DELHI TECHNOLOGICAL UNIVERSITY

Minutes of
22nd meeting
Academic Council

held on 22.11.2019

Shahbad Daulatpur, Bawana Road, Delhi-110042

DELHI TECHNOLOGICAL UNIVERSITY

Established under Govt. of Delhi Act 6 of 2009

(Formerly Delhi College of Engineering)

BAWANA ROAD, SHAHBAD DAULATPUR, DELHI-110042

No. F.DTU/Org/AC/Meeting/01(1)/10/Vol-X/4298   **Dated : 04/12/2019**

Minutes of the 22nd meeting of the Academic Council held on 11.10.2019 at 11:00 a.m. in the Pragyan Hall, DTU.

The following members were present:

1. Prof. Yogesh Singh, Vice Chancellor, DTU.
2. Prof. Surendra S. Yadav, Professor of Management, IIT, Delhi
3. Prof. S.G. Deshmukh, Professor, IIT, Delhi
4. Prof. R.S. Mishra, Dean (Outreach & Extn. Activities)
5. Prof. Ashutosh Trivedi, Dean (IRD)
6. Prof. Madhusudan Singh, Dean Academic (UG)
7. Prof. Samsher, Dean (Continuing Education) & Registrar, DTU
8. Prof. Vishal Verma, Dean (International Affairs)
9. Prof. S.C. Sharma, Dean Academic (PG)
10. Prof. S. Indu, Dean (Student Welfare)
11. Prof. Narendra Kumar (II), Dean (Student Discipline) & Chief Warden
12. Prof. S.K. Singh, HOD (Environmental Engg. Deptt.)
13. Prof. Nirendra Dev, HOD (Civil Engg. Deptt.)
14. Prof. Vipin, HOD (Mechanical Engg. Department)
15. Prof. Rinku Sharma, HOD (Deptt. of Applied Physics)
16. Prof. Uma Nangia, HOD (Electrical Engg. Deptt.)
17. Prof. Sangita Kansal, HOD (Applied Mathematics Deptt.)
18. Prof. Kapil Sharma, HOD (Deptt. of I.T.)
19. Prof. Amit Mookerjee, HOD (USME)
20. Prof. Rajni Jindal, HOD (Computer Science Engg.)
21. Dr. S.G. Warkar, HOD (Applied Chemistry Deptt.)
22. Dr. Nand Kumar, HOD (Humanities)
23. Dr. Rajan Yadav, HOD (Delhi School of Management)
24. Dr. Naokant Deo, In-charge, B.Tech (Eve.)
25. Sh. Neeraj Kumar Bhagat, Associate Professor, Electrical Engg. Deptt.
26. Dr. M. Jayasimhadri, Asstt. Prof. Applied Physics
27. Sh. Kamal Pathak, Controller of Examinations, DTU
28. Ms. Anu Agarwal, Student Representative, Special invitee

Dr. Yasha Hasija, Associate Professor represented Prof. Jai Gopal Sharma, HOD (Bio-Technology Deptt.) and Neeraj Rathee, Assistant Professor represented Prof. Ranganath M. S., HOD (Deptt. of Design)

Following persons have also been invited to attend the meeting:

1. Prof. Pragati Kumar, Electrical Engg. Deptt.
2. Dr. Manoj Kr. Sharma, CEO, (DTU IIF)
3. Sh. R.K. Shukla, Librarian
4. Sh. D.P. Dwivedi, Consultant, Finance & Planning
5. Prof. Rajeshwari Pandey, Associate Dean (UG)
6. Prof. M.M. Tripathi, Director, IQAC

Prof. S.K. Garg, Pro Vice Chancellor, DTU; Prof. Tarun Kumar Das, Registrar, University of Delhi; Dr. Bhim Singh, IIT, Delhi; Prof. Smriti Srivastava, Head-Division of ICE, NSIT, Delhi; Sh. Lokesh Mehra, (FICCI nominee); Prof. Pravir Kumar, Dean (Alumni Affairs); Prof. N.S. Raghava, HOD (E & C Deptt.) Dr. Rajesh Rohilla, HOD (Training & Placement); Prof. Naveen Kumar; Prof. Narendra Kumar-I and Prof. Rakesh Kumar could not attend the meeting due to their pre-occupation.

Agenda 22.1 : Opening Remarks by the Chairperson.

Hon'ble Vice Chancellor welcomed all the members of Academic Council in its 22nd meeting held on 22.11.2019. He informed the members that the 6th Convocation is scheduled to be held on 13.12.2019. Sh. Vinod Dham, alumni of DTU will be the Chief Guest and the function will be presided over by Hon'ble Lt. Governor of Delhi. Sh. Manish Sisodia, Hon'ble Deputy Chief Minister, Delhi will be the Guest of Honour. As per past practice, Golden Pride Function will be held on 12.12.2019 where all the Medallists and Ph.D students will be felicitated. Sh. Ashok Kumar Gupta, Chairman of Competition Commission of India will be the Chief Guest of this function.

Vice Chancellor further informed the members about participation of DTU in Time Higher Education Ranking first time and has been ranked overall at bracket of 1001+ institution in the world. In the Engineering category and Physical Science, DTU has been placed at 801+ bracket, Department of Computer Science & Engineering, DTU has been placed at 601+ bracket in the world.

Agenda 22.2 : Confirmation of the minutes of the 21st meeting of Academic Council held on 11.10.2019.

The Minutes of the 21st meeting of the Academic Council held on 11.10.2019, were circulated among all the members vide Ref. No. DTU/ORG/AC/Meeting/ 01(1)/2010/Vol-IX/3532-55 dated 23.10.2019. No comments have been received from any of the members.

The Academic Council confirmed the minutes of its 21st meeting.

Agenda 22.3 : **Action taken report on the decisions taken in the 21st meeting of the Academic Council.**

Action Taken Report on the decisions taken in the 21st meeting of the Academic Council held on 11.10.2019 is as below:

The Academic Council noted and took the action taken report on record.

Agenda 22.4 : **Approval for modification in the Recruitment Rules of Professor, Associate Professor and Assistant Professor.**

It was submitted to the Academic Council that the AICTE has notified the Rules on pay scales, service conditions and minimum qualifications for the appointment of teachers and other academic staff such as library, physical education and training & placement personnel in technical institutions and measures for the maintenance of standards in technical education- (degree) Rule, 2019 dated 01.03.2019 and UGC has also notified the Rules on minimum qualifications for appointment of teachers and other academic staff in university and colleges and measures for the maintenance of standards in higher education, 2018 dated 18.07.2018.

Accordingly, the Recruitment Rules for the posts of Professors and Associate Professors and for the following disciplines have been revised and are placed as *Annexure at page 01 to 39 and 40 to 78.*

1. Applied Chemistry and Polymer Science & Chemical Technology.
2. Applied Mathematics and Mathematics & Computing
3. Applied Physics and Engineering Physics
4. Bio Technology
5. Civil Engineering
6. Computer Science & Engineering, Information Technology, Software Engineering
7. Design
8. Electrical Engineering
9. Electronics and Communication Engineering
10. Environment Engineering
11. Economics
12. English
13. Management
14. Mechanical, Production and Automobile Engineering

Further, the Recruitment Rules for the post of Assistant Professor in the following disciplines were also revised. The revised Recruitment Rules are placed as *Annexure at page 79 to 82.*

1. Design
2. Management

Age relaxation for PWD will be applicable for all the posts of Assistant Professor, Associate Professor and Professor as per Government of India/Government of NCT of Delhi rules issued time to time.

Decision : The Academic Council passed the revised Recruitment Rules for the post of Professor, Associate Professor and Assistant Professor with following modifications and recommended to the Board of Management for its approval:

i. In the Management Discipline all relevant branches mentioned in the RRs of Assistant Professor shall be applicable to the RRs of Associate Professor as well as Professor.
ii. Metallurgical Engineering and Material Science subjects be added under the column "Relevant Branch" in the RRs of Assistant Professor and Associate Professor in Applied Chemistry.
iii. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

Agenda 22.5 : Conferment of degrees of all the students who have completed the requirements prescribed under the Ordinances of the University.

It was submitted to the Academic Council that in all 2103 students have become eligible for conferment of degrees prescribed under different Ordinance of the University. They will be confer the degrees in the ensuing convocation fixed for 13the December 2019. The programme-wise number of eligible students till date is as follows:

S.No.	Program	No. of Degrees
1	Bachelor of Technology	1501
2	Bachelor of Technology (Evening)	135
3	Master of Technology	237
4	Master of Technology (Part Time)	20
5	Master of Business Administration	150
6	Master of Business Administration (Executive)	40
7	Doctor of Philosophy	61
	TOTAL	2144

Decision : The Academic Council approved the conferment of degrees of all the eligible students and authorised Vice Chancellor to include the recipient, if any, before convocation.

Agenda 22.6   :   Approval for Guidelines for Working with Industry for Faculty of Delhi Technological University.

It was submitted to the Academic Council that the University has framed guidelines for working with industry for faculty with an objective to promote industry collaboration and interaction for mutual benefits. The goal of the university is to provide exposure to its faculty to the world's best industries and established industry-academia and industry-research relationship. The proposed guidelines are as under:

Guidelines for Working with Industry for the Faculty of Delhi Technological University

Delhi Technological University (DTU) promotes the industrial collaboration and interaction of faculty with industry for mutual benefits in alignment to the research and quality policy of the University. The goal of the university is to provide exposure to the faculty to the world's best industrial experiences and to establish industry-academia and industry-research relationship as expounded in the mission of education and research.

1. DEFINITIONS:

i. **"University"** shall mean Delhi Technological University (DTU), Delhi.
ii. **"Faculty"** means an individual who is a regular faculty of the Delhi Technological University.

2. INDUSTRY SELECTION CRITERIA

The industry shall be highly reputed and a medium sized enterprise with turnover Rs. 75 crores or above along with standing commitment to the exemplary standards namely ISO/CMM level 3 or similar standard of respective area.

3. CRITERION FOR A FACULTY TO WORK IN INDUSTRY:

TYPE OF ASSIGNMENT: RESEARCH OR PRODUCT DEVELOPMENT OR TRAINING

The faculty shall be permitted to work in industry (that satisfies the criteria specified in point 2) related to his/her area of expertise and research for a minimum period of 6 months

The following conditions must be satisfied by the faculty seeking permission to work in an industry:

- Faculty seeks to collaborate in his/her area of teaching/research, and
- Faculty must have at least three SCI/SCIE/SSCI publication in the given area OR Faculty has been teaching in the same area since past three years

4. DURATION OF THE ASSIGNMENT AND DISTRIBUTION OF INCOME

a) For 8 Hours on Saturday

CASE 1: TYPE OF ASSIGNMENT: RESEARCH or PRODUCT DEVELOPMENT
- 90% of the total income (Amount-GST-Tax) shall be shared by the faculty and 10% by the university.

CASE 2: TYPE OF ASSIGNMENT: TRAINING

- 80% of the total income (Amount-GST-Tax) shall be shared by the faculty and 20% by the university.

b) For 8 Hours on Saturday and 8 hours on any weekday as approved by competent authority

CASE 1: TYPE OF ASSIGNMENT: RESEARCH & PRODUCT DEVELOPMENT

- Only one day in a week will be permitted for 8 hours
- 80% of the total income (Amount-GST-Tax) shall be shared by the faculty. The University share shall be 20% of the total income or twice of one day salary (Basic+DA) of the faculty whichever is higher.

CASE 2: TYPE OF ASSIGNMENT: TRAINING

- Only one day in a week shall be permissible.
- 70% of the total income (Amount-GST-Tax) shall be shared by the faculty. The university share shall be 30% of the total income or twice of one day salary (Basic+DA) of the faculty whichever is higher.

5. OUTCOME OF THE INDUSTRY COLLABORATION

a) In case the faculty seeks permission for research-based assignment in industry, the outcome must be one SCI/SCIE/SSCI indexed publication.

b) In case the faculty seeks permission for product-based assignment in industry, the outcome must be one patent* published/granted or a product designated for IPR.

c) In case the faculty seeks permission for training-based in industry, the outcome must be training material posted on university website and the faculty shall conduct similar training for DTU students and faculty without any additional cost/payment.

* The patent published/granted must have Delhi Technological University as applicant in line with IPR policy of the University.

GENERAL INSTRUCTIONS:

1. Any of the above assignments should not affect the teaching, administrative and research responsibility at DTU
2. DTU holds the right to cancel an assignment, at any time without providing any reason and intimation.
3. In case of any deviation/difficulty from above guidelines, a final decision will be made by Vice Chancellor in consultation with Dean (IRD).
4. No permission shall be granted for joining tuition or coaching classes.

Decision : The Academic Council passed the Guidelines for Working with Industry for Faculty of Delhi Technological University with following modification and recommended to the Board of Management for its approval.

- **Sharing of amount received will be after deduction of taxes and expenditure.**
- **Turnover limit is reduced from 100 crore to 75 crore.**
- **Twice the salary amount for days spend in industry during working days.**

Agenda 22.7 : Introduction of a new Foundation Elective Course in B.Tech. program.

