IKG Punjab Technical University

Teaching Scheme

(3th - 6th Semester)
(7th & 8th Semester -Draft)

for

Undergraduate Degree Programme

Bachelor of Technology

in

ELECTRICAL & ELECTRONICS ENGINEERING

2018 & onwards

Sr. No.	Course code	Course Title	L	T	P	Hours/ Week	Internal Marks	External Marks	Total Marks	Credits
Semester III [Second year]						**Branch: Electrical & Electronics Engineering**				
1	BTEEE-301-18/ BTEE-301-18	Electrical Circuit Analysis	3	1	0	4	40	60	100	4
2	BTEEE-302-18/ BTEE-302-18	Analog Electronics	3	0	0	3	40	60	100	3
3	BTEEE-303-18/ BTEE-302-18	Electrical Machines – I	3	0	0	3	40	60	100	3
4	BTEEE-304-18/ BTEE-304-18	Electromagnetic Fields	3	1	0	4	40	60	100	4
5	BTEE-305-18	Engineering Mechanics	3	1	0	4	40	60	100	4
6	BTEEE-311-18/ BTEE-311-18	Analog Electronics Laboratory	0	0	2	2	30	20	50	1
7	BTEEE-312-18/ BTEE-312-18	Electrical Machines – I Laboratory	0	0	2	2	30	20	50	1
8	BTMC-XXX-18	Mandatory Course (BTMC-101-18 or BTMC 102-18)	3	0	0	3	40	60	100	S/US
9	BMPD-301-18	Mentoring and Professional Development of Students	0	1	0	1	50	-	50	S/US
10	BTEEE-321-18	Institutional Summer Vacation Training*	-	-	-	35*	-	-		S/US
		Total	**18**	**4**	**4**	**26**	**350**	**400**	**750**	**20**

Sr. No.	Course code	Course Title	L	T	P	Hours/ Week	Internal Marks	External Marks	Total Marks	Credits
to span: Semester IV [Second year]							Branch: Electrical & Electronics Engineering			
1	BTEEE-401-18/ BTEE-401-18	Digital Electronics	3	0	0	3	40	60	100	3
2	BTEEE-402-18/ BTEE-402-18	Electrical Machines – II	3	0	0	3	40	60	100	3
3	BTEEE-403-18/ BTEE-403-18	Power Electronics	3	0	0	3	40	60	100	3
4	BTEEE-404-18/ BTEE-404-18	Signals and Systems	3	0	0	3	40	60	100	3
5	BTAM-302-18	Mathematics-III (Probability & Statistics)	3	1	0	4	40	60	100	4
6	BTEEE-411-18/ BTEE-411-18	Measurements and Instrumentation Lab.	2	0	2	4	30	20	50	3
7	BTEEE-412-18/ BTEE-412-18	Digital Electronics Laboratory	0	0	2	2	30	20	50	1
8	BTEEE-413-18/ BTEE-413-18	Electrical Machines – II Laboratory	0	0	2	2	30	20	50	1
9	BTEEE-414-18/ BTEE-414-18	Power Electronics Laboratory	0	0	2	2	30	20	50	1
10	BTMC-XXX-18	Mandatory Course (BTMC-101-18 or BTMC 102-18)	3	0	0	3	40	60	100	S/US
11	BMPD-401-18	Mentoring and Professional Development of Students	0	1	0	1	50	-	50	S/US
		Total	20	2	8	30	410	440	850	22

Students to undertake Six weeks summer industry internship/ field training (during vacation).

Additional Lectures/Tutorials: Need based additional lectures/tutorials may be introduced of any Course, however, the Credits of the course will not change.

BTEEE-321-18: Institutional Summer Vacation Training: Four (04) weeks Institutional Summer Vacation Training after 2nd semester for programme. B. Tech. (Electrical & Electronics Engineering)

Objective: The training is compulsory and is for the orientation of the students of Electrical & Electronics Engineering so that they are aware of/can identify the industrial, departmental, environmental, societal and other issues that are a challenge in the society and develop the ability to find solutions. The training in the concerned discipline will be provided in College/Department Labs /Workshops.

Content to be covered:

Module I, II & III: Hands on training/ practical knowledge on any three/four of the given contents

Module IV & V: Compulsory

Module	Content	Remarks
I	• Hands on training of wiring (Tube light, Incandescent bulb & LED light fitting, extension board, staircase). • Preparation of wiring diagram for domestic load/commercial load • Study of types of switches, protective devices (samples to be made available) • Types of electrical wires and Cables (samples to be made available) • Classification of Insulation (samples to be made available)	30 hours
II	• Single Line diagram of power generation, transmission distribution • Power scenario in India (Conventional & renewable sources of energy) (recent information from the website of Ministry of power to be included) • Introduction to the concept of Heating, Ventilation and Air conditioning. • The need of industrial safety. • Introduction to electrical machines and their maintenance.	30 hours
III	• Introduction to multimeter, function generator, CRO, • Identification and testing of resistors, capacitors, transistors and diodes, etc. • Observing the response of various circuits on CRO • Design and fabrication of +5V / +12V powers supply on bread board • Design and fabrication of half wave and/or full wave rectifier • Logics gates (using ICs)	30 hours
IV	• Study of main components of a sub-station and visit to local sub Station • Visit to industry/manufacturing unit related to discipline/branch (In case of small-scale industries/MSMEs, the faculty and students to identify small issues and propose requisite solutions/ remedies/ innovative solutions based on engineering) • Invited talk by Industry Expert • Expert talk on recent technologies	25 hours

Module	Content	Remarks
V	• Visit to local NGO/village/city to identify socio-economic/ environmental issues and identify a problem and prepare a "Problem formulation report" • To have a group discussion on the issues identified with faculty and to propose requisite solutions/remedies/innovative solutions based on Engineering.	25 hours
Total Time		140 hours

Evaluation Criterion:

i)   Four (04) weeks Institutional Summer Vacation Training after 2nd semester is a compulsory non-Credit course.

ii)   The students are required to maintain a daily dairy and submit it along with the "Problem formulation report".

iii) Student falling short of 75% attendance criterion is required to repeat the training with next batch.

iv)   Continuous evaluation to be done and proper record to be maintained.

v)   The result will be "Satisfactory/Unsatisfactory" which is to be recorded within 3 working days after the completion of the training.

BTEEE-521-18	Summer Industry Internship/ Field Training	(Non-Credit)

Six weeks in an Industry in the area of Electrical & Electronics Engineering during summer vacations after 4th semester. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report. The student will make a presentation based upon the Industry Internship attended. Performance to be rated as Satisfactory/Un -Satisfactory (S/US). For unsatisfactory the internship to be repeated.

Evaluation scheme (Summer Industry Internship/ Field Training)

Internal (to be evaluated by Industry)	Marks	External* (to be evaluated by Department)	Marks
Attendance	15	Daily Dairy	5
Performance (Work done /simulation/hardware/project developed)	30	Report	10
Report	10	Presentation (Work done /simulation/hardware/project developed)	25
Daily Dairy	05		
Total	*60*	*Total*	*40*

*External examiner not to be called.

Range of credits for Honors Degree -Minimum credits as per scheme are required by a student to be eligible to get Under Graduate degree in Electrical & Electronics Engineering. A student will be eligible to get Under Graduate degree with Honours, if he/she completes an additional 20 credits. These could be acquired through MOOCs and registering in the department.

Range of Credits and Courses for Major Degree in B. Tech. (Electrical & Electronics Engineering) and Minor Degree in B.Tech. (Electrical and Computer Engineering)

(i)   A student admitted in B. Tech (Electrical & Electronics Engineering) may opt for Major Degree in B.Tech. (Electronics & Electrical Engineering) and Minor Degree in B.Tech. (Electrical and Computer Engineering) with effect from 3rd semester onwards.

(ii)   The student must clear his/her previous two semesters (1st semester and 2nd semester).

(iii)   The student/candidate will require to clear at least five theory subjects for Minor Degree in B.Tech.

(iv)   The minimum credits for Minor Degree in B. Tech. will be 20 in which the student will have to clear minimum two (2) Core Courses and three (3) Professional Elective (PE) Courses / Core Courses).

(v)   A student is permitted to take maximum 8 credits (theory + lab) per semester pertaining to their Minor Degree in B.Tech.

Virtual Laboratories: Students may take at least one virtual laboratory any time before the commencement of the 8th Semester.

Open Elective: A student may take Courses from the list of Open Electives offered by other Departments or MOOCs Courses of SWAYAM/MOOCs courses approved by the Board of Studies.

MANDATORY COURSES (Non-Credit Courses)

Sr. No.	Semester	Course Code	Course Title	Hours/Week	Credits
1.	III/IV	BTMC-101-18	Indian Constitution	3L:0T:0P	Nil
2.	III/IV	BTMC-102-18	Essence of Indian Traditional Knowledge	3L:0T:0P	Nil
3.	V	EVS 101-18	Environmental Studies	2L:0T:0P	Nil

Students to undertake Six Weeks Summer Industry Internship (during vacation).

