade and will not be treated as "F" grade. The student receiving such a grade shall make up the unfinished portion of his subject to the satisfaction of the faculty member who awarded this grade, and is given a letter grade as per regulation 10 at the discretion of the faculty member without prejudice to the previous grade "I". In case, the student fails to complete the unfinished portion within the following semester his "I" grade would be converted to "F" grade by the Controller of Examinations.

2.4 In Progress “IP” Grade

a) Type “C” subjects, like thesis, projects, studio work etc spread over more than one semester may be graded as "IP" until completion of these subjects.
b) Each portion of a Type “C” subject spread over two semesters may have been prescribed different nomenclature and different subject code. First portion of such a subject may be graded as “IP” upon completion, if the department decides to award the final letter grade upon completion of the second portion.
c) It shall appear in the transcript as such, and shall not be used in computation of GPA.

Suggestions

Summarized minutes of meetings & suggestions received

Basically this NCRC meeting was convened in the light of recommendations made in the meeting held at HEC on Jan 22, 2015 under the Chairmanship of Prof. Dr Mansoor Akbar Kundi, Executive Director HEC Islamabad to address the grievance of the B.Tech stakeholders that's why in the first meeting of NCRC , which was held on 8-10 June-2015 at HEC Islamabad ,the question was raised that ;-

- Whether previous NCRC-2010 had right to give suggestion of equivalence withdrawal of B.Tech Vs B.Sc Engg? House unanimously declared that it was not the purview of the previous NCRC-2010 Committee.
- In continuation of previous NCRC held in June 2015, curriculum is designed on semester system basis.
- As per advice of Chairman NTC and keeping in view the Sydney accord, last two semesters of all technology programs are comprised of supervised industrial trainings to keep psychomotor (Hands on) factor on higher side.
- It is strongly recommended that Universities and colleges running technology programs should appoint highly qualified preferably PhD faculty in order to enable students to have broader vision of course with practical knowledge.
- If Institutes don't have very qualified faculty, they should appoint visiting faculty. A proper head for visiting faculty should be generated as recommended in previous NCRC meeting held in June 2015.
- Existing faculty of technology programs should be given opportunity through FDP (Faculty Development Program) to improve their qualification.
- HEC and NTC should support, enhance and strengthen laboratories and workshops in these colleges and universities in order to improve hands on skills of students.
- Institutes are advised to update industrial linkage so that students in their 7th and 8th semester may conduct successfully.
- HOD/ Chairman of the Department should establish a Liaison office for correspondence and monitoring of student's participation and contribution towards learning.
- Students after completion of training must be evaluated after 7th and 8th semester by the experts of academics and industry for semester grading. Evaluation criteria is given in Annexure-K.

- Laboratory staff should be put through proper training of lab equipment for its smooth utilization. Staff should be vigilant and responsible to update stock register for addition and deletion of any equipment and components and to inform laboratory director.
- It is recommended that intake of students in BSc Engineering Technologies should be ensured that they might had completed their DAE in English language.
- A copy of generalized semester rules has been circulated attached as annexure-L. However, a training/workshop may be arranged by HEC for college principals/Chairpersons to understand semester system rules and regulations.
- Degree of B. Tech (Hon's) program has been stopped and 4 years B. Tech. (Civil Engineering) has been adopted by HEC which may be renamed i-e BSc Civil Engineering Technology as approved by Higher Education Commission in 29th meeting on September 26, 2014.
- Degree status may be continued as per Government policy 1973.
- 4-Year degree program of Engineering Technology at bachelor level must be accredited by National Technology Council / AIC and should be registered with this Council.
- Faculty should be trained with refresher courses in country or abroad to become at par with Sydney accord.
- Degree duration is 4-years including 32-weeks continuous Supervised Industrial Training in 7^{th} & 8^{th} semesters which may be seen according to international standards.