It was submitted to the Academic Council that it is proposed to include a new Foundation Elective Course (FEC) of **"Hindi Language for Non-native Speakers"** in B.Tech. Programme. The course of Hindi subject was finalized during a workshop conducted in the Department of Humanities and the syllabus of the same of two credits for the foreign students in this workshop was framed by the experts invited for the workshop. Proposal and syllabus received from the Department of Humanities is placed in *Annexure at page 83 to 86.*

The matter was discussed Dean, Academic (UG) and minor modification has been made in Unit-3.

Decision : The Academic Council approved for introduction of the new Foundation Elective Course in B.Tech. program with following modification:
   i. Foundation elective course shall be common for all the Undergraduate and Post graduate programs.
   ii. The syllabus should be pictures/films/plays/discussion based teaching.
   iii. Name of films to be used in Unit III may be left on wisdom of teacher concerned.

Agenda 22.8 : Approval for Scheme of Examination for M.Sc. in Physics, Biotechnology, Mathematics and Chemistry.

It was submitted that the Academic Council in its 21st meeting held on 11.10.2019 vide agenda item 21.8 has constituted a committee comprising of the following members to examine the contents of the syllabus for M.Sc (Physics) program :

1. Pro Vice Chancellor	Chairperson
2. Prof. S.C. Sharma, Dean Academic (PG)	Member
3. Prof. H.C. Taneja	Member
4. HoD (Applied Physics)	Member
5. HoD (Biotechnology)	Member
6. HoD (Applied Mathematics)	Member
7. Registrar	Member Secretary

In this regard, a meeting of the committee was held on 13.11.2019 at 3.30 p.m in Room No. 307, Administrative Block, DTU. During the meeting, it was decided to revise the nomenclature of course scheme of Applied Physics, Applied Mathematics, Biotechnology & Applied Chemistry. Accordingly, the committee had revised the course scheme of their respective department.

The revised scheme of the following M.Sc programs were enclosed for the approval of Academic Council :-

- M.Sc (Physics)
- M.Sc (Mathematics)
- M.Sc (Biotechnology)
- M.Sc (Chemistry)

Decision : The Academic Council authorised Dean, Academic (PG) to modify the Scheme of Examination for M.Sc. in Physics, Biotechnology, Mathematics and Chemistry within the framework of Ordinance and forward the same to the Vice Chancellor for concurrence.

'Applied' word is to be deleted. The programs will be called as M.Sc. (Mathematics), M.Sc. (Physics), M.Sc. (Biotechnology) and M.Sc. (Chemistry).

Agenda 22.9 : Formal registration of Ph.D. Students upon successful completion of course work and comprehensive examinations and approval of research Plan by respective DRCs.

It was submitted to the Academic Council that Dean Academic (PG) has forwarded a list of **12 candidates** to consider their registration for Ph.D. candidature upon successful completion of course work and comprehensive examinations. List of the candidates (department-wise) is placed below:

Sr. No.	Name of the Candidate	Roll No	Date of SRC
Department of Civil Engineering			
1	Ms. Meenakshi Singh	2K14/Ph.D/CE/02	05.05.2017
2	Mr. Deepak Singh	2K18/Ph.D./CE/02	19.09.2019
3	Ms. Arti Chouksey	2K18/Ph.D./CE/27	22.05.2019
Department of Electrical Engineering			
1	Mr. Neeraj Kumar Bhagat	2K16/Ph.D./EE/04	03.10.2019
2	Mr. Rajneesh Sharma	2K17/Ph.D./EE/16	25.09.2019
Department of Mechanical Engineering			
1	Mr. Deepak Kumar	2K18/Ph.D./ME/07	16.10.2019
2	Mr. Vipul Saxena	2K18/Ph.D./ME/35	30.09.2019
3	Prem Shanker Yadav	2K18/Ph.D./ME/34	22.10.2019
Department of Applied Chemistry			
1	Ms. Manjot Kaur	2K18/Ph.D./AC/09	25.10.2019
Department of Biotechnology			
1	Ms. Megha Kumari	2K18/Ph.D./BT/15	30.09.2019
Department of Electronics & Communication Engineering			
1	Mr. Rajiv Kumar Nehra	2K18/Ph.D./EC/10	30.07.2019
2	Ms. Garima Singh	2K18/Ph.D./EC/16	08.08.2019

Decision : The Academic Council approved formal registration of 12 candidates for Ph.D. program.

Agenda 22.10 : Cancellation/Withdrawal of admissions made during the academic year 2019-20 for Ph.D. programme.

It was submitted to the Academic Council that the certain admissions have been withdrawn during the academic year 2019-20 for Ph. D program. The list of the students who cancelled their registration is given below

Cancellation/Withdrawn of Ph.D Registration			
Sr. No.	Name of the Candidate	Roll No	Name of the Department
1	Mr. Ashwni,	(2K18/Ph.D./ME/528)	Mechanical Engineering
2	Mr. Darin Baruah	(2K16/Ph.D./CE/07)	Civil Engineering

Decision : The Academic Council approved the cancellation of admissions of above mentioned students.

Agenda 22.11 : Approval of standard Non-Disclosure Agreement (NDA) form.

It was submitted to the Academic Council that a standard form for Non-Disclosure Agreement has been drafted which may be signed by the stakeholders (faculty/student/Staff/visitor to the university) or persons/agencies collaborating with University stakeholders whenever needed so that the disclosure of Intellectual Property of the University can be protected. Copy of Non-Disclosure Agreement From is enclosed herewith. The Non-Disclosure Agreement draft has been legally vetted and approved by IPR Standing Committee of DTU. A copy of the agreement is placed in *Annexure at page 87 to 94.*

Decision : The Academic Council considered the Non-Disclosure Agreement document and recommended to place the matter before the Board of Management for its approval.

Agenda 22.12 : Approval for modifications in the existing M. Tech. (Polymer Technology) Scheme and Syllabus.

It was submitted to the Academic Council that the M. Tech. Polymer Technology scheme and syllabus has been approved by the Academic council in its 20th meeting held on 21/5/2019 vide agenda no. 20.15. Certain corrections/modifications are required in the existing M. Tech. Polymer Technology Scheme and Syllabus which are placed in *Annexure at pages 95 & 96.*

The Academic Council approved the proposed modifications in the existing M. Tech. (Polymer Technology) Scheme and Syllabus.

Agenda 22.13 : **Approval for Change in Sequence of General Elective Courses Offered in Sem. II and III, in BA (Hon.) Economics Program.**

It was submitted to the Academic Council that the sequence of generic electives offered in Sem. II and III, in BA (Hon.) Economics, may be modified as below, to provide a more logical subject/topic sequence, and meet pre-requisites for these electives:

1) Semester 2: Marketing Management (BA 204) offered instead of Customer Relationship Management (BA115).

2) Semester 3: Customer Relationship Management (BA 115) offered instead of Marketing Management (BA 204).

3) Course codes may be changed such that Marketing Management is BA 115, and Customer Relationship Management is BA 204, to maintain Semester nomenclature consistency.

Current Course Structure, Electives List and relevant syllabus placed in *Annexure at page 97 to 101.*

Decision : The Academic Council approved the proposed changes in B.A. (Hons.) Economics program.

Agenda 22.14 : **Approval for Modification of, and Additional Norms for Dissertation Course (BA319), Sem. VI, B.A. (Hon.) Economics Program.**

It was submitted to the Academic Council that the students are given option of Dissertation Course (BA319) in place of one Discipline Specific Elective course. Following modifications are proposed to the current norms (placed in *Annexure at page 10*L to 105).

Points 4, 6 and 7 of the norms may be changed to read as follows:

4. The students will be required to submit signed consent of Internal Faculty Guide within one week of the commencement of the term. Failing this, department may advise student to register for alternate DEC course.

6. The evaluation and marking scheme will be as follows:
   i. Mid Semester Exam:
       1. Report – 20
       2. Presentation and/or Viva voce – 20
   ii. End Semester Exam:
       1. Report – 30
       2. Presentation and/or Viva voce – 30

7. For the Mid- semester examination, a suitable committee will be constituted by the department comprising the faculty guide, the project coordinator and at least one additional member of the faculty, for the evaluation of the report, presentation and oral viva voice. The end semester exam will be as conducted by a suitable committee appointed by the BoS, as per existing DTU norms for project/dissertation.

The above would clarify and state norms in line with DTU norms.

Additional norms may be approved as follows:

The above changes in Dissertation norms may be implemented from the coming Even Semester of Academic Year 2019-20.

Decision : The Academic Council approved for Modification of, and Additional Norms for Dissertation Course (BA319), Sem. VI, B.A. (Hon.) Economics Program as above and removed CGPA requirement. Further advised to revamp as per Undergraduate Ordinance.

Agenda 22.15 : Approval for Allocation of General Elective Courses Offered in Sem. I to Sem. IV, in BBA (Hon.) Economics Program.

It was submitted to the Academic Council that at present any of six (6) listed General Elective course may be chosen in any order, in any of the first four semesters. There is a need to allocate a particular sequence of GEC offered across semesters, mainly due to pre-requisite courses, but also to ensure availability of given course in that semester for student registering for back papers in next odd/even semester.

The following sequence is proposed:

i.   Semester 1 : Indian Economy (GE005)
ii. Semester 2 : Digital Marketing Analytics(GE006)
iii. Semester 3 : India's Diversity (GE004) and/or Tax Planning (GE 001)
iv. Semester 4: Econometrics (GE002) and/or Production & Operations Management (GE003)

Current Course Structure, Electives List and relevant syllabus is placed as *Annexure at page 106 to 134.*

The Academic Council approved for allocation of General Elective Courses Offered in Sem. I to Sem. IV, in BBA (Hon.) Economics Program.

Agenda 22.16 : **Introduction of M.Tech (FT/PT) program in Power Electronics and Systems from the academic year 2020 onwards.**

It was submitted to the Academic Council that the Department of Electrical Engineering intends to introduce a new M.Tech. (FT/PT) programme in Power Electronics and Systems 2020 onwards. In continuation to the strategic plan 2019-21, vide letter EED/2019/625 Dated 05-07-2019, a committee of experts at departmental level was constituted vide office order Dated 20-09-2019 to explore the modalities of the aforesaid programme. The committee prepared a detailed curriculum in prescribed PG structure of DTU while following the AICTE guidelines. Subsequently a BOS meeting was called on 08.11.2019 where the scheme and syllabus was discussed in detail.

Finally, a workshop cum BoS meeting was conducted on 13.11.2019 where the experts from academia, industry, alumni and student representatives were invited. A detailed seat matrix of the above programme was prepared and is placed as **Annexure at page 135.** It was also intended to apply on the online portal of AICTE, once it opens in near future.

In view of the above, the detailed scheme and syllabus of M.Tech. (Power Electronics and Systems) programme proposed to be commenced from August 2020 is placed as **Annexure at pages 136 to 176** for kind consideration and necessary approval of the Academic Council.

The Academic Council approved for Introduction of M.Tech (FT/PT) program in Power Electronics and Systems from the academic year 2020 onwards.

Agenda 22.17 : **Any other matter with the permission of the Chair.**

The content to be printed on the Degree Certificate to be awarded to B.Tech. and B.Tech. (Evening) students admitted from the year 2015 onwards.

It was submit to the Academic Council that for the students admitted to B.Tech. and B.Tech. (Evening) from the year 2015 onwards, their performance in the registered courses are evaluated in Grades and Cumulative Grade Point Average (CGPA) is calculated after completion of programme for Consolidated Result. Therefore, Cumulative Grade Point Average should be printed on the Degree Certificate.

In view of the above, for the students of B.Tech. and B.Tech. (Evening) admitted from the year 2015 onwards, the content to be printed on Degree Certificate is to be kept similar to the one which is already printed on the Degree Certificate of MBA and M.Tech. The sample of Degree Certificate is placed in **Annexure at page 177.**

Decision : The Academic Council approved the content for Degree Certificate.

Following two other matters were also discussed:

Agenda 22.18 : Timely evaluation of Mid-Sem.

The Controller of Examinations, DTU informed the Academic Council that there has been delay in uploading the Mid-Semester marks of the students by the faculty resulting into delay in compiling the overall results. It has been impressed upon that to avoid any further delay in future, a time bound schedule may be announced which may be adhered by the faculty.

> **Decision : The Academic Council decided that a window of time period should be announced by the Controller of Examinations to upload the marks. The name of the faculty not uploading the marks timely, may be brought into the notice of Vice Chancellor.**

Agenda 22.19 : Separation of Practical Component from courses and to assign separate credit and separate examination.

> **Decision : The Academic Council advised that the matter may be first discussed in small forum and then it may be placed before the Academic Council later on.**

The minutes are issued with the approval of the Chairman for circulation to Hon'ble members.