	Semester V [Third year]					Branch: Electrical & Electronics Engineering				
Sr. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**Hours/ Week**	**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
1	BTEE-501-18	Power Systems – I (Apparatus & Modelling)	3	1	0	4	40	60	100	4
2	BTEE-502-18	Control Systems	3	1	0	4	40	60	100	4
3	BTEE-503-18	Microprocessors	3	1	0	4	40	60	100	4
4	BTXXX-504X-18	Programme Elective-1	3	0	0	3	40	60	100	3
5	EVS-101-18	Environmental Studies	2	0	0	2	50	-	50	S/US
6	BTEE-511-18	Power Systems-I Laboratory	0	0	2	2	30	20	50	1
7	BTEE-512-18	Control Systems Laboratory	0	0	2	2	30	20	50	1
8	BTEE-513-18	Microprocessors Laboratory	0	0	2	2	30	20	50	1
9	BTEEE-521-18	Summer Industry Internship	-	-	-	-	40	60	100	S/US
10	BMPD-501-18	Mentoring and Professional Development of Students	0	1	0	1	50	-	50	S/US
	Total		**14**	**4**	**6**	**24**	**390**	**360**	**750**	**18**
	Semester VI [Third year]					Branch: Electrical & Electronics Engineering				
Sr. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**Hours/ Week**	**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
1	BTEE-601-18	Power Systems – II (Switchgear & Protection)	3	1	0	4	40	60	100	4
2	BTELE-602-18	Digital Signal Processing	3	1	0	4	40	60	100	4
3	BTXXX-603X-18	Programme Elective-2	3	0	0	3	40	60	100	3
4	BTXXX-604X-18	Programme Elective-3	3	0	0	3	40	60	100	3
5	OXX-XXX-18	Open Elective-1	3	0	0	3	40	60	100	3
6	HSMC-XXX-18	Humanities & Social Sciences including Mgt.	3	0	0	3	40	60	100	3
7	BTEE-611-18	Electronic Design Laboratory	1	0	2	3	30	20	50	2
8	BTEE-612-18	Power System II Laboratory	0	0	2	2	30	20	50	1
9	BTEEE-621-18	Minor Project	0	0	6	6	60	40	100	3
10	BMPD-601-18	Mentoring and Professional Development of Students	0	1	0	1	50	-	50	S/US
	Total		**19**	**3**	**10**	**32**	**410**	**440**	**850**	**26**

Institute/Department to decide regarding sending students for One Semester Training in 7th or 8th Semester.										
Semester VII/VIII [Fourth year]							**Branch: Electrical & Electronics Engineering**			
Sr. No.	Course code	Course Title	L	T	P	Hours/ Week	Internal Marks	External Marks	Total Marks	Credits
1	BTXXX-701X-18	Programme Elective-4	3	0	0	3	40	60	100	3
2	BTXXX-702X-18	Programme Elective-5	3	0	0	3	40	60	100	3
3	BTXXX-703X-18	Programme Elective-6	3	0	0	3	40	60	100	3
4	OXX-XXX-18	Open Elective-2	3	0	0	3	40	60	100	3
5	OXX-XXX-18	Open Elective-3	3	0	0	3	40	60	100	3
6	HSMC-XXX-18	Humanities & Social Sciences including Mgt.	3	0	0	3	40	60	100	3
7	BTEEE-703-18	Major Project	0	0	12	12	120	80	200	6
8	BMPD-701-18	Mentoring and Professional Development of Students	-	1	0	1	50	-	50	S/US
Total			18	1	12	31	410	440	850	24

Institute/Department/Student may decide for Industry oriented courses in lieu of One Semester Training in 7th or 8th Semester (Subject to approval from Competent Authority).

Semester VII/VIII [Fourth year]					Branch: Electrical & Electronics Engineering		
BTEEE-721-18 One Semester Training	**Internal Marks**				**External Marks**	**Total Marks**	**Credits**
	Mid- semester		End-semester				
Evaluation by	*Institute*	*Industry*	*Institute*	*Industry*	*External Examiner*		
Software Training& Project	50	25	50	25	200	500	16
Industrial Training &Project	50	25	50	25			
Total	**300**				**200**	**500**	**16**

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OR

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Semester VII/VIII [Fourth year]							Branch: Electrical & Electronics Engineering			
Sr. No.	Course code	Course Title	L	T	P	Hours/ Week	Internal Marks	External Marks	Total Marks	Credits
1	BTELE-801-18	Optical Fibers and Communication	3	0	0	3	40	60	100	3
2	BTEEE-802-18	Power Quality and FACTS	3	1	0	4	40	60	100	4
3	BTELE-803-18	Microwave Engineering	3	0	0	3	40	60	100	3
4	BTELE 812-18	Industrial Survey/Project based Technical Report or Technical paper writing/ and Seminar presentation.	0	0	8	8	60	40	100	4
5	BTELE-820-18	Optical Fibers and Communication lab	0	0	4	4	30	20	50	2
6	BMPD-801-18	Mentoring and Professional Development of Students	0	1	0	1	50	-	50	S/US
		Total	**9**	**2**	**12**	**23**	**260**	**240**	**500**	**16**

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Or

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Students may obtain relevant credits through MOOCS/SWAYAM Courses

PROFESSIONAL CORE COURSES [ELECTRICAL & ELECTRONICS ENGINEERING]
(also Core Courses for Minor Degree of B. Tech. (Electrical & Electronics Engineering)

Sem.	Course code	Course Title	L	T	P	Hours/ Week	Internal Marks	External Marks	Total Marks	Credits
Odd	BTEEE-301-18/ BTEE-301-18	Electrical Circuit Analysis	3	1	0	4	40	60	100	4
Odd	BTEEE-302-18/ BTEE-302-18	Analog Electronics	3	0	0	3	40	60	100	3
Odd	BTEEE-311-18/ BTEE-311-18	Analog Electronics Laboratory	0	0	2	2	30	20	50	1
Odd	BTEEE-303-18/ BTEE-303-18	Electrical Machines – I	3	0	0	3	40	60	100	3
Odd	BTEEE-312-18/ BTEE-312-18	Electrical Machines – I Laboratory	0	0	2	2	30	20	50	1
Odd	BTEEE-304-18/ BTEE-304-18	Electromagnetic Fields	3	1	0	4	40	60	100	4
Even	BTEEE-401-18/ BTEE-401-18	Digital Electronics	3	0	0	3	40	60	100	3
Even	BTEEE-412-18/ BTEE-412-18	Digital Electronics Laboratory	0	0	2	2	30	20	50	1
Even	BTEEE-402-18/ BTEE-402-18	Electrical Machines – II	3	0	0	3	40	60	100	3
Even	BTEEE-413-18/ BTEE-413-18	Electrical Machines – II Laboratory	0	0	2	2	30	20	50	1
Even	BTEEE-403-18/ BTEE-403-18	Power Electronics	3	0	0	3	40	60	100	3
Even	BTEEE-414-18/ BTEE-414-18	Power Electronics Laboratory	0	0	2	2	30	20	50	1

Even	BTEEE-404-18/ BTEE-404-18	Signals and Systems	3	0	0	3	40	60	100	3
Even	BTEEE-411-18/ BTEE-411-18	Measurements and Instrumentation Lab.	2	0	2	4	30	20	50	3
Odd	BTEE-501-18	Power Systems – I (Apparatus & Modelling)	3	1	0	4	40	60	100	3
Odd	BTEE-511-18	Power Systems-I Laboratory	0	0	2	2	30	20	50	1
Odd	BTEE-502-18	Control Systems	3	1	0	4	40	60	100	4
Odd	BTEE-512-18	Control Systems Laboratory	0	0	2	2	30	20	50	1
Odd	BTEE-503-18	Microprocessors	3	1	0	4	40	60	100	4
Odd	BTEE-513-18	Microprocessors Laboratory	0	0	2	2	30	20	50	1
Even	BTEE-601-18	Power Systems – II (Switchgear and Protection)	3	1	0	4	40	60	100	4
Even	BTELE-602-18	Digital Signal Processing	3	1	0	3	40	60	100	4
Even	BTEE-611-18	Electronic Design Laboratory	1	0	4	5	30	20	50	3
Even	BTEE-612-18	Power Systems-III Laboratory	0	0	2	2	30	20	50	1

Sr. No.	Semester	Programme Elective	Course Code	Course Title	Hrs/week	Credits
	PROFESSIONAL ELECTIVE (PE) COURSES [Electrical & Electronics Engineering] **(also Professional Elective Courses for Minor Degree of B. Tech. (Electrical & Electronics Engineering)**					
1.	V (odd)	PE-1	BTEE-504A-18	Electrical Engineering Materials	3L:0T:0P	3
2.	V (odd)	PE-1	BTEE-504B-18	Switchgear and Protection	3L:0T:0P	3
3.	V (odd)	PE-1	BTEE-504C-18	Electrical Machine Design	3L:0T:0P	3
4.	V (odd)	PE-1	BTEEE-504D-18	Computer Architecture	3L:0T:0P	3
5.	VI (even)	PE-2	BTEE-603A-18	Electromagnetic Waves	3L:0T:0P	3
6.	VI (even)	PE-2	BTEE-603B-18	Power System Dynamics and Control	3L:0T:0P	3
7.	VI (even)	PE-2	BTEE-603C-18	Electrical Drives	3L:0T:0P	3
8.	VI (even)	PE-2	BTEEE-603D-18	Digital Control Systems	3L:0T:0P	3
9.	VI (even)	PE-3	BTEE-604A-18	High Voltage Engineering	3L:0T:0P	3
10.	VI (even)	PE-3	BTEE-604B-18	Power System Reliability	3L:0T:0P	3
11.	VI (even)	PE-3	BTEE-604C-18	Line-Commutated and Active PWM Rectifiers	3L:0T:0P	3
12.	VI (even)	PE-3	BTEEE-604D-18	Embedded Systems	3L:0T:0P	3
13.	VII/VIII (Odd/Even)	PE-4	BTEE-701A-18	Electrical Energy Conservation & Auditing	3L:0T:0P	3
14.	VII/VIII (Odd/Even)	PE-4	BTEE-701B-18	Computer Aided Power System Analysis	3L:0T:0P	3
15.	VII/VIII (Odd/Even)	PE-4	BTEE-701C-18	Power Quality and FACTS	3L:0T:0P	3
16.	VII/VIII (Odd/Even)	PE-4	BTEEE-701D-18	Microcontroller and PLC	3L:0T:0P	3
17.	VII/VIII (Odd/Even)	PE-5	BTEE-702A-18	Computational Electromagnetics	3L:0T:0P	3
18.	VII/VIII (Odd/Even)	PE-5	BTEEE-702B-18	High Voltage DC Transmission Systems	3L:0T:0P	3
19.	VII/VIII (Odd/Even)	PE-5	BTEE-702C-18	Control Systems Design	3L:0T:0P	3
20.	VII/VIII (Odd/Even)	PE-6	BTEEE-702D-18	Optimization Techniques	3L:0T:0P	3