(Prof. Samsher)
Registrar

Copy to:

1. Pr. Secretary to Hon'ble Lt. Governor (Delhi), 6, Raj Niwas, Civil Lines, Delhi.
2. PA to V.C. for kind information of the Vice Chancellor, DTU.
3. Prof. S. K. Garg, Pro VC, DTU
4. All Deans, DTU.
5. Prof. Surendra S. Yadav, Professor of Management, IIT, Hauz Khas, Delhi
6. Sh. S.G. Deshmukh, Mechanical Engineering Deptt., IIT, Hauz Khas, Delhi
7. Dr. Bhim Singh, Electrical Engineering Deptt., IIT, Hauz Khas, Delhi
8. Prof. Smriti Srivastava, Head-Division of ICE, NSUT, Delhi
9. Prof. Tarun Kumar Das, Prof. of Mathematics & Registrar, University of Delhi

10. Sh. Lokesh Mehra, A-166, Ground Floor, Sarita Vihar, Delhi 110076
11. All HODs, DTU.
12. Prof. Rakesh Kumar, Civil Engg. Deptt.
13. Prof. Narendra Kumar-I, Elec. Engg. Deptt.
14. Prof. Naveen Kumar, Mech. Engg. Deptt.
15. Sh. Neeraj Kumar Bhagat, Associate Prof.,
16. Dr. M. Jayasimhadri, Assistant Prof., Applied Physics Deptt.
17. Controller of Examinations.
18. Registrar, DTU

(Prof. Samsher)
Registrar

ANNEXURE

For

Minutes

22nd meeting of

Academic Council

DTU

22-11-2019

DTU Campus, Shahbad Daulatpur, Bawana Road, Delhi-110042

DELHI TECHNOLOGICAL UNIVERSITY

Established by Govt. of Delhi vide Act 6 of 2009
(Formerly Delhi College of Engineering)
SHAHBAD DAULATPUR, BAWANA ROAD, DELHI-110042

PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINES OF APPLIED CHEMISTRY AND POLYMER SCIENCE & CHEMICAL TECHNOLOGY

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	A. For engineering background candidates. I. B.E./B.Tech. and M.E./ M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.	Chemistry, Analytical Chemistry, Industrial Chemistry, Applied Chemistry, Green Chemistry, Chemical Science, Polymer Science, Chemical Engineering, Chemical Technology, Polymer Science & Chemical Technology, Polymer Engineering, Plastic Engineering, Plastic Technology, Polymer Technology, Biochemistry, Rubber Technology, Textile Technology, Fiber Technology, Oil & Paint Technology, Paint Technology, Printing & Packaging Technology, Packaging Technology, Printing Technology, Metallurgical Engineering, Material Science.	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central

	'OR' **B. For Science background candidates.** I. M.Sc. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch. II. A minimum of 10 research publications in the peer- reviewed or UGC- listed journals and a total research score of One Hundred Twenty (120) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.			government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINES OF APPLIED MATHEMATICS AND MATHEMATICS & COMPUTING.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	**A. For engineering background candidates.** I. B.E./B.Tech. and M.E./ M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate	Mathematics, Applied Mathematics, Statistics, Mathematical Statistics, Applied Statistics, Operation Research, Mathematics & Computing, Mathematics & Computer Applications, Financial Mathematics, Computer Science, Computer Engineering, Computer Science & Engineering, Computer Technology, Computer Applications, Computer Engineering & Applications, Computer Science & Technology, Computer Technology & Applications, Information Technology Software Engineering	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction orders issued

Professor in SCI journals/ UGC/AICTE approved list journals. 'OR' B. For Science background candidates. I. M.A/M.Sc. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch. II. A minimum of 10 research publications in the peer- reviewed or UGC- listed journals and a total research score of One Hundred Twenty (120) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.			by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINES OF APPLIED PHYSICS AND ENGINEERING PHYSICS.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	**A. For engineering background candidates.** I. B.E./B.Tech. and M.E./ M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as	Applied Physics, Atomic & Molecular, Spectroscopy, Biophysics, Communication System, Digital Electronics, Electromagnetism, Electronics, Electronic Science, Electronics & Communication, Electrical & Electronics Engg., Electrical Engg., Electronic Engineering, Electronic & Comm. Engg., Electronics & Instrumentation, Electronics & Telecommunication Engg., Energy Storage & Conversion Systems, Energy Systems, Engineering Physics, Experimental Physics, Fibre Optics & Optical Communication, High Power Microwave Devices, Laser Physics, Laser Spectroscopy, Luminescent Materials, Metamaterials, Material Science, Microfluidics, MEMS & NEMS, Microfabrication, Microwave Engineering,	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance

Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals. 'OR' **B. For Science background candidates.** I. M.Sc. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch. II. A minimum of 10 research publications in the peer- reviewed or UGC- listed journals and a total research score of One Hundred Twenty (120) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.	Microwave & Optical, Communication Nanotechnology, Nuclear Engineering, Nuclear Science & Engineering, Nuclear Technology, Photonics, Physics, Plasmonics, Plasma Physics & Plasma Applications, Plasma Science & Technology, Power Electronics, Quantum Information, Semiconductor Physics & Devices, Solid-State Physics, Space Physics, Spintronics, Spin Engineering, Superconductors, Thin Films and Nano Structured Materials.		with the instruction/ orders issued by the central government /GNCT from time to time

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.

Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.

7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINE OF BIOTECHNOLOGY

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. B.E./B.Tech. and M.E./ M.Tech. and Ph.D in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University 'OR' M.Sc. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D in relevant branch II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE	Agriculture Science, Biochemical Engineering, Biochemistry, Bioinformatics, Biological Sciences, Biology, Biomedical Electronics, Biomedical Engineering, Biomedical Instrumentation, Biomedical Science, Bioprocess Technology, Biotechnology and Biochemical Engineering, Biotechnology and Molecular Biology, Biotechnology, Botany, Cell Biology, Cell and Molecular Biology, Fishery, Genetic Engineering, Genetics and Plant Breeding, Genetics, Immunology, Industrial Biotechnology, Life Sciences, Microbiology, Molecular Biology	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/

	approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.	and Genetic Engineering, Molecular Biology, Molecular Medicine, Neurosciences, Plant Biotechnology, Plant Molecular. Biology, Toxicology, Zoology.		orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E.. B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering). M.E.. M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINE OF CIVIL ENGINEERING

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. B.E./B.Tech. and M.E./ M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent. in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE	Civil & Environmental Engineering, Civil & Rural Engineering, Civil & Water Management Engineering, Civil Engineering, Civil Engineering & Planning, Civil Engineering (Construction Technology), Civil Engineering (Environmental Engineering), Civil & Infrastructure Engineering, Civil Engineering (Public Health Engineering), Civil Engineering Environment & Pollution Control, Civil Technology, Building Construction Technology, Civil (Public Health & Environment Engineering), Civil Engineering (Transportation Engineering), Civil Environmental Engineering, Construction Technology, Construction & Project Management, Construction Engineering, Construction Planning & Management, Construction Project & Management, Construction Technology, Construction Technology & Management, Earthquake Engineering, Foundation Engineering, Fracture Mechanics, Geo Informatics, Geo Informatics & Surveying	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/ patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing. planning. executing. analyzing. quality control, innovating.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD

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| | approved list journals. | Technology, Geo Machines & Structures, Geo Mechanics & Structures, Geo Technical & Geo Environmental Energy, Geo Technical Earthquake Engineering, Geo Technical Engineering, Geo Technology, Highway Engineering, Highway Technology, Hill Area Development Engineering, Hydraulic Engineering, Infrastructure Engineering, Infrastructure & Management, Infrastructure & Technology, Infrastructure Management, Irrigation & Drainage Engineering, Irrigation Engineering, Remote Sensing, Remote Sensing & Wireless Network, Remote Rock Mechanics Sensing & Gis, Seismic Design & Earthquake Engineering, Soil Dynamics Soil Mechanics, Soil Mechanics & Foundation Engineering, Spatial Information technology, Structural & Foundation Engineering, Structural Design, Structural Dynamic & Earthquake Engineering, Structural Engineering & Construction, Structural Engineering & Construction Management, Town & Country Planning, Traffic & Transporting Engineering, Transportation Engineering, Transportation Engineering & Management, Transportation System Engineering, Water & Environmental Technology, Water Resource Engineering, Water Resource Management, Water Resource & Hydraulic | training, technical books/research paper publications/IPR/ patents, etc., as deemed fit by the expert members of the Selection committee. | category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time. |

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		Engineering, Water Resource & Environmental Engineering, Water Resources & Hydro informatics.		

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN DISCIPLINES OF COMPUTER ENGINEERING, SOFTWARE ENGINEERING & INFORMATION TECHNOLOGY

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. B.E./B.Tech and M.E./ M.Tech in relevant branch with 1st class or equivalent either in B.E./B.Tech or M.E./ M.Tech from a recognized University 'OR' 1st class MCA and 1st class in M.Tech in relevant branch from a recognized University 'OR' 1st class or equivalent in B.E./B.Tech in relevant branch/1st class in MCA and Ph.D in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2	Advanced Communication and Information System, Advanced Electronics & Communication Engineering, Artificial Intelligence, Computer & Communication Engineering, Computer Applications, Computer Engineering, Computer Engineering & Applications, Computer Networking, Computer Science, Computer Science & Engineering, Computer Science & Information Technology, Computer Technology & Applications, Computer Science & Technology, Computer Science and Systems Engineering, Computer Technology, Electrical & Electronics Engineering, Electrical Engineering, Electronic & Computer Engineering, Electronic Engineering, Electronic & Communication Engineering, Electronics & Instrumentation, Electronics & Telecommunication Engineering, Information & Communication Technology, Information Engineering, Information Science & Engineering,	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/ IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/ designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/ IPR/patents, etc., as	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the

| | successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals. | Information Science & Technology, Information Security, Information Systems, Information Technology, Information Technology & Engineering, Mathematics & Computing, Mobile & Pervasive Computing, Software Engineering, Software Systems, Software Technology, Software Testing, VLSI Design, Web Designing, Web Technologies, 3-D Animation & Graphics, Applied Electronics & Instrumentation, Microelectronics. | deemed fit by the expert members of the Selection committee. | instruction/ orders issued by the central government /GNCT from time to time |

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINES OF DESIGN.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	(I) B.Des. and M.Des. with 1st class or equivalent either in B.Des. or M.Des. from a recognized University OR B.E./B.Tech. and M.Des. with 1st class or equivalent either in B.E./B.Tech. or in M.Des. from a recognized University OR B.Arch. and M.Arch. with 1st class or equivalent either in B.Arch. or in M.Arch. from a recognized University OR 75% or equivalent in B.Des. and Ph.D. in the areas of Design from a recognized University OR Graduation in any branch and Master of Fine Arts (MFA)/Master of Visual Arts (MVA) with first class either in Graduation or MFA/MVA from a recognized University (II) Qualifications as above with PhD or equivalent, in relevant areas. (III) At least total 6 research publications	------------	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance

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	at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.			with the instruction/ orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech. M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINES OF ELECTRICAL ENGINEERING.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. B.E./B.Tech and M.E./ M.Tech in relevant branch with 1st class or equivalent either in B.E./B.Tech or M.E./ M.Tech from a recognized University. 'OR' Ist Class or equivalent in B.E./B.Tech in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2	Electrical Engineering, Electrical & Electronics Engineering, Electronics Engineering, Electronics & Communication Engineering, Electronics & Electrical Communication Engineering, Instrumentation & Control Engineering, Control & Instrumentation, Power Engineering, Electronics & Applied Instrumentation Engineering, Instrumentation Engineering, High Voltage Engineering, Electrical Machine & Drives, Drive & Power Electronics, Power Systems, Power Electronics & Drives, Power Apparatus & Systems, Electrical Machines, Power Apparatus & Electric Drives, Systems & Control. System Engineering, Energy Systems, Microwave & Optical Communication, Communication Systems, Signal Processing & Embedded System, Process Control, Control Engineering, Measurement & Instrumentation, Digital Design, Microelectronics & VLSI Design, RF and Microwave	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents. etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years 4. Age relaxable

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	successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.	Engineering, Telecommunication Systems Engineering, Power & Energy Systems, Machine Drives & Power Electronics, Robotics System, Communication Engineering, Control & Computing, Power Electronics & Power Systems, Electronics Systems, Power & Control, Signal Processing, Signal Processing & Digital Design, Machine Drives & Power Electronics, Power & Energy Systems Engineering, Instrumentation & Signal processing, Advance Communication & Information System, Advanced Electrical Power System, Advanced Electronics, Advanced Electronics & Communication Engineering, Applied Electronics, Applied Electronics & Communications System, Applied Instrumentation, Automation & Control Power Systems, Bio Electronics, Biomedical Electronics, Biomedical Signal Processing & Instrumentation, Communication Engineering & Signal Processing, Computer Applications In Industrial Drives, Control Engineering, Digital Communication, Digital Communication & Networking, Digital Electronics, Digital Electronics & Communication Engineering, Digital Electronics & Engineering, Digital Image processing, Digital Instrumentation, Digital Signal Processing, Digital Systems,		for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

		Digital Systems & Communication, Electric Power System, Electrical Drive & Power Engineering, Electrical & Power Engineering, Electrical Energy Systems, Electrical Engg (Instrumentation & Control), Electrical Instrumentation & Control Engineering, Electrical Power & Energy Systems, Electrical Power Systems, Electronics Circuits & System Design, Electronics & Communication (VLSI Design), Electronics & Instrumentation Engineering, Electronic & Tele communication Engineering, Electronic & Control Systems, Electronics & Telecommunication Engg (Radio & Systems), Electronics Communication & Instrumentation Engineering, Electronics Design & Technology, Electronics Product Design & Technology, Electronics Systems & Communication, Electronics Technology, Electronics Tele Communication, Embedded & Real Time Systems, Embedded Systems & VLSI Design, Embedded Systems, Embedded Systems Technologies, Energy Engineering, Guidance & Navigation Control, Guided Missiles, High Voltage & Power System Engineering, Illumination Engineering, Illumination Technology & Design Image Processing, Industrial Automation & RF		

		Engineering, Industrial drives & Control, Industrial Electronics, Industrial Power Control & Drives, Instrumentation Engineering, Integrated Circuits Technology, Integrated Power Systems, Micro & Nano Electronics, Micro Electronics & VLSI deigns, Micro Electronics & Control Systems, Micro Electronics Engineering, Microwave & Optical Communication Engineering, Microwave & Communication Engineering, Microwave & Millimeter Engineering, Microwave & Radar Engg, Microwave & TV Engineering, Microwave Engineering, Optics & Optoelectronics, Optoelectronics & Communication, Optoelectronics & Laser Technology, Optoelectronics Engineering, Power & Energy Engineering, Power & Industrial Drives, Power Control & drives, Power Electronics & Control, Power Electronics & Electrical Drives, Power Electronics & Machine Drives, Power Electronics & Systems, Power Electronics Engineering, Power Engineering & Energy Systems, Power system & Control, Power System & Control Automation, Power System with Emphasis on H.V. Engineering, Power Systems & Automation, Power Systems & Power Electronics, Power Systems Control & Automation Engineering, Radio Physics & Electronics,		

		Reliability Engineering, Renewable Energy, Sensor Technology, Signal Processing & Communication, Solar Power Systems, Telecommunication Engineering, Telematics, VLSI & Embedded Systems Design, VLSI & Microelectronics, VLSI Design, VLSI Design & Embedded Systems, VLSI Design & Signal Processing, VLSI Design & Testing, VLSI System Design, VLSI Systems, Applied Electronics & Instrumentation Engineering, Biomedical Engineering, Biomedical Instrumentation, Electrical & Electronics (Power System), Electrical & Instrumentation Engineering, Electrical & Power Engineering, Electrical Engineering (Electronics & Power), Electrical Engineering Industrial Control, Electrical Instrumentation & Control Engineering, Electrical, Electronics & Power Electronics Science & Engineering, Electronic Instrumentation & Control Engineering, Electronics & Telecommunication Engineering, Electronics & Computer Engineering, Electronics & Control Systems, Electronics & Electrical Engineering, Electronics & Power Engineering, Electronics System Engineering, Information Technology &		

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		Engineering, Instrument Technology, Instrumentation & Electronics, Mechatronics Engineering, Medical Electronics Engineering, Power Electronics & Instrumentation Engineering, Energy & Environment Management.		

Notes :

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2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
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4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN DISCIPLINE OF ELECTRONICS & COMMUNICATION ENGINEERING

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. B.E./B.Tech and M.E./ M.Tech in relevant branch with 1st class or equivalent either in B.E./B.Tech or M.E./ M.Tech from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech in relevant branch and Ph.D. in relevant branch from a recognized University. 'OR' M.Sc. in Physics/Relevant branch and ME/M.Tech. in relevant branch and Ph.D in relevant branch with 1st class or equivalent either in M.Sc. or M.E./M.Tech from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-	Advanced Electronics, Advanced Electronics & Communication Engineering, Applied Electronics, Applied Electronics & Instrumentation Engineering, Applied Electronics & Communications, Advanced Communication & Information System, Advanced Computer Aided Design, Biomedical Electronics, Biomedical Signal Processing, Computer Engineering, Computer Engineering & Application, Communication & Signal Processing, Computer & Communication Engineering, Computer Applications, Computer Engineering, Computer Engineering & Applications, Computer Science & Engineering, Computer Science & Technology, Communication & Information Systems, Communication & Networking, Communication Engineering, Communication Engineering & Signal Processing, Communication Networks, Communication Systems, Digital Design, Digital Electronics,	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD

	supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.	Digital Electronics & Microprocessor, Digital Electronics & Communication , Digital Electronics & Communication Engineering, Digital Electronics & Communication Systems, Digital Electronics Engineering, Digital Image Processing, Digital Signal Processing, Digital Systems, Digital Communication, Digital Communication Engineering, Digital Communications, Digital Communications & Networking, Digital Systems & Computer Electronics, Electronic Engineering, Electronics & Communication Engg, Electronics & Computer Science, Electronics (Fiber Optics), Electronics (Robotics), Electronics & Biomedical Engineering, Electronics & Communication Engineering (Microwaves), Electronics & Communications Engineering, Electronics & Computer Engineering, Electronics & Control Systems, Electronics & Electrical Engineering, Electronics & Electrical Communication Engineering, Electronics & Telecommunications Engineering, Electronics & Telematics Engineering, Electronics Design Technology, Electronics Engineering, Electronics Engineering (Industry Integrated), Electronics Engineering		category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

		(Micro Electronics), Electronics Engineering, (Specialization In Consumer Electronics), Electronics Engineering With Microprocessor, Electrical Engineering, Electronics System Engineering, Electronics Technology, Embedded System & Computing, Embedded System & VLSI. Embedded System & VLSI Design, Embedded Systems, Embedded Systems Technologies, Image Processing, Industrial Electronics, Integrated Circuits Technology, Integrated Electronics & Circuits, IC Design, Information Technology, Information Science & Engineering, Information Science & Technology, Information Security, Information Systems, Information Technology & Engineering, Mobile & Pervasive Computing, Medical Electronics, Medical Electronics Engineering, Micro & Nano Electronics, Micro Electronics, Micro Electronics & VLSI Design, Micro Electronics & Control Systems, Micro Electronics Engineering, Microelectronics & VLSI Design, Microelectronics Engineering, Mobile Technology, Microwave & Optical Communication, Microwave & Communication Engineering,		

		Microwave & Millimeter Engineering, Microwave & Radar Engineering, Microwave & TV Engineering, Microwave Engineering, Microwaves, Microwave & Optical Communication, Mobile Communication, Mobile Communication & Network Technology, Modern Communication Engineering, Nano Science & Technology, Nano Electronics, Nano Technology, Optics & Optoelectronics, Opto Electronics & Communication Systems, Optoelectronics & Communication, Opto-Electronics Engineering, Optoelectronics - Optical Communication, Optical Communication, Radar & Communication, Radio Frequency & Microwave Engineering, Radar & Satellite Communication, Radio Physics & Electronics, RF & Photonics, Signal Processing, Signal Processing & Digital Design, Signal Processing & Communications, Signal Processing & Embedded Systems, Telecommunication Engineering, VLSI, VLSI Design, VLSI & Embedded Systems, VLSI & Embedded Systems Design, VLSI And Microelectronics, VLSI Design & Embedded Systems, VLSI Design & Signal Processing, VLSI Design & Testing, VLSI System Design,		

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		VLSI Systems, VLSI Design Tools & Technology, Wireless & Mobile Communications, Wireless Sensor Networks, Wireless Communication & Computing, Wireless Communication Technology, Wireless Communications, Wireless Networks & Applications, Instrumentation Engineering, Instrumentation & Control Engineering, Power Electronics.		

Notes :

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4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. B.E. / B.Tech. and M.E. / M.Tech. in relevant branch with 1st class or equivalent either in B.E. / B.Tech. or M.E. / M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. 'OR' M.Sc., M.Tech. and Ph.D. in relevant branch with 1st class or equivalent either in M.Sc. or M.Tech. from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6	Civil Engineering, Environment Engineering, Civil & Environment Engineering, Public Health & Environment Engineering, Earthquake Engineering, Geotechnical Engineering, Seismic Design & Earthquake Engineering, Traffic & Transporting Engineering, Water Resource Engineering, Water Resources & Hydraulic Engg, Geographic Information System (G.I.S.) & Global Positioning System, Environmental Engineering, Environmental Engineering & Management, Environmental Management, Environmental Science & Engineering, Environmental Science & Technology, Green Technology, Health Science & Water Engineering, Water & Environmental Technology, Water Resource Engineering, Water Resource Management, Water Resources & Hydro Informatics.	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance

	research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.			with the instruction/ orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech. B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINE OF ECONOMICS.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. Master's degree in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch. II. A minimum of 10 research publications in the peer- reviewed or UGC- listed journals and a total research score of One Hundred Twenty (120) as per the criteria given in Appendix II. Table 2 of UGC notification dated 18 July, 2018.	Economics, Managerial Economics, Industrial Economics, Business Economics, Financial Economics, Economics & Rural Development, Analytical & Applied Economics, Quantitative Economics, Applied Economics, Finance and Control Behavioral Economics	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINE OF ENGLISH.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. M.A. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch. II. A minimum of 10 research publications in the peer- reviewed or UGC- listed journals and a total research score of One Hundred Twenty (120) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.	English	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech. B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF PROFESSOR IN THE DISCIPLINE OF MANAGEMENT

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1,44,200	I. First class or equivalent in Master's degree in Business Management/ Administration in a relevant management related discipline or first class in Two year full time PGDM declared equivalent by AIU/Accredited by the AICTE/UGC. 'OR' First class or equivalent in M. Tech./Master's Degree in relevant branch. 'OR' First class or equivalent Graduate and professionally qualified Charted Accountant/Cost & Works Accountant/Company Secretary of the concerned statutory bodies. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6	Account & Finance, Accountancy, Accounts, Agricultural Economics & Business Management, Banking & Insurance, Business Administration, Business Analytics, Business Data Analytics, Business Economics, Business Law, Business Management, Business Policy & Strategic Management, Commerce, Computer Aided Management, Computer Applications, Computer Engineering & Applications, Computer Engineering, Computer Science & Engineering, Computer Science & Information Technology, Computer Science & Technology, Computer Science and Systems Engineering, Computer Science, Computer Technology & Applications, Computer Technology, Data Analytics,	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience. good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for

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	research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR' At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.	Data Science, Decision Science, E Commerce, Economics, Engineering Management, Finance & Control, Finance, Financial Management, Financial Markets, Global Business Operation, Human Resource Development, Human Resource Management, Industrial Engineering, Industrial Management, Information System, Information Technology & Engineering, Information Technology, International Business, Knowledge Engineering, Knowledge Management, Knowledge Science, Management Science, Marketing Management, Operations Research, Organizational Development, Personal Management & Industrial Relation, Psychology, Quality Engineering & Management, Sales & Marketing Management, Software Engineering, Software Systems, Software Technology, Statistics, Strategic Management, Technology Management		the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time

Notes :

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Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Professor Level-14 Entry Pay - 1.44.200	I. B.E./B.Tech. and M.E./M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals and at least 2 successful Ph.D. guided as Supervisor/Co-supervisor. 'OR'	Advanced Computer Aided Design, Advanced Design & Manufacturing, Advanced Manufacturing & Mechanical Systems Design, Advanced Manufacturing Systems, Advanced Manufacturing Technology, Advanced Materials Technology, Aerodynamics & Propulsion, Aeronautical Engineering, Aerospace Engineering, Aircraft Maintenance Engineering, Automated Manufacturing System, Automation & Robotics, Automobile Engineering, Automotive Technology, CAD/CAM Engineering, CAD/CAM/CAE, CAD-CAM & Automation, Computational Analysis in Mechanical Mechanics, Computational Design, Computational Mechanics (Mechanical Engineering), Computer Aided Design & Manufacturing, Computer Aided Design Manufacture & Automation, Computer Integrated Design & Manufacturing, Design & Manufacturing, Design & Production Engineering, Design & Thermal Engineering, Design Engineering, Design of Mechanical Equipment, Design of Mechanical Systems, Dynamics & Control, Energy & Environmental Management, Energy Engineering,	A minimum of 10 years of experience in teaching /research /industry out of which at least 3 years shall at the post equivalent to that of an Associate Professor. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Associate Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	55 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years.