21.	VII/VIII (Odd/Even)	PE-6	BTEE-703A-18	Industrial Electrical Systems	3L:0T:0P	3
22.	VII/VIII (Odd/Even)	PE-6	BTEE-703B-18	Restructured Power Systems	3L:0T:0P	3
23.	VII/VIII (Odd/Even)	PE-6	BTEE-703C-18	Advanced Electric Drives	3L:0T:0P	3
24.	VII/VIII (Odd/Even)	PE-6	BTEEE-703D-18	Transducers and its Applications	3L:0T:0P	3

The institute may offer Professional Elective (PE) Courses [Electronics and Electrical Engineering] as per the groups given below (PE in the list if AICTE curriculum)

		Group: A	Group: B	Group: C	Group: D
V (Odd)	PE-1	Electrical Engineering Materials	Switchgear and Protection	Electrical Machine Design	Computer Architecture
VI (even)	PE-2	Electromagnetic Waves	Power System Dynamics and Control	Electrical Drives	Digital Control Systems
	PE-3	High Voltage Engineering	Power System Reliability	Line-Commutated and Active PWM Rectifiers	Embedded Systems
VII /VIII(Odd/Even)	PE-4	Electrical Energy Conservation & Auditing	Computer Aided Power System Analysis	Power Quality and FACTS	Microcontroller and PLC
	PE-5	Computational Electromagnetics	High Voltage DC Transmission Systems	Control Systems Design	Optimization Techniques
	PE-6	Industrial Electrical Systems	Restructured Power Systems	Advanced Electric Drives	Transducers and its Applications

LIST OF OPEN ELECTIVE COURSES FOR STUDENTS OF OTHER PROGRAMMS
OFFERED BY ELECTRICAL & ELECTRONICS ENGINEERING
Prerequisite: To have passed Basic Electrical Engineering/Basic Electronics Engineering Course

Sr. No.	Course Code	Semester	Course Title	L	T	P	Hours/ Week	Credits
1.	OEEE-101-18	Odd	Fundamentals in Control systems	3	0	0	3	3
2.	OEE-102-18	Odd-	Power Electronics	3	0	0	3	3
3.	OEEE-103-18	Odd	Energy Management	3	0	0	3	3
4.	OEE-104-18	Odd	Renewable Energy Sources	3	0	0	3	3
5.	OEEE-201-18	Even	Electric Drives	3	0	0	3	3
6.	OEE-201-18	Even	Electric Machines	3	0	0	3	3
7.	OEEE-202-18	Even	Materials in Electrical Systems	3	0	0	3	3
8.	OEEE-203-18	Even	Electric Safety	3	0	0	3	3

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sr. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Semester
1	BTHU-101-18	English	2:0:0	2	I/II
2	BTHU-102-18	English Laboratory	0:0:2	1	I/II
3	HSMC-XXX-18	To be selected by Individual Institutions from the given list of Humanities & Social Sciences including Management	3:0:0	3	VI
4	HSMC-XXX-18		3:0:0	3	VII
Total			-	9	-

List of Humanities & Social Sciences including Management

Sr. No.	Course Code	Course Title	Hours/ week	Credits
1.	HSMC103-18	Education, Technology and Society	2L:1T:0P	3
2.	HSMC104-18	History of Science and Technology in India	2L:1T:0P	3
3.	HSMC113-18	Values and Ethics	2L:1T:0P	3
4.	HSMC118-18	Introduction to Women's and Gender Studies	2L:1T:0P	3
5.	HSMC123-18	Human Relations at Work	2L:1T:0P	3
6.	HSMC124-18	Sanskrit Bhasa	2L:1T:0P	3
7.	HSMC (MME-303)	Law and Engineering	2L:1T:0P	3

Details of Credits and Maximum Marks

Semester	Hrs per week	Credits	Maximum Marks
1&2	24+29	17.5+20.5=38	500+650=1150
3	26	20	750
4	30	22	850
5	24	18	750
6	32	26	850
7	31	24	850
8	23 (for those not opting for one semester training)	16	500
Total		**164**	**5700**

I. GUJRAL PUNJAB TECHNICAL UNIVERSITY

Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

NOTIFICATION

Sub: Change / upgradation of branch in 3rd semester of B. Tech program.

The student who opt for change/ updgration of branch in 3rd Semester of B. Tech w.e.f. admission session 2018-2019 onwards within College/Institute affiliated to IKGPTU, shall have to study the bridge course / additional subjects as per following guidelines:

A- For Mathematics

1. Two Bridge courses (Bridge course-I, II) have been formulated in Mathematics for change of branch. Bridge Course-I should be opted by the students shifting the branch within the departments of Mechanical Engineering, Civil Engineering, Electrical Engineering and Electronics & Communication Engineering and related branches. The list of related branches is enclosed at **Annexure-I**.

2. For shifting the branch from any of the above said departments to Computer Science and Engineering, the students should opt for Bridge Course-II.

3. The student shifting the branch from Computer Science Engineering to any of the above said branches of Mechanical Engineering, Civil Engineering, Electrical Engineering, Electronics and Communication Engineering students should opt Bridge Course-I.

4. Both the Bridge Courses should be audit/qualifying courses and no extra credit be awarded to students qualifying these courses.

5. These courses should be evaluated by the concerned teacher allocated to teach this course through internal evaluation. The evaluation of these courses should be done at college/departmental level as no extra credits are to be awarded to the students.

6. Concerned teacher should be given 2 hours load per week for teaching the bridge course.

7. No extra credit should be awarded to the student for qualifying the course.

8. The audit/qualifying course should have to be qualified by the students within one year of change of branch.

9. The institute shall issue a certificate that the student has passed additional / Bridge Course successfully.

10. Upon certification by teacher for qualifying the audit course/s (theory and practical), earlier issued result notification/s and DMCs of the concerned student shall be cancelled and the Examination Department of IKGPTU shall issue new result notification and DMCs as per upgraded curriculum with same number of credits.

B. For Physics:

1. In Physics no Bridge Course or Qualifying course is required if the students opt for shifting of branch within the following groups:
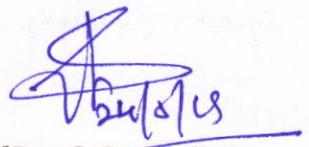
Group	Branch	Shifted to Branch & Vica-Versa
I	Computer Science	Electronics and Communication
II	Electrical Engineering	Chemical Sciences
III	Chemical Sciences	Biotechnology

2. If the student opts for shifting of branch outside the above mentioned groups, then he/she is required to qualify the complete course of physics (theory and practical) of previous semester of the opted branch.

3. No extra credit should be awarded to the student for qualifying the course.

4. These courses should be evaluated by the concerned teacher allocated to teach this course through internal evaluation. The evaluation of these courses should be done at college/departmental level as no extra credits are to be awarded to the students.

5. Concerned teacher should be given 2 hours load per week for teaching the bridge course.

6. The audit/qualifying course should have to be qualified by the students within one year of change of branch.

7. The institute shall issue a certificate that the student has passed additional / Bridge Course successfully.

8. Upon certification by teacher for qualifying the audit course/s (theory and practical), earlier issued result notification/s and DMCs of concerned student shall be cancelled and the Examination Department of IKGPTU shall issue new result notification and DMCs as per upgraded curriculum with same number of credits.

Encl: Total 04 pages

(Dr. S.S. Walia)
Registrar

Endst. No. IKGPTU/REG/NF/2|02-2|05   Dated: 24.05.2019

A copy is forwarded to the following officers for information please.

1. I/c Secretariat, O/o Vice Chancellor: For information of Vice Chancellor
2. All HoDs (Non-Teaching)
3. Director (Main Campus): To inform the all HoDs (Teaching) and Incharge, all Constituent Campuses
4. Director, IKGPTU Hoshiarpur Campus

(Dr. S. S. Walia)
Registrar

Sr. No.	Branch	Related Branches
1	Civil Engineering-	1. Civil Engineering
		2.Construction Engineering & Management
2	Electrical Engineering-	1.Electrical Engineering
		2.Automation & Robotics
		3.Electrical & Electronics Engineering
		4.Electronics & Electrical Engineering
		5.Electrical Engineering & Industrial Control
		6.Instrumentation & Control Engineering
3	Mechanical Engineering	1.Mechanical Engineering
		2.Marine Engineering
		3.Production Engineering
		4.Industrial Engineering
		5.Tool Engineering
		6.Automobile Engineering
		7.Aerospace Engineering
		8.Aeronautical Engineering
4	Computer Science Engineering	1.Computer Engineering
		2.Computer Science Engineering
		3.Information Technology
		4.3D Animation Engineering
5	Electronics and communication Engineering	1.Electronics & Communication Engineering
		2.Electronics & Computer Engineering
		3.Electronics & Instrumentation Engineering
		4.Electronics & Telecomm Engineering
		5.Electronics Engineering
6	Chemical Sciences	1.Chemical Engineering
		2.Petrochem & Petroleum Refinery Engineering
		3.Textile Engineering
		4.Food Technology
7	Bio-Technology-	Bio-Technology

Subject Code: BTAMBC1-18

Section-A

Unit-I: Partial Differential Equations

Introduction to PDEs, Lagrange's Equation, Classification of PDEs, D' Alembert's solution of wave equations, heat equations and their solutions by variable separable method and Fourier series, Solution of boundary-value problems for various linear PDEs.