	At least 10 research publications at the level of Associate Professor in SCI journals/ UGC/AICTE approved list journals.	Energy Engineering Management, Energy Management, Energy Materials, Energy Systems, Energy Systems & Management, Energy Systems Engineering, Energy Technology, Fluid Mechanics/ Solid Mechanics, Fluids & Thermal Engineering, Foundry Engineering, Fracture Mechanics, Fuel & Combustion, Gas Turbine Technology, Heat Power & Thermal Engineering, Heat Power Engineering, Heat Ventilation & Air conditioning, Hydraulics Engineering, Industrial & Production Engineering, Industrial Automation & Robotics, Industrial Design, Industrial Engineering, Industrial Engineering & Management, Industrial Metallurgy, Industrial Production Engineering, Industrial Refrigeration & Cryogenics, Industrial Safety & Engineering, Industrial Tribology & Maintenance Management, Internal Combustion & Automobiles, Internal Combustion Engineering, Internal Combustion Engines & Turbo Machinery, Machine Design, Machine Design & Robotics, Machine Engineering, Maintenance Engineering, Manufacturing Engineering, Manufacturing Engineering & Automation, Manufacturing Engineering & Management, Manufacturing Engineering & Technology, Manufacturing Process, Manufacturing Process & Automation Engineering, Manufacturing Science & Engineering, Manufacturing Systems &		4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

		Management, Manufacturing Technology, Marine Engineering, Material Science & Engineering, Material Science & Technology, Materials Engineering, Materials Science Technology, Mechanical & Automation Engineering, Mechanical Engineering, Mechanical Engineering (Automobile), Mechanical Engineering (Industry Integrated), Mechanical Engineering (Production), Mechanical Engineering (Repair & Maintenance), Mechanical Engineering Design, Mechanical System Design, Mechatronics, Metallurgical & Materials Engineering, Metallurgical Engineering, Metallurgy, Metallurgy & Material Technology, Mining Engineering, Nuclear Engineering, Nuclear Science & Technology, Power & Energy Engineering, Power & Industrial Drives, Power Engineering, Power Plant Engineering & Energy Management, Process Metallurgy, Product Design, Product Design & Commerce, Product Design & Development, Product Design & Manufacturing, Production & Industrial Engineering, Production Engineering, Production Engineering System Technology, Production Technology, Production Technology & Management, Project Management, Propulsion Engineering, Quality Engineering & Management, Refrigeration & Air Conditioning, Reliability Engineering, Renewable Energy, Renewable Energy Technology, Robotics & Mechatronics,		

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| | | Solid Mechanics,
System Technology,
Thermal & Fluid Engineering,
Thermal Engineering,
Thermal Power Engineering,
Thermal Science,
Thermal Science & Energy
Systems,
Thermal Science & Engineering,
Thermal Systems & Design,
Tool & Die Engineering,
Tool Design,
Tool Engineering,
Turbo – Machines,
Virtual Prototyping & Digital
Manufacturing,
Welding Engineering,
Welding Technology. | | |

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINES OF APPLIED CHEMISTRY AND POLYMER SCIENCE & CHEMICAL TECHNOLOGY

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	**A. For engineering background candidates.** I. B.E./B.Tech. and M.E./M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals. 'OR' **B. For Science background candidates.** I. M.Sc. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch.	Chemistry, Analytical Chemistry, Industrial Chemistry, Applied Chemistry, Green Chemistry, Chemical Science, Polymer Science, Chemical Engineering, Chemical Technology, Polymer Science & Chemical Technology, Polymer Engineering, Plastic Engineering, Plastic Technology, Polymer Technology, Biochemistry, Rubber Technology, Textile Technology, Fiber Technology, Oil & Paint Technology, Paint Technology, Printing & Packaging Technology, Packaging Technology, Printing Technology, Metallurgical Engineering, Material Science.	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance

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			books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	with the instruction/ orders issued by the central government /GNCT from time to time.
	II. A minimum of 7 publications in the peer-reviewed or UGC-listed journals and a total research score of seventy five (75) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.			

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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DELHI TECHNOLOGICAL UNIVERSITY

Established by Govt. of Delhi vide Act 6 of 2009
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SHAHBAD DAULATPUR, BAWANA ROAD, DELHI-110042

PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINES OF APPLIED MATHEMATICS AND MATHEMATICS & COMPUTING.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	**A. For engineering background candidates.** I. B.E./B.Tech. and M.E./M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals. 'OR' **B. For Science background candidates.** I. M.A./M.Sc. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is	Mathematics, Applied Mathematics, Statistics, Mathematical Statistics, Applied Statistics, Operation Research, Mathematics & Computing, Mathematics & Computer Applications, Financial Mathematics, Computer Science, Computer Engineering, Computer Science & Engineering, Computer Technology, Computer Applications, Computer Engineering & Applications, Computer Science & Technology, Computer Technology & Applications, Information Technology Software Engineering	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the

	followed) and Ph.D. in relevant branch. II. A minimum of 7 publications in the peer- reviewed or UGC- listed journals and a total research score of seventy five (75) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.		books/research paper publications/IPR/pate nts, etc., as deemed fit by the expert members of the Selection committee.	instruction/ orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINES OF APPLIED PHYSICS AND ENGINEERING PHYSICS.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	**A. For engineering background candidates.** I. B.E./B.Tech. and M.E./ M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals. 'OR' **B. For Science background candidates.** 1. M.Sc. in relevant branch with at least 55% marks (or an	Applied Physics, Atomic & Molecular, Spectroscopy, Biophysics, Communication System, Digital Electronics, Electromagnetism, Electronics, Electronic Science, Electronics & Communication, Electrical & Electronics Engg., Electrical Engg., Electronic Engineering, Electronic & Comm. Engg., Electronics & Instrumentation, Electronics & Telecommunication Engg., Energy Storage & Conversion Systems, Energy Systems, Engineering Physics, Experimental Physics, Fibre Optics & Optical Communication, High Power Microwave Devices, Laser Physics, Laser Spectroscopy, Luminescent Materials, Metamaterials, Material Science, Microfluidics, MEMS, & NEMS, Microfabrication, Microwave Engineering, Microwave & Optical, Communication	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/paten	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for

| | equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch.

II. A minimum of 7 publications in the peer- reviewed or UGC- listed journals and a total research score of seventy five (75) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018. | Nanotechnology, Nuclear Engineering, Nuclear Science & Engineering, Nuclear Technology, Photonics, Physics, Plasmonics, Plasma Physics & Plasma Applications, Plasma Science & Technology, Power Electronics, Quantum Information, Semiconductor Physics & Devices, Solid-State Physics, Space Physics, Spintronics, Spin Engineering, Superconductors, Thin Films and Nano Structured Materials. | ts, etc., as deemed fit by the expert members of the Selection committee. | the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time. |

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E.. B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINE OF BIOTECHNOLOGY

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. B.E./B.Tech. and M.E./ M.Tech. and Ph.D in relevant branch with 1ˢᵗ class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University 'OR' 1ˢᵗ class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University 'OR' M.Sc. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D in relevant branch II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list	Agriculture Science, Biochemical Engineering, Biochemistry, Bioinformatics, Biological Sciences, Biology, Biomedical Electronics, Biomedical Engineering, Biomedical Instrumentation, Biomedical Science, Bioprocess Technology, Biotechnology and Biochemical Engineering, Biotechnology and Molecular Biology, Biotechnology, Botany, Cell Biology, Cell and Molecular Biology, Fishery, Genetic Engineering, Genetics and Plant Breeding, Genetics, Immunology, Industrial Biotechnology, Life Sciences, Microbiology, Molecular Biology	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time

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	journals.	and Genetic Engineering, Molecular Biology, Molecular Medicine, Neurosciences, Plant Biotechnology, Plant Molecular Biology, Toxicology, Zoology.	by the expert members of the Selection committee.	

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINE OF CIVIL ENGINEERING

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. B.E./B.Tech. and M.E./ M.Tech. in relevant branch with 1st class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals.	Civil & Environmental Engineering, Civil & Rural Engineering, Civil & Water Management Engineering, Civil Engineering, Civil Engineering & Planning, Civil Engineering (Construction Technology), Civil Engineering (Environmental Engineering), Civil & Infrastructure Engineering, Civil Engineering (Public Health Engineering), Civil Engineering Environment & Pollution Control, Civil Technology, Building Construction Technology, Civil (Public Health & Environment Engineering), Civil Engineering (Transportation Engineering), Civil Environmental Engineering, Construction Technology, Construction & Project Management, Construction Engineering, Construction Planning & Management, Construction Project & Management, Construction Technology, Construction Technology & Management, Earthquake Engineering, Foundation Engineering, Fracture Mechanics,	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable

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		Geo Informatics, Geo Informatics & Surveying Technology, Geo Machines & Structures, Geo Mechanics & Structures, Geo Technical & Geo Environmental Energy, Geo Technical Earthquake Engineering, Geo Technical Engineering, Geo Technology, Highway Engineering, Highway Technology, Hill Area Development Engineering, Hydraulic Engineering, Infrastructure Engineering, Infrastructure & Management, Infrastructure & Technology, Infrastructure Management, Irrigation & Drainage Engineering, Irrigation Engineering, Remote Sensing, Remote Sensing & Wireless Network, Remote Rock Mechanics Sensing & Gis, Seismic Design & Earthquake Engineering, Soil Dynamics Soil Mechanics, Soil Mechanics & Foundation Engineering, Spatial Information technology, Structural & Foundation Engineering, Structural Design, Structural Dynamic & Earthquake Engineering, Structural Engineering & Construction, Structural Engineering & Construction Management, Town & Country Planning, Traffic & Transporting Engineering, Transportation Engineering, Transportation Engineering & Management, Transportation System Engineering, Water & Environmental Technology, Water Resource Engineering,	publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

		Water Resource Management, Water Resource & Hydraulic Engineering, Water Resource & Environmental Engineering, Water Resources & Hydro informatics.		

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN DISCIPLINES OF COMPUTER ENGINEERING, SOFTWARE ENGINEERING & INFORMATION TECHNOLOGY

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. B.E./B.Tech and M.E./ M.Tech in relevant branch with 1st class or equivalent either in B.E./B.Tech or M.E./ M.Tech from a recognized University 'OR' 1st class MCA and 1st class in M.Tech in relevant branch from a recognized University 'OR' 1st class or equivalent in B.E./B.Tech in relevant branch/1st class in MCA and Ph.D in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals.	Advanced Communication and Information System, Advanced Electronics & Communication Engineering, Artificial Intelligence, Computer & Communication Engineering, Computer Applications, Computer Engineering, Computer Engineering & Applications, Computer Networking, Computer Science, Computer Science & Engineering, Computer Science & Information Technology, Computer Technology & Applications, Computer Science & Technology, Computer Science and Systems Engineering, Computer Technology, Electrical & Electronics Engineering, Electrical Engineering, Electronic & Computer Engineering, Electronic Engineering, Electronic & Communication Engineering, Electronics & Instrumentation, Electronics & Telecommunication Engineering, Information & Communication Technology, Information Engineering, Information Science &	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance

		Engineering, Information Science & Technology, Information Security, Information Systems, Information Technology, Information Technology & Engineering, Mathematics & Computing, Mobile & Pervasive Computing, Software Engineering, Software Systems, Software Technology, Software Testing, VLSI Design, Web Designing, Web Technologies, 3-D Animation & Graphics, Applied Electronics & Instrumentation, Microelectronics.	publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	with the instruction/ orders issued by the central government /GNCT from time to time

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINES OF DESIGN.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	(I) B.Des. and M.Des. with 1st class or equivalent either in B.Des. or M.Des. from a recognized University OR B.E./B.Tech. and M.Des. with 1st class or equivalent either in B.E./B.Tech. or in M.Des. from a recognized University OR B.Arch. and M.Arch. with 1st class or equivalent either in B.Arch. or in M.Arch. from a recognized University OR 75% or equivalent in B.Des. and Ph.D. in the areas of Design from a recognized University OR Graduation in any branch and Master of Fine Arts (MFA)/Master of Visual Arts (MVA) with first class either in Graduation or MFA/MVA from a recognized University (II) Qualifications as above with PhD or equivalent, in relevant areas. (III) At least total 6 research publications in SCI journals/ UGC/AICTE	-----------	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit by the expert members of the Selection committee.	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction

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	approved list journals			orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications. experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINES OF ELECTRICAL ENGINEERING.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. B.E./B.Tech and M.E./ M.Tech in relevant branch with 1st class or equivalent either in B.E./B.Tech or M.E./ M.Tech from a recognized University. 'OR' Ist Class or equivalent in B.E./B.Tech in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals.	Electrical Engineering, Electrical & Electronics Engineering, Electronics Engineering, Electronics & Communication Engineering, Electronics & Electrical Communication Engineering, Instrumentation & Control Engineering, Control & Instrumentation, Power Engineering, Electronics & Applied Instrumentation Engineering, Instrumentation Engineering, High Voltage Engineering, Electrical Machine & Drives, Drive & Power Electronics, Power Systems, Power Electronics & Drives, Power Apparatus & Systems, Electrical Machines, Power Apparatus & Electric Drives, Systems & Control, System Engineering, Energy Systems, Microwave & Optical Communication, Communication Systems, Signal Processing & Embedded System, Process Control, Control Engineering, Measurement & Instrumentation, Digital Design, Microelectronics & VLSI Design, RF and Microwave Engineering,	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable

| | | Telecommunication Systems Engineering, Power & Energy Systems, Machine Drives & Power Electronics, Robotics System, Communication Engineering, Control & Computing, Power Electronics & Power Systems, Electronics Systems, Power & Control, Signal Processing, Signal Processing & Digital Design, Machine Drives & Power Electronics, Power & Energy Systems Engineering, Instrumentation & Signal processing, Advance Communication & Information System, Advanced Electrical Power System, Advanced Electronics, Advanced Electronics & Communication Engineering, Applied Electronics, Applied Electronics & Communications System, Applied Instrumentation, Automation & Control Power Systems, Bio Electronics, Biomedical Electronics, Biomedical Signal Processing & Instrumentation, Communication Engineering & Signal Processing, Computer Applications In Industrial Drives, Control Engineering, Digital Communication, Digital Communication & Networking, Digital Electronics, Digital Electronics & Communication Engineering, Digital Electronics & Engineering, Digital Image processing, Digital Instrumentation, Digital Signal Processing, Digital Systems, Digital Systems & | books/research paper publications/IPR/pate nts, etc., as deemed fit by the expert members of the Selection committee. | for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time. |

| | | Communication,
Electric Power System,
Electrical Drive & Power
Engineering,
Electrical & Power Engineering,
Electrical Energy Systems,
Electrical Engg (Instrumentation
& Control),
Electrical Instrumentation &
Control Engineering,
Electrical Power & Energy
Systems,
Electrical Power Systems,
Electronics Circuits & System
Design,
Electronics & Communication
(VLSI Design),
Electronics & Instrumentation
Engineering,
Electronic & Tele
communication Engineering,
Electronic & Control Systems,
Electronics &
Telecommunication Engg (Radio
& Systems),
Electronics Communication &
Instrumentation Engineering,
Electronics Design &
Technology,
Electronics Product Design &
Technology,
Electronics Systems &
Communication,
Electronics Technology,
Electronics Tele
Communication,
Embedded & Real Time
Systems,
Embedded Systems & VLSI
Design,
Embedded Systems,
Embedded Systems
Technologies,
Energy Engineering,
Guidance & Navigation Control,
Guided Missiles,
High Voltage & Power System
Engineering,
Illumination Engineering,
Illumination Technology &
Design
Image Processing,
Industrial Automation & RF
Engineering,
Industrial drives & Control,
Industrial Electronics. | · | |

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		Industrial Power Control & Drives, Instrumentation Engineering, Integrated Circuits Technology, Integrated Power Systems, Micro & Nano Electronics, Micro Electronics & VLSI deigns, Micro Electronics & Control Systems, Micro Electronics Engineering, Microwave & Optical Communication Engineering, Microwave & Communication Engineering, Microwave & Millimeter Engineering, Microwave & Radar Engg, Microwave & TV Engineering, Microwave Engineering, Optics & Optoelectronics, Optoelectronics & Communication, Optoelectronics & Laser Technology, Optoelectronics Engineering, Power & Energy Engineering, Power & Industrial Drives, Power Control & drives, Power Electronics & Control, Power Electronics & Electrical Drives, Power Electronics & Machine Drives, Power Electronics & Systems, Power Electronics Engineering, Power Engineering & Energy Systems, Power system & Control, Power System & Control Automation, Power System with Emphasis on H.V. Engineering, Power Systems & Automation, Power Systems & Power Electronics, Power Systems Control & Automation Engineering, Radio Physics & Electronics, Reliability Engineering, Renewable Energy, Sensor Technology, Signal Processing & Communication, Solar Power Systems, Telecommunication		

| | | Engineering, Telematics, VLSI & Embedded Systems Design, VLSI & Microelectronics, VLSI Design, VLSI Design & Embedded Systems, VLSI Design & Signal Processing, VLSI Design & Testing, VLSI System Design, VLSI Systems, Applied Electronics & Instrumentation Engineering, Biomedical Engineering, Biomedical Instrumentation, Electrical & Electronics (Power System), Electrical & Instrumentation Engineering, Electrical & Power Engineering, Electrical Engineering (Electronics & Power), Electrical Engineering Industrial Control, Electrical Instrumentation & Control Engineering, Electrical, Electronics & Power Electronics Science & Engineering, Electronic Instrumentation & Control Engineering, Electronics & Telecommunication Engineering, Electronics & Computer Engineering, Electronics & Control Systems, Electronics & Electrical Engineering, Electronics & Power Engineering, Electronics System Engineering, Information Technology & Engineering, Instrument Technology, Instrumentation & Electronics, Mechatronics Engineering, Medical Electronics Engineering, Power Electronics & Instrumentation Engineering, Energy & Environment Management. | | |

Notes :

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2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

DELHI TECHNOLOGICAL UNIVERSITY

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SHAHBAD DAULATPUR, BAWANA ROAD, DELHI-110042

PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN DISCIPLINE OF ELECTRONICS & COMMUNICATION ENGINEERING

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. B.E./B.Tech and M.E./ M.Tech in relevant branch with 1st class or equivalent either in B.E./B.Tech or M.E./ M.Tech from a recognized University. 'OR' Ist class or equivalent in B.E./B.Tech in relevant branch and Ph.D. in relevant branch from a recognized University. 'OR' M.Sc. in Physics/Relevant branch and ME/M.Tech. in relevant branch and Ph.D in relevant branch with Ist class or equivalent either in M.Sc. or M.E./M.Tech from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III.At least total 6 research publications	Advanced Electronics, Advanced Electronics & Communication Engineering, Applied Electronics, Applied Electronics & Instrumentation Engineering, Applied Electronics & Communications, Advanced Communication & Information System, Advanced Computer Aided Design, Biomedical Electronics, Biomedical Signal Processing, Computer Engineering, Computer Engineering & Application, Communication & Signal Processing, Computer & Communication Engineering, Computer Applications, Computer Engineering, Computer Engineering & Applications, Computer Science & Engineering, Computer Science & Technology, Communication & Information Systems, Communication & Networking, Communication Engineering, Communication Engineering & Signal Processing, Communication Networks, Communication Systems, Digital Design, Digital Electronics, Digital Electronics & Microprocessor,	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents. etc., as deemed fit by the expert members	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for

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	in SCI journals/ UGC/AICTE approved list journals.	Digital Electronics & Communication , Digital Electronics & Communication Engineering, Digital Electronics & Communication Systems, Digital Electronics Engineering, Digital Image Processing, Digital Signal Processing, Digital Systems, Digital Communication, Digital Communication Engineering, Digital Communications, Digital Communications & Networking, Digital Systems & Computer Electronics, Electronic Engineering, Electronics & Communication Engg, Electronics & Computer Science, Electronics (Fiber Optics), Electronics (Robotics), Electronics & Biomedical Engineering, Electronics & Communication Engineering (Microwaves), Electronics & Communications Engineering, Electronics & Computer Engineering, Electronics & Control Systems, Electronics & Electrical Engineering, Electronics & Electrical Communication Engineering, Electronics & Telecommunications Engineering, Electronics & Telematics Engineering, Electronics Design Technology, Electronics Engineering, Electronics Engineering (Industry Integrated), Electronics Engineering (Micro Electronics), Electronics Engineering, (Specialization In Consumer Electronics), Electronics Engineering With	of the Selection committee.	the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

		Microprocessor, Electrical Engineering, Electronics System Engineering, Electronics Technology, Embedded System & Computing, Embedded System & VLSI, Embedded System & VLSI Design, Embedded Systems, Embedded Systems Technologies, Image Processing, Industrial Electronics, Integrated Circuits Technology, Integrated Electronics & Circuits, IC Design, Information Technology, Information Science & Engineering, Information Science & Technology, Information Security, Information Systems, Information Technology & Engineering, Mobile & Pervasive Computing, Medical Electronics, Medical Electronics Engineering, Micro & Nano Electronics, Micro Electronics, Micro Electronics & VLSI Design, Micro Electronics & Control Systems, Micro Electronics Engineering, Microelectronics & VLSI Design, Microelectronics Engineering, Mobile Technology, Microwave & Optical Communication, Microwave & Communication Engineering, Microwave & Millimeter Engineering, Microwave & Radar Engineering, Microwave & TV Engineering,		

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		Microwave Engineering, Microwaves, Microwave & Optical Communication, Mobile Communication, Mobile Communication & Network Technology, Modern Communication Engineering, Nano Science & Technology, Nano Electronics, Nano Technology, Optics & Optoelectronics, Opto Electronics & Communication Systems, Optoelectronics & Communication, Opto-Electronics Engineering, Optoelectronics - Optical Communication, Optical Communication, Radar & Communication, Radio Frequency & Microwave Engineering, Radar & Satellite Communication, Radio Physics & Electronics, RF & Photonics, Signal Processing, Signal Processing & Digital Design, Signal Processing & Communications, Signal Processing & Embedded Systems, Telecommunication Engineering, VLSI, VLSI Design, VLSI & Embedded Systems, VLSI & Embedded Systems Design, VLSI And Microelectronics, VLSI Design & Embedded Systems, VLSI Design & Signal Processing, VLSI Design & Testing, VLSI System Design, VLSI Systems, VLSI Design Tools & Technology, Wireless & Mobile Communications, Wireless Sensor Networks, Wireless Communication &		

		Computing, Wireless Communication Technology, Wireless Communications, Wireless Networks & Applications, Instrumentation Engineering, Instrumentation & Control Engineering, Power Electronics.		

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINE OF ENVIRONMENTAL ENGINEERING.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. B.E. / B.Tech. and M.E. / M.Tech. in relevant branch with 1st class or equivalent either in B.E. / B.Tech. or M.E. / M.Tech. from a recognized University. 'OR' 1st class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. 'OR' M.Sc., M.Tech. and Ph.D. in relevant branch with 1st class or equivalent either in M.Sc. or M.Tech. from a recognized University. II. Qualifications as above with PhD or equivalent, in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals	Civil Engineering, Environment Engineering, Civil & Environment Engineering, Public Health & Environment Engineering, Earthquake Engineering, Geotechnical Engineering, Seismic Design & Earthquake Engineering, Traffic & Transporting Engineering, Water Resource Engineering, Water Resources & Hydraulic Engg, Geographic Information System (G.I.S.) & Global Positioning System, Environmental Engineering, Environmental Engineering & Management, Environmental Management, Environmental Science & Engineering, Environmental Science & Technology, Green Technology, Health Science & Water Engineering, Water & Environmental Technology, Water Resource Engineering, Water Resource Management, Water Resources & Hydro Informatics.	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/pate	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance

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				nts, etc., as deemed fit by the expert members of the Selection committee.	with the instruction/ orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETF qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINE OF ECONOMICS.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. Master's degree in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch. II. A minimum of 7 publications in the peer- reviewed or UGC- listed journals and a total research score of seventy five (75) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.	Economics, Managerial Economics, Industrial Economics, Business Economics, Financial Economics, Economics & Rural Development, Analytical & Applied Economics, Quantitative Economics, Applied Economics, Finance and Control Behavioral Economics	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

				fit by the expert members of the Selection committee.	

Notes :

1. Any deviation in the nomenclature of the relevant branches or degrees as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINE OF ENGLISH.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. M.A. in relevant branch with at least 55% marks (or an equivalent grade in a point scale wherever grading system is followed) and Ph.D. in relevant branch. II. A minimum of 7 publications in the peer- reviewed or UGC- listed journals and a total research score of seventy five (75) as per the criteria given in Appendix II, Table 2 of UGC notification dated 18 July, 2018.	English	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical	50 years 'Relaxations' 1. The age is relaxable for SC/STcandidatesupto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government. 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time.

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			books/research paper publications/IPR/pate nts, etc., as deemed fit by the expert members of the Selection committee.	

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
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4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
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6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINE OF MANAGEMENT

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A 1 Entry Pay - 1,31,400	I. First class or equivalent Master's degree in Business Management/ Administration in a relevant management related discipline or first class in Two year full time PGDM declared equivalent by AIU/Accredited by the AICTE/UGC. 'OR' First class or equivalent in M. Tech./Master's Degree in relevant branch. 'OR' First class Graduate and professionally qualified Charted Accountant/Cost & Works Accountant/Company Secretary of the concerned statutory bodies. II. Qualifications as above with PhD or equivalent, in relevant branch.	Account & Finance, Accountancy, Accounts, Agricultural Economics & Business Management, Banking & Insurance, Business Administration, Business Analytics, Business Data Analytics, Business Economics, Business Law, Business Management, Business Policy & Strategic Management, Commerce, Computer Aided Management, Computer Applications, Computer Engineering & Applications, Computer Engineering, Computer Science & Engineering, Computer Science & Information Technology, Computer Science & Technology, Computer Science and Systems Engineering, Computer Science, Computer Technology & Applications, Computer Technology, Data Analytics, Data Science,	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/patents record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/designing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/patents, etc., as deemed fit	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance

	III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals.	Decision Science, E Commerce, Economics, Engineering Management, Finance & Control, Finance, Financial Management, Financial Markets, Global Business Operation, Human Resource Development, Human Resource Management, Industrial Engineering, Industrial Management, Information System, Information Technology & Engineering, Information Technology, International Business, Knowledge Engineering, Knowledge Management, Knowledge Science, Management Science, Marketing Management, Operations Research, Organizational Development, Personal Management & Industrial Relation, Psychology, Quality Engineering & Management, Sales & Marketing Management, Software Engineering, Software Systems, Software Technology, Statistics, Strategic Management, Technology Management	by the expert members of the Selection committee.	with the instruction/ orders issued by the central government /GNCT from time to time.