Unit-II: Numerical Methods

Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method, Newton-Raphson method, System of linear equations: Gauss elimination method, Gauss Seidel method, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Ordinary Differential equations: Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first order equations.

Section-B

Unit-III: Complex Variable – Differentiation

Elementary functions of complex variables, limit, continuity and differentiability, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate.

Unit-IV: Complex Variable – Integration

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

Text / References:

1. Sneddon, I.N., *Elements of Partial Differential Equation, 3rd Edition*. McGraw Hill Book Company, 1998.

2. Copson, E.T., *Partial Differential Equations, 2nd Edition*. Cambridge University Press, 1995.

3. Strauss, W.A., *Partial Differential Equations: An Introduction, 2nd Edition*. 2007.

4. Sharma, J.N., *Numerical Methods for Engineers and Scientists, 2nd Edition*. Narosa Publ. House New Delhi/Alpha Science International Ltd., Oxford UK, 2007, Reprint 2010.

5. Jain, M.K., Iyengar, S.R.K. and Jain, R.K., *Numerical Methods for Scientific and Engineering Computation, 5th Edition. New Age International Publ.* New Delhi, 2010

6. Ahlfors, L.V., *Complex Analysis, 2nd Edition*. McGraw-Hill International Student Edition, 1990.

7. Kumar, R.R., Complex Analysis, Pearson Education, 2015.

8. Churchill, R. and Brown, J.W., *Complex Variables and Applications, 6th Edition*. New-York: McGraw-Hill, 1996.

Unit-I: Measures of Central tendency: Moments, skewness and kurtosis, Variance, Correlation coefficient, Probability, conditional probability, independence; Discrete random variables.

Unit-II: Continuous random variables, Probability distributions: Binomial, Poisson and Normal, Poisson approximation to the binomial distribution, evaluation of statistical parameters for these three distributions.

Unit-III: Correlation and regression for bivariate data, Rank correlation, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance for small and large samples (z-test, t-test, F-test and Chi-square test).

Text / References:

1. Hoel, P. G., Port, S. C. and Stone, C. J., *Introduction to Probability Theory*, Universal Book Stall, 2003 (Reprint).
2. Ross, S., *A First Course in Probability*, 6th Ed., Pearson Education India, 2002.
3. Feller, W., *An Introduction to Probability Theory and its Applications*, Vol. 1, 3rd Ed., Wiley, 1968.
4. Bali, N.P. and Goyal, M., *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2010.

IKG Punjab Technical University

Syllabus

(3rd - 4th Semester)

for

Undergraduate Degree Programme

Bachelor of Technology

in

ELECTRICAL & ELECTRONICS ENGINEERING

2018 & onwards

SEMESTER: III
[Second Year]

BTEEE-301-18/ BTEE-301-18	**Electrical Circuit Analysis**	**3L:1T:0P**	**4 credits**

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	Apply network theorems for the analysis of electrical circuits.
CO 2	Obtain the transient and steady-state response of electrical circuits.
CO 3	Analyze circuits in the sinusoidal steady-state (single-phase and three-phase). Analyze two port circuit behavior.
CO 4	Synthesize networks and filters.

Module 1: Basic Network Analysis (14 Hours)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks. Solution of first and second order differential equations for series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Module 2: Electrical circuit and steady state analysis (14 Hours)

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot convention in coupled circuits, Ideal Transformer. Analysis of electrical circuits using Laplace Transform for standard inputs, transformed network with initial conditions. Frequency response (magnitude and phase plots), series and parallel resonances.

Module 3: Network functions and two port network (10 Hours)

Driving point impedance and admittance, natural response of a network, transfer impedance and admittance, concept of pole and zeros in a network function, Routh Hurwitz criterion of stability.

Two Port Networks: terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Module 4: Network Synthesis and Filters (10 Hours)

Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Filters: Classification of filters, characteristics impedance and propagation constant of pure reactive network, ladder network, T-section, π-section, terminating half section, pass bands and stop bands, Design of constant-K, m-derived filters.

Text / References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

BTEEE- 302-18/ BTEE- 302-18	**Analog Electronics**	**3L:0T:0P**	**3 credits**

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	Understand the characteristics of transistors.
CO 2	Design and analyse various rectifier and amplifier circuits.
CO 3	Design sinusoidal and non-sinusoidal oscillators.
CO 4	Understand the functioning of OP-AMP and design OP-AMP based circuits.

Module 1: Diode and BJT circuits (12 Hours)

P-N junction diode, *V-I* characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.
BJT circuits: Structure and *V-I* characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers.

Module 2: MOSFET circuits (10 Hours)

MOSFET structure and *V-I* characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Module 3: Differential, multi-stage and operational amplifiers (10 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 4: Linear applications of op-amp (10 Hours)

Idealized analysis of op-amp circuits. Specifications. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, voltage regulator, Oscillators: Principle of operation, Wein's bridge and phase shift oscillator.

Text/References:

1. A. S. Sedra & K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

BTEEE-303-18/ BTEE-303-18	Electrical Machines-I	3L:0T:0P	3 credits

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to:

CO 1	Understand the concepts of magnetic circuits.
CO 2	Understand the operation of DC machines.
CO 3	Analyse the differences in operation of different DC machine configurations.
CO 4	Analyse single phase and three phase transformers circuits.

Module 1: Magnetic fields and magnetic circuits (6 Hours)
Review of magnetic circuits - MMF, flux, reluctance, inductance; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Module 2: DC machines (12 Hours)
Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Module 3: DC machine - motoring and generation (12 Hours)
Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. *V-I* characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

Module 4: Transformers (12 Hours)
Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency, Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses, Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

Text / References:
1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.

2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

BTEEE-303-18/ BTEE-303-18	**Electromagnetic Fields**	**3L:1T:0P**	**4 credits**

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

Course Outcomes:

At the end of the course, students will demonstrate the ability:

CO 1	To understand the basic laws of electromagnetism.
CO 2	To obtain the electric and magnetic fields for simple configurations under static conditions.
CO 3	To analyse time varying electric and magnetic fields.
CO 4	To understand Maxwell's equation in different forms and different media.
CO 5	To understand the propagation of EM waves.

This course shall have Lectures and Tutorials. Most of the students find difficult to visualize electric and magnetic fields. Instructors may demonstrate various simulation tools to visualize electric and magnetic fields in practical devices like transformers, transmission lines and machines.

Module 1: **Review of Vector Calculus (8 hours)**

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus- differentiation, partial differentiation, integration, vector operator, del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

Module 2: Static Electric Field (15 Hours)

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

Module 3: Magnetic Forces, and Inductance (10 Hours)

Biot-Savart's law, Ampere's law of force, Ampere's circuital law, Faraday's law, Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, calculations of inductances and mutual inductances for a solenoid and toroid.

Module 4: Maxwell's Equations in Time Varying Fields and Wave theory (15 Hours)

Concept of displacement current and conduction current, Maxwell's equation-differential and integral form, Poynting's theorem, its significance and Poynting's vector, Boundary Conditions.

Wave theory: Derivation of wave equation, uniform plane waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Attenuation, phase and propagation constant, intrinsic impedance, Relation between E & H, wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect.

Text / References:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

BTEE-305-18	**Engineering Mechanics**	**3L:1T:0P**	**4 credits**

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to:

CO 1	Understand the concepts of co-ordinate systems.
CO 2	Analyse the three-dimensional motion.
CO 3	Understand the concepts of rigid bodies.
CO 4	Analyse the free-body diagrams of different arrangements.
CO 5	Analyse torsional motion and bending moment.

Module 1: Introduction to vectors and tensors and co-ordinate systems (5 hours)
Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.

Module 2: Three-dimensional Rotation (4 hours)
Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.

Module 3: Kinematics of Rigid Body (6 hours)
Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between twoand three-dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.

Module 4: Kinetics of Rigid Bodies (5 hours)
Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.

Module 5: Free Body Diagram (1 hour)
Free body diagrams; Examples on modelling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.

Module 6: General Motion (9 hours)
Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.

Module 7: Bending Moment (5 hours)
Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.

Module 8: Torsional Motion (2 hours)
Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.

Module 9: Friction (3 hours)
Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.
Text / References:
1.   J. L. Meriam and L. G. Kraige, "Engineering Mechanics: Dynamics", Wiley, 2011.
2.   M. F. Beatty, "Principles of Engineering Mechanics", Springer Science & Business Media,1986.

BTEEE-311-18/ BTEE-311-18	Analog Electronics Laboratory	0L:0T:2P	1 Credit

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	Understand the use and importance of various types of equipment used in the laboratory.
CO 2	Ability to make circuits on bread-board.
CO 3	Analyze, take measurements to understand circuit behavior and performance under different conditions.
CO 4	Troubleshoot, design and create electronic circuits meant for different applications.
CO 5	Evaluate the performance electronic circuits and working small projects employing semiconductor devices.

Hands-on experiments related to the course contents of BTEEE302-18

Note: A student to perform any 8-10 experiments and make one minor working model project.

Suggested List of Experiments:

1. To draw *V-I* characteristics of a PN junction diode (Ge, Si, switching and signal).
2. To design half wave rectifier.
3. To design full wave and bridge rectifiers.
4. To study the transistor characteristics in common base, common collector, and common emitter configurations.
5. To study the *V-I* characteristics of a MOSFET.
6. To design a voltage regulator IC using zener diode and also see the effect of line and load regulation
7. To design various clippers and clampers using diodes.
8. To obtain the frequency response of an amplifier and calculate the gain bandwidth of the amplifier.
9. To investigate the emitter follower (Buffer) amplifier and determine A_V, R_i, and R_O
10. To design and study various type of oscillators, and determine frequency of oscillations.
11. To design a transistor series voltage regulator with current limits and observe its current feedback characteristics.
12. To study the characteristics of a complementary symmetry amplifier.
13. To study the application of an Op-Amp (741) as inverting and non-inverting amplifier.
14. To use the OP-AMP as summing, scaling and averaging amplifier.
15. Design differentiator and integrator using OP-AMP and also determine the time constant and cut-off frequency.

BTEEE-312-18/ BTEE-312-18	Electrical Machines – I Laboratory	0L:0T:2P	1 Credit

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	Analyze three-phase transformer/system connections.
CO 2	Evaluation of equivalent circuit parameters, efficiency and voltage regulation by performing various tests on transformer.
CO 3	Analyze parallel operation of transformers.
CO 4	Analyze performance characteristics of DC generators.

Hands-on experiments related to the course contents of BTEEE312-18

Note: A student to perform any 8-10 Experiments and make one minor working model project.

Suggested List of Experiments:

1. To perform the load test on a single phase transformer.
2. To perform open circuit and short circuit tests on a single phase transformer and hence draw the equivalent circuit, calculate the voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of a three phase transformer.
6. To perform Scott connections on three phase transformer to get two phase supply.
7. To study the constructional details of DC machine and to draw sketches of different components.
8. To measure armature and field resistance of DC shunt generator and to obtain its open circuit characteristics.
9. To obtain load characteristics of DC shunt/series/compound generator.
10. To draw speed-torque and torque-speed characteristics of DC shunt/series /compound generator.
11. To study the three point and four point DC motor starters.
12. To perform Swinburne's test (no load test) to determine various losses of DC shunt motor.
13. To visualize the magnetic fields produced by a bar magnet and a current carrying coil using FEMM/ ANSYS Maxwell.
14. To visualize the magnetic field produced in an electrical machine using FEMM/ ANSYS Maxwell.

SEMESTER: IV
[Second Year]

BTEEE-401-18/ BTEE-401-18	**Digital Electronics**	**3L:0T:0P**	**3 credits**

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to:

CO 1	Understand working of logic families and logic gates.
CO 2	Design and implement Combinational and Sequential logic circuits.
CO 3	Understand the process of Analog to Digital conversion and Digital to Analog conversion.
CO 4	Be able to understand memories.

Module 1: Fundamentals of Digital Systems and logic families (10 Hours)
Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

Module 2: Combinational Digital Circuits (10 Hours)
Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 3: Sequential circuits and systems (12 Hours)
A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K-T and D- types flipflops, applications of flipflops, shift registers, applications of shift registers, serial o parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Module 4: A/D and D/A Converters (10 Hours)
Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit ,analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using Voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs, concept of memories.

Text/References:
1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

BTEEE-402-18/ BTEE-402-18	**Electrical Machines – II**	**3L:0T:0P**	**3 credits**

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	Understand the concepts of rotating magnetic fields.
CO 2	Understand the operation of AC machines.
CO 3	Analyse performance characteristics of AC machines.
CO4	To understand the difference between the synchronous machines and asynchronous machines

Module 1: Fundamentals of AC machine windings (8 Hours)

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor

Module 2: Pulsating and revolving magnetic fields (12 Hours)

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Module 3: Induction Machines (12 Hours)

Concept of rotating magnetic field, Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and maximum torque, power flow diagram, Equivalent circuit. Phasor diagram, Losses and efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-fed induction machines.

Single phase induction motors: Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications

Module 4: Synchronous machines (10 Hours)

Constructional features, cylindrical rotor and salient pole synchronous machine - generated EMF, coil span and distribution factor, equivalent circuit and phasor diagram, armature reaction at different power factor loads, voltage regulation by synchronous impedance and zero power factor method, concept of short circuit ratio, Operating characteristics of synchronous machines, V-curves and inverter-V curves. Hunting. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Text/References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
6. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

BTEEE-403-18/ BTEE-403-18	Power Electronics	3L:0T:0P	3 credits

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

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO 1	Understand the differences between signal level and power level devices.
CO 2	Analyse controlled rectifier circuits.
CO 3	Analyse the operation of DC-DC choppers.
CO 4	Analyse the operation of voltage source inverters.

Module 1: Power switching devices (8 Hours)

Diode, Thyristor, MOSFET, IGBT: *V-I* characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

Module 2: Thyristor rectifiers (10 Hours)

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

Module 3: DC-DC buck converter (12 Hours)

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. DC-DC boost converter: Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

Module 4: Single-phase voltage source inverter (12 Hours)

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage. Three-phase voltage source inverter: Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation

Text/References:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

BTEEE-404-18/ BTEE-404-18	**Signals and Systems**	**3L:0T:0P**	**3 credits**

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	Understand the concepts of continuous time and discrete time systems.
CO 2	Analyse systems in complex frequency domain.
CO 3	Understand sampling theorem and its implications.
CO 4	Understand mathematical tools to be able to apply in state variable modeling

Module 1: Introduction to Signals and Systems (12 hours):

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

Module 2: Behavior of continuous and discrete-time LTI systems (12 hours)

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

Module 3: Fourier, Laplace and z- Transforms (10 hours)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Module 4: Sampling and Reconstruction (8 hours)

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Text/References:

1. V. Oppenheim, A.S. Willsky & S.H. Nawab, "Signals and systems", Prentice Hall, 1997.
2. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall,2009.
6. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

BTAM 302-18	Mathematics-III (Probability and Statistics)	L-3, T-1,P-0	4 Credits
Internal Marks: 40	External Marks: 60	Total Marks: 100	
Pre-requisite: None			
Course Objectives: The objective of this course is to familiarize the student with statistical techniques. It aims to equip he students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.			
Course Outcomes: At the end of the course, the student will be able to			
CO1	Have basics knowledge about measure of central tendency, skewness, kurtosis and moments and their applications in engineering fields.		
CO2	Familiarize the student with expectations of discrete and continuous random variable.		
CO3	Familiarize probability techniques and random variables and detailed knowledge of probability distribution with so as to use it with any date of engineering problem formulation.		
CO4	Have basic idea about statistics including correlation, regression and then up to advanced level with testing of large samples that is important in solving problems related to engineering.		
CO5	To fit the given data into curves by various methods which forms an important application in engineering .		

Section A   **(22 lectures)**

Unit I

Measures of Central tendency: Moments, skewness and Kurtosis, Variance, Probability, conditional probability, Discrete and Continuous random variables, Expectations of Discrete and Continuous random variables.

Unit II

Probability distributions: Binomial, Poisson and normal , Poisson approximation to the binomial distribution, evaluation of statistical parameters for these three distribution, Bivariate distributions and their properties.

Section B   **(20 lectures)**

Unit III

Correlation and regression for bivariate data, Rank correlation, Curve fitting by the method of least square, fitting of straight lines , second degree parabolas and more general curve.

Unit IV

Test of significances: Sampling and standard error, Tests of significance for large samples and small samples (t-distribution, F-distribution), Chi-square test for goodness of fit and independence of attributes.

Suggestion Text/Reference Books

1.   S.P. Gupta, Statistical Methods, Sultan Chand & Sons, 33rd Edition, 2005.
2.   S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & sons, 2014.
3.   S. Ross, A First Course in Probability, 6th Edition, Pearons Education India, 2002.
4.   N.P Bali and Mukesh Goyal, A text book of Engineering Mathematics , Laxmi Publications, Reprint, 2010.
5.   Robert V. Hogg, Joseph W. Mekean and Allen T. Craig, Introduction to Mathematics Statistics,7th Edition, Pearsons, 2012.

BTEEE-411-18/ BTEE-411-18	Measurements and Instrumentation Laboratory	2L:0T:2P	3 credits

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	Design and validate DC and AC bridges.
CO 2	Analyze the dynamic response and the calibration of few instruments.
CO 3	Learn about various measurement devices, their characteristics, their operation and their limitations.
CO 4	Understand statistical data analysis.
CO 5	Understand computerized data acquisition.

Lectures/Demonstrations:

1. Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.
2. Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, C_p, C_{pk}.
3. Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.
4. Current and Voltage Measurements. Shunts, Potential Dividers. Instrument Transformers, Hall Sensors.
5. Measurements of R, L and C.
6. Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.
7. Digital Storage Oscilloscope.

Experiments

1. Measurement of a batch of resistors and estimating statistical parameters.
2. Measurement of L using a bridge technique as well as LCR meter.
3. Measurement of C using a bridge technique as well as LCR meter.
4. Measurement of Low Resistance using Kelvin's double bridge.
5. Measurement of High resistance and Insulation resistance using Megger.
6. Usage of DSO for steady state periodic waveforms produced by a function generator. Selection of trigger source and trigger level, selection of time-scale and voltage scale. Bandwidth of measurement and sampling rate.
7. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.
8. Usage of DSO to capture transients like a step change in R-L-C circuit.
9. Current Measurement using Shunt, CT, and Hall Sensor.
10. Measurement of frequency using Wein's Bridge.
11. To find 'Q' of an inductance coil and verify its value using Q- meter.
12. Plotting of Hysteresis loop for a magnetic material using flux meter.

Note: A student to perform any 8-10 Experiments and make one minor working model project.

BTEEE-412-18/ BTEE-412-18	Digital Electronics Laboratory	0L:0T:2P	1 Credit

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1	To understand of basic electronic components and circuits
CO 2	Understanding verify truth tables of TTL gates
CO 3	Design and fabrication and realization of all gates and basic circuits
CO 4	Design the truth tables and basic circuits
CO 5	Testing of basic electronics circuits

Hands-on experiments related to the course contents of BTEEE401-18

Note: A student to perform any 8-10 Experiments and make one working minor project.