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
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4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.

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DELHI TECHNOLOGICAL UNIVERSITY

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSOCIATE PROFESSOR IN THE DISCIPLINES OF MECHANICAL ENGINEERING, PRODUCTION ENGINERING, INDUSTRIAL ENGINERING AND AUTOMOBILE ENGINEERING.

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Experience	Age Limit
Associate Professor Level-13 A1 Entry Pay - 1,31,400	I. B.E./B.Tech. and M.E/ M.Tech. in relevant branch with 1ˢᵗ class or equivalent either in B.E./B.Tech. or M.E./ M.Tech. from a recognized University. 'OR' 1ˢᵗ class or equivalent in B.E./B.Tech. in relevant branch and Ph.D. in relevant branch from a recognized University. II. Qualifications as above with PhD or equivalent. in relevant branch. III. At least total 6 research publications in SCI journals/ UGC/AICTE approved list journals.	Advanced Computer Aided Design, Advanced Design & Manufacturing, Advanced Manufacturing & Mechanical Systems Design, Advanced Manufacturing Systems, Advanced Manufacturing Technology, Advanced Materials Technology, Aerodynamics & Propulsion, Aeronautical Engineering, Aerospace Engineering, Aircraft Maintenance Engineering, Automated Manufacturing System, Automation & Robotics, Automobile Engineering, Automotive Technology, CAD/CAM Engineering, CAD/CAM/CAE, CAD-CAM & Automation, Computational Analysis in Mechanical Mechanics, Computational Design, Computational Mechanics (Mechanical Engineering), Computer Aided Design & Manufacturing, Computer Aided Design Manufacture & Automation, Computer Integrated Design & Manufacturing, Design & Manufacturing, Design & Production Engineering, Design & Thermal Engineering.	A minimum of 8 years of experience of teaching and /or research in an academic /research position equivalent to that of Assistant Professor in a University/ College / accredited research institutions/ industry out of which at least 2 years shall be post Ph.D. experience. In case of research experience, good academic record and books/research paper publications/IPR/paten ts record shall be required as deemed fit by the expert members of the selection committee. If the experience in industry is considered, the same shall be at managerial level equivalent to Assistant Professor with active participation record in devising/design ing, planning, executing, analyzing, quality control, innovating, training, technical books/research paper publications/IPR/paten ts, etc., as deemed fit	50 years 'Relaxations' 1. The age is relaxable for SC/ST candidates upto 5 years and for OBC candidates upto 3 years in respect of vacancies reserved for them respectively. 2. Relaxable for Government Servants upto 5 years in accordance with the instructions or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years.

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| | | Design Engineering, Design of Mechanical Equipment, Design of Mechanical Systems, Dynamics & Control, | by the expert members of the Selection committee. | 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time. |
| | | Energy & Environmental Management, Energy Engineering, Energy Engineering Management, Energy Management, Energy Materials, Energy Systems, Energy Systems & Management, Energy Systems Engineering, Energy Technology, Fluid Mechanics/ Solid Mechanics, Fluids & Thermal Engineering, Foundry Engineering, Fracture Mechanics, Fuel & Combustion, Gas Turbine Technology, Heat Power & Thermal Engineering, Heat Power Engineering, Heat Ventilation & Air conditioning, Hydraulics Engineering, Industrial & Production Engineering, Industrial Automation & Robotics, Industrial Design, Industrial Engineering, Industrial Engineering & Management, Industrial Metallurgy, Industrial Production Engineering, Industrial Refrigeration & Cryogenics, Industrial Safety & Engineering, Industrial Tribology & Maintenance Management, Internal Combustion & Automobiles, Internal Combustion Engineering, Internal Combustion Engines & Turbo Machinery, | | |

| | | Machine Design, Machine Design & Robotics, Machine Engineering, Maintenance Engineering, Manufacturing Engineering, Manufacturing Engineering & Automation, Manufacturing Engineering & Management, Manufacturing Engineering & Technology, Manufacturing Process, Manufacturing Process & Automation Engineering, Manufacturing Science & Engineering, Manufacturing Systems & Management, Manufacturing Technology, Marine Engineering, Material Science & Engineering, Material Science & Technology, Materials Engineering, Materials Science Technology, Mechanical & Automation Engineering, Mechanical Engineering, Mechanical Engineering (Automobile), Mechanical Engineering (Industry Integrated), Mechanical Engineering (Production), Mechanical Engineering (Repair & Maintenance), Mechanical Engineering Design, Mechanical System Design, Mechatronics, Metallurgical & Materials Engineering, Metallurgical Engineering, Metallurgy, Metallurgy & Material Technology, Mining Engineering, Nuclear Engineering, Nuclear Science & Technology, Power & Energy Engineering, Power & Industrial Drives, Power Engineering, Power Plant Engineering & Energy Management, | | |

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		Process Metallurgy, Product Design, Product Design & Commerce, Product Design & Development, Product Design & Manufacturing, Production & Industrial Engineering, Production Engineering, Production Engineering System Technology, Production Technology, Production Technology & Management, Project Management, Propulsion Engineering, Quality Engineering & Management, Refrigeration & Air Conditioning, Reliability Engineering, Renewable Energy, Renewable Energy Technology, Robotics & Mechatronics, Solid Mechanics, System Technology, Thermal & Fluid Engineering, Thermal Engineering, Thermal Power Engineering, Thermal Science, Thermal Science & Energy Systems, Thermal Science & Engineering, Thermal Systems & Design, Tool & Die Engineering, Tool Design, Tool Engineering, Turbo – Machines, Virtual Prototyping & Digital Manufacturing, Welding Engineering, Welding Technology.		

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
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4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.

6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.

7. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

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PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSISTANT PROFESSOR IN THE DISCIPLINES OF DESIGN

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Age Limit
Assistant Professor Level-10 Entry Pay - 57,700/-	I. B.Des. andM.Des. with 1st class or equivalent either in B.Des. orM.Des. from a recognized University OR B.E./B.Tech. andM.Des. with 1st class or equivalent either in B.E./B.Tech. or in M.Des. from a recognized University OR B.Arch. and M.Arch. with 1st class or equivalent either in B.Arch. or in M.Arch. from a recognized University OR 75% or equivalent in B.Des. and Ph.D. in the areas of Design from a recognized University OR Graduation in any branch and Master of Fine Arts (MFA)/Master of Visual Arts (MVA) with first class either in Graduation or MFA/MVA from a recognized University. II. Minimum two (2) years of professional design experience in industry/ research organization/ design studios.	---------------	35 years 'Relaxations' 1. The age is relaxable for SC/ST) candidates upto 5 years and upto 3 years for OBC candidates in respect of vacancies reserved for them 2. Relaxable for Government Servants upto 5 years in accordance with the instruction or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/ orders issued by the central government /GNCT from time to time

Notes :

1. Any deviation in the nomenclature of the relevant branches as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.

6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.

7. The University shall conduct a screening test for short listing of candidates. The shortlisted candidates will make a presentation before a committee in the concerned department and other invitees of DTU, prior to appearing before the Selection Committee.

8. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

DELHI TECHNOLOGICAL UNIVERSITY

Established by Govt. of Delhi vide Act 6 of 2009

(FORMERLY DELHI COLLEGE OF ENGINEERING)

BAWANA ROAD, DELHI-110042

PAY SCALE, ESSENTIAL QUALIFICATIONS, RELEVANT BRANCH, AGE LIMIT AND RELAXATIONS FOR THE POST OF ASSISTANT PROFESSOR IN THE DISCIPLINE OF MANAGEMENT

Designation, Pay Matrix Level & Entry Pay	Essential Qualifications	Relevant Branch	Age Limit
Assistant Professor Level-10 Entry Pay - 57,700/-	I. First class Master's degree in Business Management /Administration or first class in Two year full time PGDM declared equivalent by AIU/Accredited by the AICTE/UGC. 'OR' First class in M. Tech./M.E. in relevant branch. 'OR' First class Master's degree in relevant branch 'OR' First class Graduate and professionally qualified Charted Accountant/Cost & Works Accountant/Company Secretary of the concerned statutory bodies. II. Two years of professional experience after acquiring the above mentioned degrees of Master's degree.	Account & Finance, Accountancy, Accounts, Agricultural Economics & Business Management, Banking & Insurance, Business Administration, Business Analytics, Business Data Analytics, Business Economics, Business Law, Business Management, Business Policy & Strategic Management, Commerce, Computer Aided Management, Computer Applications, Computer Engineering & Applications, Computer Engineering, Computer Science & Engineering, Computer Science & Information Technology, Computer Science & Technology, Computer Science and Systems Engineering, Computer Science, Computer Technology & Applications, Computer Technology, Data Analytics, Data Science, Decision Science, E Commerce, Economics, Engineering Management,	35 years 'Relaxations' 1. The age is relaxable for SC/ST) candidates upto 5 years and upto 3 years for OBC candidates in respect of vacancies reserved for them. 2. Relaxable for Government Servants upto 5 years in accordance with the instruction or orders issued by the Central Government 3. Relaxable for teachers of government funded institutions of higher education for 5 years. 4. Age relaxable for the PWD category candidates in accordance with the instruction/

		Finance & Control, Finance, Financial Management, Financial Markets, Global Business Operation, Human Resource Development, Human Resource Management, Industrial Engineering, Industrial Management, Information System, Information Technology & Engineering, Information Technology, International Business, Knowledge Engineering, Knowledge Management, Knowledge Science, Management Science, Marketing Management, Operations Research, Organizational Development, Personal Management & Industrial Relation, Psychology, Quality Engineering & Management, Sales & Marketing Management, Software Engineering, Software Systems, Software Technology, Statistics, Strategic Management, Technology Management	orders issued by the central government /GNCT from time to time

Notes :

1. Any deviation in the nomenclature of the relevant branches or degrees as mentioned above may also be considered by the University.
2. AMIE/IETE qualifications in relevant branches mentioned in the RR are also eligible.
3. B.Sc. (Engineering), B.E., B.Tech, B.S. (Four years) shall be considered as equivalent.
4. M.Sc. (Engineering), M.E., M.Tech, M.S. shall be considered as equivalent.
5. Selection Committee, may in cases of exceptional merit, recommend additional increments in case of higher qualifications, experience and academic achievements by the candidates.
6. Persons already in employment in Government Department/Autonomous Bodies/Universities under Central/State Government should apply through proper channel.
7. The University shall conduct a screening test for short listing of candidates. The shortlisted candidates will make a presentation before a committee in the concerned department and other invitees of DTU, prior to appearing before the Selection Committee.
8. If a class/division is not awarded, minimum of 60% marks in aggregate shall be considered equivalent to first class/division. If a Grade Point in 10 point scale system is adopted the Cumulative Grade Point Average will be converted into equivalent marks by multiplying the CGPA by a factor of 10.