Suggested List of Experiments:

1. Design a delay circuit using 555 timer and study the monostable, bistable and astable operations using 555.
2. a)   Verification of the truth tables of TTL gates viz;
          7400,7402, 7404, 7408,7432,7486.
   b)   Design and fabrication and realization of all gates using NAND/NOR gates.
3. Verification of truth table of Mutiplexer(74150)/Demultiplexer(74154)
4. Design and verification of truth tables of half-adder, full-adder and subtractor circuits using gates 7483 and 7486(controlled inverter).
5. To study the operation of Arithmetic Logic Unit IC 74181.
6. Design fabrication and testing of
   a)   Monostable multivibrator of $t = 0.1$ms approx. using 74121/123.testing for both positive and negative edge triggering, variation in pulse width and retriggering.
   b)   Free running mutivibrator at 1KHz and 1Hz using 555 with 50% duty cycle. Verify the timing from theoretical calculations.
7. Design and test S-R flip-flop using NOR/NAND gates.
8. Design, fabricate and test a switch debouncer using 7400.
9. Verify the truth table of a JK flip flop using IC 7476,
10. Verify the truth table of a D flip flop using IC 7474 and study its operation in the toggle and asynchronous mode.
11. Operate the counters 7490, 7493 and 74193(Up/Down counting mode). Verify the frequency division at each stage. Using a frequency clock (say 1 Hz) display the count of LED's.
12. Verify the truth table of decoder driver7447/7448. Hence operate a 7 segment LED display through a counter using a low frequency clock. Repeat the above with the BCD to Decimal decoder 7442.

BTEEE-413-18/ BTEE-413-18	Electrical Machines-II Laboratory	0L:0T:2P	1 Credit

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to:

CO 1	Construct equivalent circuits induction motors by routine tests.
CO 2	Comprehend the requirement of starting and speed control methods of induction motors in the various applications of industry.
CO 3	Construct equivalent circuits of synchronous generator and motor.
CO 4	Apply knowledge to show utility of alternator, synchronous motors and synchronous condenser for various applications in power system.
CO 5	Construct characteristic curves for induction and synchronous machines
CO 6	Understand the concept of parallel operation of three phase alternators.

Hands-on experiments related to the course contents of BTEEE402-18
Note: A student to perform any 8-10 Experiments and make one hardware/software based minor project.
Suggested List of Experiments:

1. To perform load-test on three-phase Induction motor and to plot torque versus speed characteristics.
    a) To perform no-load and blocked–rotor tests on three-phase Induction motor to obtain equivalent circuit.
    b) To develop an algorithm (Matlab/C/C++) for speed torque characteristics using calculated equivalent circuit parameters.
2. To study the speed control of three-phase Induction motor by Kramer's Concept.
3. To study the speed control of three-phase Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.
4. To study star- delta starters physically and
    a) to draw electrical connection diagram
    b) to start the three-phase Induction motor using it.
    c) to reverse the direction of three-phase Induction motor
5. To start a three-phase slip –ring induction motor by inserting different levels of resistance in the rotor circuit and plot torque –speed characteristics.
6. To perform no-load and blocked–rotor test on single-phase Induction motor and to determine the parameters of equivalent circuit drawn on the basis of double revolving field theory.
7. To perform no load and short circuit. Test on three-phase alternator and draw open and short circuit characteristics.
8. To find voltage regulation of an alternator by zero power factor (ZPF.) method.
9. To study effect of variation of field current upon the stator current and power factor with synchronous motor running at no load and draw Voltage and inverted Voltage curves of motor.
10. Parallel operation of three phase alternators using
    (i) Dark lamp method   (ii) Two-Bright and one dark lamp method
11. To study synchroscope physically and parallel operation of three-phase alternators using synchroscope.
12. Starting of synchronous motors using:
    (i) Auxiliary motor   (ii) Using Damper windings

BTEEE-414-18/ BTEE-414-18	Power Electronics Laboratory	0L:0T:2P	1 Credit

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to:

CO 1	Understand the properties and characteristics of thyristors.
CO 2	Understand the different types of waveforms of inverter and chopper circuits.
CO 3	Analyze speed and direction control of single phase and three phase electric motors using ac and dc drive.
CO 4	Understand the effect of free-wheeling diode on pf with RL load.
CO 5	Check the performance of a choppers, and inverter.

Hands-on experiments related to the course contents of BTEEE403-18

Note: A student to perform any 8-10 Experiments and make one hardware/software based minor project.

Suggested List of Experiments:

1. To plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
3. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
4. Study of the microprocessor-based firing control of a bridge converter.
5. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
6. To study Jones chopper or any chopper circuit to check the performance.
7. Thyristorised speed control of a D.C. Motor.
8. Speed Control of induction motor using thyristors.
9. Study of series inverter circuit and to check its performance.
10. Study of a single-phase cycloconverter.
11. To check the performance of a McMurray half-bridge inverter.

BTEEE-521-18	Summer Industry Internship/ Field Training	(Non-Credit)

Six weeks in an Industry in the area of Electronics and Electrical Engineering. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report. The student will make a presentation based upon the Industry Internship attended. Performance to be rated as Satisfactory/Un -Satisfactory (S/US). For unsatisfactory the internship to be repeated.

Evaluation scheme (Summer Industry Internship/ Field Training)

Internal (to be evaluated by Industry)	Marks	External* (to be evaluated by Department)	Marks
Attendance	15	Daily Dairy	5
Performance (Work done /simulation/hardware/project developed)	30	Report	10
Report	10	Presentation (Work done /simulation/hardware/project developed)	25
Daily Dairy	05		
Total	*60*	*Total*	*40*

*External examiner not to be called.

Mandatory Courses (non-credit)

BTMC-101-18	**Indian Constitution**	**3L:0T:0P**	**0 credits**

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

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does nottruly incorporate our own

ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened   the   same   through   progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1   Meaning of the constitution law and constitutionalism
2   Historical perspective of the Constitution of India
3   Salient features and characteristics of the Constitution of India
4   Scheme of the fundamental rights
5   The scheme of the Fundamental Duties and its legal status
6   TheDirectivePrinciplesofStatePolicy–Itsimportanceandimplementation
7   Federal structure and distribution of legislative and financial powers between the Union and the States
8   Parliamentary Form of Government in India – The constitution powers and status of the President of India
9   Amendment of the Constitutional Powers and Procedure
10   The historical perspectives of the constitutional amendments in India
11   Emergency Provisions : National Emergency, President Rule, Financial Emergency

12   Local Self Government – Constitutional Scheme in India
13   Scheme of the Fundamental Right to Equality
14   Scheme of the Fundamental Right to certain Freedom under Article19
15   ScopeoftheRighttoLifeandPersonalLibertyunderArticle21

Objectives: The objective of the course is to provide the basic knowledge about the Political System of the Country. The basic idea is to make the students aware of their duties and rights. Apart from it the course will aim to educate the pupils about the working of different organs of the government, various constitutional bodies and the agencies of the government. In addition to it, students will be given brief knowledge regarding the different challenges of Indian Political System, forms of Government in India and nature & dimensions of Indian Federal System.

Course Pedagogy: Since the course is of Practical Importance, it is recommended that during the course students will be taken out for one visit to any place with the potential of imparting practical knowledge to the students about the Indian Political System. Such places can be Indian Parliament. State Legislative Assembly, Youth Parliament Pune. It is expected that students should be given case studies about the Indian Political System and Debates on Constitutional Issues should be organised in the campus.

Course Outcome: After the successful completion of the course students will be to understand the different dimensions of Indian Political System. They will be aware about their duties towards the fellow citizens. Students will be able to challenges of the democratic institutions and theoretical aspects of the state and its organs.

Suggested Reading:

1. Indian Political System by J C Johri
2. Indian Political System by Mahendra Prasad Singh
3. Fundamentals of Indian Political System by Rajesh K Jha
4. Our Constitution by Subhash C Kashyap
5. Our Political System by Subhash C Kashyap
6. Indian Federalism – An Introduction by Mahendra Prasad Singh
7. Indian Federalism and Autonomy by S Chandrasekhar

BTMC-102-18	Essence of Indian Traditional Knowledge	3L:0T:0P	0 credits

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

Part-1
Course objective
The course aims at imparting basis principals of thought process. Reasoning and inferencing Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit Literature are also important in modern society with rapid technological advancements and societal disruptions Part-1 focuses on introduction to Indian Knowledge System. Indian perspective of modern scientific world -view and basis principal of Yoga and holistic health care system.

Course contents
i.   Basic Structure of Indian Knowledge system
ii.   Modern Science and Indian Knowledge system
iii.   Yoga and Holistic Health Care
iv.   Case studies

References
- Fritzof Capra Too of Physics
- Fritzof Capra The Wave of life
- Yoga Sutra of Patanjali. Ramakrishna Mission. Kolkata.
- RN Jha Science of Consciousness Psychotherapy and Yoga Practices. Vidyanidhi Prakashan. Delhi2016
- PB Sharma (English translation) ShodashangHridayam

Pedagogy: Problem based learning, group discussion, collaborative mini projects
Outcome: Ability to understand connect up and explain basics of Indian traditional Knowledge in Modern scientific perspective.

Part-2
Course objective
The course aims at imparting basis principals of thought process. Reasoning and inferencing Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit Literature are also important in modern society with rapid technological advancements and societal disruptions Part-2 focuses on Indian philosophical traditions. Indian linguistic Tradition, and Indian artistic tradition.

Course contents
i.   Philosophical Tradition
ii.   Indian Linguistic Tradition (Phonology, morphology, syntax and semantics)
iii.   Indian Artistic Tradition
iv.   Case studies

References
- V.Sivaramakrishnan (Ed.), Cultural Heritage of India-Course material, Bhartiya Vaidya Bhawan Mumbai 5th Edition 2014
- S.C Chaterjee &D.M .Datta , An introduction to Indian Philosophy ,University of Calcutta 1984
- KS Subrahmanialyer ,Vakyapadiya of Bhattaraihari (Brahma Kanda), Deccan College Pune 1965

- VN Jha, Language Thought and Reality
- Pramod Chandra. India Arts Howard Univ. Press 1983
- Krishna Chaitanya Arts of India. Abhinav Publications. 1987
- R Nagaswamy , Foundations of Indian Art Tamil Arts Academy.2002

Pedagogy: Problem based learning, group discussion, collaborative mini projects
Outcome: Ability to understand connects up and explain basics of Indian traditional Knowledge in Modern scientific perspective.

SEMESTER: V
[Third Year]

BTEE-501-18	Power Systems-I (**Apparatus and Modelling**)	3L:1T:0P	Credits:4

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

CO 1 Understand the concepts of power systems.
CO 2 Understand the various power system components.
CO 3 Evaluate fault currents for different types of faults.
CO 4 Understand the generation of over-voltages and insulation coordination.
CO 5 Understand basic protection schemes.
CO 6 Understand concepts of HVDC power transmission and renewable energy generation.

Module 1: Basic Concepts (4 hours)

Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids.
Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources.
Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

Module 2: Power System Components (15 hours)

Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance and Inductance calculations for simple configurations. Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines.

Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub-transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations.

Module 3: Over-voltages and Insulation Requirements (4 hours)

Generation of Over-voltages: Lightning and Switching Surges. Protection against Over-voltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams.

Module 4: Fault Analysis and Protection Systems (10 hours)

Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding. Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

Module 5: Introduction to DC Transmission & Renewable Energy Systems (9 hours)

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DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC) based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines.

Text/References:

1. J.S. Dhillon I.J. Nagrath and D.P. Kothari, Power System Engineering, 3rd Edition, McGraw Hill Education (India) Private Ltd., 2019
2. D.P. Kothari and J. S. Dhillon, Power System Optimization, 2nd edition, Prentice Hall of India Pvt. Ltd.,New Delhi, 2011, ISBN -978-81-203-4085-5.
3. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
4. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
5. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
6. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
7. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

BTEE-502-18	Control Systems	3L:1T:0P	4 credits

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO 1 Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.

CO 2 Understand the concept of stability and its assessment for linear-time invariant systems. Design simple feedback controllers.

Module 1: Introduction to control problem (4 hours)

Industrial Control examples. Control hardware and their models. Transfer function models of linear time-invariant systems.
Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

Module 2: Time Response Analysis (10 hours)

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response.
Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Module 3: Frequency-response analysis (6 hours)

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Module 4: Introduction to Controller Design (10 hours)

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems.
Root-loci method of feedback controller design.
Design specifications in frequency-domain. Frequency-domain methods of design.

Module 5: State variable Analysis (6 hours)

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability.
Pole-placement by state feedback.
Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Module 6: Introduction to Optimal Control and Nonlinear Control (5 hours) Performance

Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts.

Text/References:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
4. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

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BTEE-503-18	**Microprocessors**	**3L:1T:0P**	**4 credits**

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to:
CO 1 Study of 8085 and 8086 Microprocessors.
CO 2 Do assembly language programming.
CO 3 Do interfacing design of peripherals like 8255, 8253,8279,8251 etc.
CO 4 Develop systems using different microprocessors.

Module 1: Fundamentals of Microprocessors: (3 Hours)
Digital Computers: General architecture and brief description of elements, programming system, Buses and CPU Timings. Microprocessor and Microprocessor Development Systems: Evolution of Microprocessor, memory, data transfer schemes, architecture advancements of microprocessors, typical microprocessor development system, higher lever languages.

Module 2: The 8085 Architecture (10 Hours)
Microprocessor architecture and its operations, Pin configuration, internal architecture. Timing & Signals: control and status, interrupt: ALU, machine cycles, Instruction format, op-codes, mnemonics, number. of bytes, Instruction Set of 8085: Addressing Modes: Register addressing, direct addressing; register indirect addressing, immediate addressing, and implicit addressing. RTL, variants, number. of machine cycles and T states, addressing modes. Instruction Classification: Data transfer, arithmetic operations, logical operations, branching operation, machine control; Writing assembly Language programs, Assembler directives.

Module 3: The 8086 Architecture (9 Hours)
8086 Microprocessors: Architecture: Architecture of INTEL 8086 (Bus Interface Unit, Execution unit), register organization, memory addressing, memory segmentation, Operating Modes Instruction Set of 8086 Addressing Modes: Instruction format: Discussion on instruction Set: Groups: data transfer, arithmetic, logic string, branch control transfer, processor control. Interrupts: Hardware and software interrupts, responses and types.

Module4: Fundamental of Programming (9 Hours)
Development of algorithms, flowcharts in terms of structures ,(series, parallel, if-then-else etc.) Assembler Level Programming: memory space allocation (mother board and user program) Assembler level programs (ASMs) .

Module 5: Peripheral memory and I/O **Interfacing (9 Hours)**
Interfacing devices, Interfacing of Memory, Programmed I/O, Interrupt Driven I/O, memory I/O, 8255-Programmable peripheral interface, 8253/8254 Programmable timer/counter. 8259 programmable Interrupt Controller, 8251- USART

Text / References:
1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.
2. Uffenbeck, John, "Microcomputers and Microprocessors" PHI/ 3rd Edition.
3. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programaming and Interfacing" Tata Mc. Graw Hill.
4. Krishna Kant, "Microprocessors and Microcontrollers" PHI Learning.
5. Brey, Barry B. "INTEL Microprocessors" Prentice Hall (India)
6. ADitya P Mathur, "Introduction to Microprocessor" Tata Mc Graw Hill
7. M. Rafiquzzaman, "Microprocessors- Theory and applications" PHI

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8. B. Ram, "Advanced Microprocessor & Interfacing" Tata McGraw Hill
9. Renu Singh & B.P.Singh, "Microprocessor and Interfacing and applications" New Age International 10. N. Senthil Kumar, "Microprocessors and Microcontroller", Oxford University Press.
10. Liu and Gibson G.A., "Microcomputer Systems: The 8086/8088 Family" Prentice Hall (India)

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Semester	Programme Elective	Course Code	Course Title	Hrs/week	Credits
V (odd)	PE-1	BTEE-504A-18	Electrical Engineering Materials	3L:0T:0P	3
V (odd)	PE-1	BTEE-504B-18	Switchgear and Protection	3L:0T:0P	3
V (odd)	PE-1	BTEE-504C-18	Electrical Machine Design	3L:0T:0P	3
V (odd)	PE-1	BTEEE-504D-18	Computer Architecture	3L:0T:0P	3

BTEE-504A-18	Electrical Engineering Materials	3L:0T:0P	3 credits

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

Course Outcomes:

CO 1 To Understand the basic concepts of materials.
CO 2 To use simplified materials selection concepts for design purposes.
CO 3 To Understand the properties of Materials.

Module I: Elementary Materials Science Concepts (8 hours)

Bonding and types of solids, Crystalline state and their defects, Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall effect.

Module II: Conductivity of Metal (8 hours)

Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

Module III: Magnetic properties of Materials (8 hours)

Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.

Module IV: Dielectric Properties (8 hours)

Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity.

Module V: Semiconductors (8 hours)

Energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

Text Books:
1. Adrianus J Dekker Electrical Engineering Materials PHI Learning Publishers.
2. L. Solymar, Electrical Properties of Materials, 8th Edition by Oxford University Press New Delhi.
3. C Indulkar, Introduction to Electrical Engineering Materials 4th Edn. 2004 Edition by, S. Chand & Company Ltd-New Delhi.
4. SK Bhattacharya, Electrical and Electronic Engineering Materials, Khanna Publishers, New Delhi.

BTEE-504B-18	Switchgear and Protection	3L:0T:0P	3 credits

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to:
CO 1 Understand power system protection.
CO 2 Understand the main components used in power system protection for electric machines, transformers.
CO 3 Understand the bus bars, overhead and underground feeders.
CO 4 Understand the earthing protection.

Module 1: Electrical Switchgear
Fundamentals and Types of Circuit Breakers, Gaseous Discharges and Ionization Process in a Gaseous Insulating Medium, decay Process, Quenching of AC Arc, Arc Interruption Theories, Fuse-types, Rating, Selection, theory and characteristics, application, Factors Affecting RRRV, Re-Striking Voltage and Recovery Voltage, Resistance Switching, Quenching of DC Arc, High-Voltage AC Circuit Breakers, High-Voltage DC (HVDC) Circuit Breakers, Isolators.

Module 2: Protective Relaying System
Basics terminology and operating principle of Relays, Functions of Protective Relay Schemes, Basic Tripping Circuit with System Transducers, Zones of Protection, Requirements of a Protective System, Relay Operating Criteria, Main and Back-Up Protection.
Relays: Introduction, classification, constructional features; and Characteristics of Electromagnetic, Induction, Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Negative sequence relay, introduction to static and up-based relays.
Static Relays: Introduction, Basic Elements & Classification of Static Relays, Advantages and limitations of Static Relays.

Module 3: Power Apparatus Protection
Generator Protection: Generators faults, Differential Protection, Inter-Turn Fault Protection, Stator Earth-Fault Protection, Rotor Earth-Fault Protection, Negative Phase Sequence Protection (Protection Against Unbalanced Loading), Field Failure Protection (Protection Against Loss of Excitation), Overload Protection, Overvoltage Protection, Reverse Power Protection, Under-Frequency Protection.
Transformer Protection: Faults in Transformers, Gas-Operated Relays, Overcurrent Protection, Restricted Earth-Fault Protection, Differential Protection, Protection Against Over fluxing, Protection of Grounding Transformers, Protection Against Overheating

Module 4: Protection of Feeders and Transmission line:
Protection of Feeders: Basic Radial Feeder, Methods of Discrimination, Time and current protection, different pilot wire protection of feeders, current balance differential protection, Differential and Distance protection of feeders, choice between Impedance, Reactance and Mho relays.
Protection of Transmission Lines: Overcurrent Relays, Rules for Setting the IDMT Relays, Distance Relays: Stepped Distance Characteristics of a Distance Relay, Elementary idea about carrier current protection of lines, Quantities to be Fed to Distance Relays

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Module 5: Bus Zone, Over voltage and Earthing Protection:

Bus-zone protection: Introduction, Bus-bar arrangements, Bus-zones faults, Protection Requirements, Fault-bus and backup protection of bus-bars, Non-Unit Protection by Back-up Relays, Unit Protection Schemes.

Protection against over voltage and earthing: Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/Surge Absorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.

Text Books

1. B. A. Oza, Nirmal Kumar, C. Nair, R. P. Mehta, V. H. Makwana, Power System Protection & Switchgear, 1st Edition, Mc Graw Hill
2. Badri Ram, D. N. Vishwakarma, Power System Protection and Switchgear, Mc Graw Hill
3. Power System Protection and Switchgear by Wiley, John Wiley & Sons Canada, Limited,
4. Sunil S. Rao, Switchgear and Protection, 8th Edition, Khanna Book Publications
5. Handbook on switchgears, Bharat Heavy Electrical Limited

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| BTEE-504C-18 | Electrical Machine Design | 3L:0T:0P | 3 credits |

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

Course Outcomes:

At the end of this course, students will demonstrate the ability to
  i.   Understand the construction and performance characteristics of electrical machines.
  ii. Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
  iii. Understand the principles of electrical machine design and carry out a basic design of an ac machine.
  iv. Use software tools to do design calculations.

Module 1: Introduction

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

Module 2: Transformers

Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

Module 3: Induction Motors

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

Module 4: Synchronous Machines

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

Module 5: Computer aided Design (CAD):

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Text / References:

  1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
  2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.
  3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
  4. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.

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5. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.
6. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
7. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

BTEEE-504D-18	**Computer Architecture**	**3L:0T:0P**	**3 credits**

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

Course Outcomes:
At the end of this course, students will demonstrate the ability to

CO 1 Understand the concepts of microprocessors, their principles and practices.

CO 2 Write efficient programs in assembly language of the 8086 family of microprocessors. Organize a modern computer system and be able to relate it to real examples.

CO 3 Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO 4 Implement embedded applications using ATOM processor.

Module 1: Introduction to computer organization (6 hours)
Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

Module 2: Memory organization (6 hours)
System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.

Module 3: Input – output Organization (8 hours)
Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

Module 4: 16 and 32 microprocessors (8 hours)
80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

Module 5: Pipelining(8 hours)
Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.

Module 6: Different Architectures (8 hours)
VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming

Text/Refence Books
1. V. Carl, G. Zvonko and S. G. Zaky, **"Computer organization"**, McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, **"The Intel microprocessors"**, Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, **"Computer Architecture A Quantitative Approach"**, Morgan Kauffman, 2011.
4. W. Stallings, **"Computer organization"**, PHI, 1987.

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5. P. Barry and P. Crowley, **"Modern Embedded Computing"**, Morgan Kaufmann, 2012.
6. N. Mathivanan, **"Microprocessors, PC Hardware and Interfacing"**, Prentice Hall, 2004.
7. Y. C. Lieu and G. A. Gibson, **"Microcomputer Systems: The 8086/8088 Family"**, Prentice Hall India, 1986.
8. J. Uffenbeck, **"The 8086/8088 Design, Programming, Interfacing"**, Prentice Hall, 1987.
9. B. Govindarajalu, **"IBM PC and Clones"**, Tata McGraw Hill, 1991.
10. P. Able, **"8086 Assembly Language Programming"**, Prentice Hall India.

EVS-101-18	Environmental Studies	2L:0T:0P (Contact hours 21)	0 credits

Internal Marks: 50   *External Marks: 00*   *Total Marks: 50*

* 40 Hours are kept for various activities under the head of activities. There will be a final theory examination for the students of 50 marks but these marks will not be added to their final result as assessment will be satisfactory or non-satisfactory.

Course Outcomes:

CO 1 Students will enable to understand environmental problems at local and national level through literature and general awareness.

CO 2 The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.

CO 3 The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.

CO 4 Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world

Environment Science (Mandatory non-credit course)

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students.

Detailed Contents

Module 1: Natural Resources : Renewable and non-renewable resources

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

• Role of an individual in conservation of natural resources.

• Equitable use of resources for sustainable lifestyles.

Module 2: Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem.

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Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems:
a) Forest ecosystem
b) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3 : Biodiversity and its conservation
- Introduction – Definition: genetic, species and ecosystem diversity.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India

Module 4 : Social Issues and the Environment
- From Unsustainable to Sustainable development
- Resettlement and rehabilitation of people; its problems and concerns.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion,
- Nuclear accidents and holocaust. Case Studies.
- Public awareness.

*ACTIVITIES
Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity
Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.

Following activities must be included.
Identify a tree fruit flower peculiar to a place or having origin from the place.
Making high resolution big photographs of small creatures (bees, spiders, ants. Mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).
Videography/ photography/ information collections on specialties/unique features of different types of common creatures.
Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.

(A) Awareness Activities:
a) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
b) Slogan making event
c) Poster making event
d) Cycle rally
e) Lectures from experts
f) Plantation
g) Gifting a tree to see its full growth
h) Cleanliness drive

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i)   To live with some eminent environmentalist for a week or so to understand his work.
j)   To work in kitchen garden for mess
k)   To know about the different varieties of plants
l)   Shutting down the fans and ACs of the campus for an hour or so
m)   Visit to a local area to document environmental assets river/forest/grassland/hill/mountain/lake/Estuary/Wetlands
n)   Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
o)   Visit to a Wildlife sanctuary, National Park or Biosphere Reserve

Suggested Readings
1.   Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2.   Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3.   Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4.   Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5.   Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
6.   Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
7.   Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
8.   Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
9.   Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
10.   Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11.   Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
12.   Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
13.   Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
14.   Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

BTEE-511-18	*Power Systems – I Laboratory*	0L:0T:2P	1 credit

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

Hands-on experiments related to the course contents of BTEE501-18. Visits to power system installations (generation stations, EHV substations etc.) are Exposure to fault analysis and Electro-magnetic transient program (EMTP) and Numerical Relays are suggested.

Note: A student to perform any 8-10 Experiments.

Suggested List of Experiments:

(A) Hardware Based:
1. To measure negative sequence and zero sequence reactance of Synchronous Machines.
2. Fault analysis for line-to-line (L-L), Line-to-Ground (L-G) and double line to ground fault.
3. To study the performance of a transmission line and compute its ABCD parameters.
4. To study the earth resistance using three spikes.
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays.
8. To study operation of oil testing set.

(B) Simulation Based Experiments (using MATLAB or any other software)
9. To obtain steady state, transient and sub-transient short circuit currents in an alternator
10. To perform symmetrical fault analysis in a power system
11. To perform unsymmetrical fault analysis in a power system

BTEE-512-18	*Control Systems Laboratory*	**0L:0T:2P**	**1 credit**

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

Hands-on experiments related to the course contents of BTEE502-18

Note: A student to perform any 8-10 Experiments.

Suggested List of Experiments:
1. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
2. To study the synchro Transmitter-Receiver set and to use it as an error detector
3. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
4. To study the Speed – Torque characteristics of an DC Servo Motor and explore its applications.
5. To study the variations of time lag by changing the time constant using control engineering trainer
6. To simulate a third order differential equations using an analog computer and calculate time response specifications
7. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer
8. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop systems
    a) To study the operation of a position sensor and study the conversion of position in to corresponding voltage
    b) To study an PI control action and show its usefulness for minimizing steady state error of time response.
9. To measure Force / Displacement using Strain Gauge in a wheat stone bridge
10. To design a Lag compensator and test its performance characteristics.
11. To design a Lead-compensator and test its performance characteristics.
12. To design a Lead-Lag compensator and test its performance characteristics.

BTEE-513-18	Microprocessors Laboratory	0L:0T:2P	1 credit

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

Hands-on experiments related to the course contents of BTEE503-18

Note: A student to perform any 8-10 Experiments.

Suggested List of Experiments:

1. To study 8085 based microprocessor system
2. To study 8086 and 8086A based microprocessor system
3. To study Pentium Processor
4. To develop and run a program for finding out the largest/smallest number from a given set of numbers.
5. To develop and run a program for arranging in ascending/descending order of a set of numbers
6. To perform multiplication/division of given numbers
7. To perform conversion of temperature from 0 F to 0 C and vice-versa
8. To perform computation of square root of a given number
9. To perform floating point mathematical operations (addition, subtraction, multiplication and division) 10. To obtain interfacing of RAM chip to 8085/8086 based system
10. To obtain interfacing of keyboard controller, 8279
11. To obtain interfacing of PPI, 8255
12. To obtain interfacing of USART, 8251
13. To perform microprocessor-based stepper motor operation through 8085 kit
14. To perform microprocessor-based traffic light control
15. To perform microprocessor-based temperature control of hot water.

BTEEE-521-18	Summer Industry Internship	(Non-Credit) S/US

Internal Marks: 40   *External Marks: 60*

Six weeks in an Industry in the area of Electrical Engineering. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report. Performance to be rated as Satisfactory/Un - Satisfactory (S/US). For unsatisfactory the internship to be repeated.

BMPD-501-18	Mentoring and Professional Development of Students	0L:1T:0P	(Non-Credit)

Internal Marks: 50   *External Marks: 00*

The assigned mentor to engage the students to in activities such as:

  i.   Identification of any one of the local environmental concern and propose workable solution for it.
 ii.   Arrange an Industrial visit of 2-3 days
iii.   Expert/Invited talk pertaining to recent industrial development.
 iv.   Preparation of database for placement activities.
  v.   Resume preparation.

The mentor to keep record of all activities (including those mentioned above) and assign internal marks accordingly.