सिमेस्टर – I   अनिवार्य हिन्दी पाठ्यक्रम   क्रेडिट : 2

[विदेशी छात्रों एवँ हिन्दी इतर भाषा- भाषी भारतीयों के लिए]

इकाई - 1 : देवनागरी लिपि, वर्तनी एवँ वर्णमाला

i) • हिन्दी वर्णमाला
   • हिन्दी स्वर - व्यंजन
   • हिन्दी विराम चिह्न
   • हिन्दी वर्णमाला का रोमन लिपि में परिचय

ii) • हिन्दी पढ़ना, लिखना, छोटे शब्द और वाक्य बनाना
    • मुख्य फलों, फूलों, सब्जियों, व्योहारों, रंगों, अनाजों, खेलों, ऋतुओं इत्यादि के नाम
    • हिन्दी - गिनती
    • पारिभाषिक शब्दावली (सूची 100 शब्द
                          50 अंग्रेजी - हिन्दी
                          50 हिन्दी - अंग्रेजी)

iii) • अनेक शब्दों के लिए एक शब्द
     • विलोम शब्द
     • पर्यायवाची
     • समानार्थी
     • स्त्रीलिंग शब्द
     • पुल्लिंग शब्द

iv) मुहावरे - लोकोक्तियाँ
    (25-25 की सूची)

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इकाई-2: हिन्दी वार्तालाप

- अपना एवं राज्य/देश का परिचय
- मेरा परिवार
- किसी दुकानदार से बातचीत
- किसी कार्यालय (बैंक, डाकखाना, विश्वविद्यालय इत्यादि के कर्मचारी/अधिकारी से बातचीत)
- किसी अस्पताल में बातचीत
- मोबाइल/टेलीफोन पर बातचीत
- किसी रेस्टोरेंट/मॉल/होटल आदि में बातचीत
- किसी दर्शनीय स्थल पर बातचीत
- भारतीय या स्वदेशी मौसम विषयक बातचीत
- मेट्रो/रेल/हवाई यात्रा विषयक अनुभव पर बातचीत

इकाई-3: हिन्दी चलचित्र: (कोई तीन) प्रदर्शन के माध्यम से व्यवहारिक हिन्दी का ज्ञान।

इकाई : ५ — समाज, शिक्षा और संस्कृति (लेखन कला)

i) • किसी पर्व/उत्सव के विषय में लेखन
   • किसी नगर/देश के दर्शनीय स्थलों का लिखित परिचय
   • राज्य/देश के सांस्कृतिक वर्णन
   • विश्व के प्रतिष्ठित व्यक्ति/व्यक्तियों का परिचय
   • किसी फिल्म का कथानक/कहानी

ii) संवाद - लेखन

   • शिक्षक से संवाद
   • माता-पिता से संवाद
   • मित्र, डॉक्टर, लाइब्रेरियन से संवाद
   • पर्यटन - गाइड से बातचीत

प्रस्तावित पुस्तकें :

1. स्वयं हिन्दी सीखें : प्रो॰ वी॰ जगन्नाथन
2. अंग्रेजी - हिन्दी शब्दकोश : फादर कामिल बुल्के
3. हिन्दी - अंग्रेजी शब्दकोश : डॉ॰ भोलानाथ तिवारी, श्री महेन्द्र चतुर्वेदी
4. मानक वर्तनी : केन्द्रीय हिन्दी निदेशालय, मानव संसाधन विकास मंत्रालय
5. वार्तलिपि तथा देवनागरी लिपि : डॉ॰ विकास शर्मा, कंचन सेठी

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6. वृहत् हिन्दी कोश : केन्द्रीय हिन्दी निदेशालय

7. Basic Hindi Course for Foreigness : Central Hindi Institute, Agra, U.P.

DELHI TECHNOLOGICAL UNIVERSITY

NON-DISCLOSURE AGREEMENT

This Non-Disclosure Agreement (hereinafter, the "Agreement" is entered into on this [.] day of [.], 20[.] (hereinafter, the "Effective Date")

BY AND BETWEEN

Name: Delhi Technological University (DTU)

Address: Bawana Road, Delhi - 110042

Represented by:

(hereinafter referred to as the "First Party", which expression shall, where the context admits, include its successors and permitted assigns), of the one part;

AND

Name:

Address:

Represented by:

(hereinafter referred to as the "Second Party", which expression shall, unless repugnant to the meaning or context hereof, be deemed to include its successors and permitted assigns); ON THE SECOND PART.

The Party of First and the Second Part are individually referred to as "Party" individually and collectively referred to as "Parties".

Whereas the Parties intend to participate in discussions in order to explore a potential business relationship may share information that is confidential and proprietary either during the discussions or during the course of the business relationship, for the purpose of enabling the parties to interact and work productively (hereinafter referred to as the "Purpose");

Whereas the Parties desire to protect such Confidential Information and ensure that it is not disclosed to any third party without the permission of the Party.

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Now, therefore this agreement witnessth and it is hereby agreed by and between the parties hereto as follows:

1.   CONFIDENTIAL INFORMATION

a.   For purposes of this Agreement, "Confidential Information" means and includes all information or material that has or could have commercial value or other utility in the business in which Parties are engaged and any data or information that is proprietary to the Parties and not generally known to the public, whether in tangible or intangible form, whenever and however disclosed, including, but not limited to:

i.   Any Trade Secrets, Trade Knowledge, Proprietary documents, business plans, process, structure or practices, research ideas, research outputs, innovation ideas and outputs, design;

ii.   Any marketing strategies, plans, financial information, or projections; operations, sales estimates, business plans and performance results relating to the past, present or future business activities of such party, its affiliates, subsidiaries and affiliated companies;

iii.   Any information related to the cost of project execution or delivery of service;

iv.   Plans for products or services, and client lists or partner lists;

v.   Any algorithm, software, design, process, procedure, formula, source code, object code, flow charts, databases, improvement, technology or method;

vi.   Any concepts, reports, data, know-how, works-in-progress, designs, development tools, specifications;

vii.   Any invoices, bills, e-mail communications, mobile text communications, and any other communication related to the projects, products or services undertaken by either of the Parties for the other Party or on the behalf of the other Party or its vendors;

viii.   Any other information that should reasonably be recognized as confidential information of the other Party.

b.   Confidential Information need not be novel, unique, patentable, copyrightable or constitute a trade secret in order to be designated Confidential Information. The Parties acknowledge that the Confidential Information is proprietary to the other Party, has been developed and obtained through great efforts by the Party and that Parties regard all of their Confidential Information as trade secrets.

c.   The Parties shall use the Confidential Information solely for and in connection with the Purpose.

d.   Notwithstanding any other provision of this Agreement, the Parties acknowledge that Confidential Information shall not include any information that:

i.   is or becomes legally and publicly available to either Party without breach of this Agreement;

ii.   was rightfully in the possession of either Party without any obligation of confidentiality; or

iii.   is disclosed or is required to be disclosed under any relevant law, regulation or order of court, provided the other Party is given prompt notice of such requirement or such order and (where possible) provided the opportunity to contest it, and the scope of such disclosure is limited to the extent possible.

2.   NON-DISCLOSURE

a.   The Parties shall use the Confidential Information only for the Purpose and not disclose any or part or summary or extract of the Confidential Information to any third party, including third parties affiliated with the other Party, without that Party's prior written consent, which prior consent the Party may refuse to give without assigning any reasons.

b.   The Parties shall hold and keep in strictest confidence any and all Confidential Information and shall treat the Confidential Information with at least the same degree of care and protection as it would treat its own Confidential Information.

c.   Either Party shall not disclose the sale of materials of the other Party to any individual/person/any client of the other Party.

d.   Either Party shall not copy or reproduce in any way (including without limitation, store in any computer or electronic system) any Confidential Information or any documents containing Confidential Information without the Party's prior

written consent. The Party shall immediately upon request by the other Party deliver to the Party owning the Confidential Information that has been disclosed to the other Party, including all copies (if any) made in terms of these.

e. Either Party shall not commercially/non-commercially use or disclose any Confidential Information or any materials derived therefrom to any other person or entity other than persons in the direct employment of the other Party who have a need to have access to and knowledge of the Confidential Information solely for the purpose as defined above, and such persons are under similar obligation of confidentiality and non-disclosure as these presents. In the event that any employees, agents or affiliates of either Party disclose or cause to be disclosed the Confidential Information, that Party shall be liable for such disclosure.

f. The Parties may not disclose Confidential Information to any third party under any circumstances regardless of whether the third party has executed a Non-Disclosure Agreement with the Party.

g. Both Parties agrees to notify the other Party immediately if it learns of any use or disclosure of the Party's Confidential Information in violation of the terms of this Agreement.

h. The Parties further acknowledge and agree that no representation or warranty, express or implied, is or will be made, and no responsibility or liability is or will be accepted by either Party, or by any of its respective directors, officers, employees, agents or advisers, as to, or in relation to, the accuracy of completeness of any Confidential Information made available to the other Party or its advisers; it is responsible for making its own evaluation of such Confidential Information.

i. During the term of this agreement, either Parties may use the association with the other Party only towards the purpose as envisaged under their business association under this Agreement.

j. Both the Parties hereby acknowledge, understand and agree that they shall not approach the clients of the other Party in any manner for whom one Party has delivered a product or a service on behalf of the other Party, for an existing project or for any future projects.

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3.   PUBLICATIONS

Neither Party shall not make news releases, public announcements, give interviews, issue or publish advertisements or publicise in any other manner whatsoever in connection with this Agreement, the contents/ provisions thereof, other information relating to this Agreement, the Purpose, the Confidential Information or other matter of this Agreement, without the prior written approval of the other Party. Further, neither Party shall use any photographs/ video/ other materials belonging or related to the other Party in promotional content through electronic, print or other mediums.

4.   TERM

a.   This Agreement shall be effective from the date hereof and all non-disclosure provisions shall continue to be in force at all times even after the cessation of the discussions or business relationship between the parties.

b.   Upon any demand made by either Party, the other Party shall immediately cease any and all disclosures or uses of Confidential Information, and at the request of the Party, shall promptly return or destroy all written, graphic or other tangible forms of the Confidential Information and all copies, abstracts, extracts, samples, notes or modules or like thereof, in accordance with this clause and Section 6 of this Agreement. The obligations of the Parties with respect to disclosure and confidentiality shall continue to be binding and applicable without limit in point in time except and until such information enters the public domain.

5.   TITLE AND PROPRIETARY RIGHTS

a.   Notwithstanding the disclosure of any Confidential Information by one Party to the other Party, the original Party shall retain title and all intellectual property and proprietary rights in the Confidential Information.

b.   No license under any trademark, patent or copyright, or application for same, which are now or thereafter may be obtained by the one Party is either granted or implied by the conveying of Confidential Information, to the other Party.

c.   Neither Party shall conceal, alter, obliterate, mutilate, deface or otherwise interfere with any trademark, trademark notice, copyright notice, confidentiality notice or any notice of any other proprietary right of the other Party on any copy of

the Confidential Information, and shall reproduce any such mark or notice on all copies of such Confidential Information.

d.   Likewise, the other Party shall not add or emboss its own or any other any mark, symbol or logo on such Confidential Information.

6.   RETURN OF CONFIDENTIAL INFORMATION

Upon written demand of the either Party, the other Party shall:

a.   Cease using the Confidential Information;

b.   Return the Confidential Information and all copies, abstract, extracts, samples, notes or modules thereof to the Party that makes such demand, within seven (7) days from receipt of notice; and

c.   Upon such return, certify in writing that the other Party has complied with the obligations set forth in this paragraph.

7.   REMEDIES

a.   The Parties acknowledge that if either Party fails to comply with any of its obligations hereunder, the other Party may suffer immediate, irreparable harm for which monetary damages may not be adequate.

b.   The Parties acknowledge that damages are not a sufficient remedy for the other Party for any breach of any of the Party's undertakings herein provided; and the Parties further acknowledge that the affected Party is entitled to, without limitation to the other rights guaranteed under this Agreement, to specific performance or injunctive relief (as appropriate) as one of the remedies for any breach or threatened breach of those undertakings by the defaulting Party, in addition to any other remedies available to the affected Party in law or in equity.

8.   ENTIRE AGREEMENT, AMENDMENT AND ASSIGNMENT

This Agreement constitutes the entire agreement between the Parties relating to the matters discussed herein and /supersedes any and all prior oral discussions and/or written correspondence or agreements between the Parties. This Agreement

may be amended or modified only with the mutual written consent of the parties, by way of an addendum. Neither this Agreement nor any right granted hereunder shall be assignable or otherwise transferable.

9.   DISPUTE RESOLUTION

The Parties agree to first mediate any disputes or claims between them in good faith and resolve the disputes amicably. In the event that mediation fails, any controversy or claim arising out of or relating to this Agreement or breach of any duties hereunder shall be settled by Intellectual Property Rights Standing Committee (IPRSC) of DTU. The decision of IPRSC will be final and binding on Parties.

10.   GOVERNING LAW AND JURISDICTION

This Agreement shall be governed by and construed in accordance with the laws of India. Each party hereby irrevocably submits to the exclusive jurisdiction of the courts of Delhi, India, for the adjudication of any dispute hereunder or in connection herewith.

11.   MISCELLANEOUS

a.   No failure or delay by either Party in exercising or enforcing any right, remedy or power hereunder shall operate as a waiver thereof, nor shall any single or partial exercise or enforcement of any right, remedy or power preclude any further exercise or enforcement thereof or the exercise or enforcement of any other right, remedy or power.

b.   The failure of either party to enforce its rights under this Agreement at any time for any period shall not be construed as a waiver of such rights.

c.   In the event that any of the provisions of this Agreement shall be held by a court or other tribunal of competent jurisdiction to be unenforceable, the remaining portions hereof shall remain in full force and effect.

d.   All obligations respecting the Confidential Information provided hereunder shall survive any termination of this Agreement.

IN WITNESS WHEREOF, the Parties hereto have executed these presents the day, month and year first hereinabove written.

---------------------------------   -----------------------------------

(First Party)   (Second Party)

Name: Name:

Designation: Designation:

WITNESSES:

1..
Name:
Address:

2..
Name:
Address:

Agenda: Small Corrections and modifications are required in existing M. Tech. Polymer Technology scheme

(a) At page no. 30, Semester-1
  (i) Laboratory classes are introduced in Polymer degradation (Elective-2)

  (ii) Elective 2, So.3, PTE 5305: The name of the course needs to be modified as "Environment impact assessment of polymers"

Existing

S. No.	Course Code	Course Name	Type/area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
4	PTE5301/5303/.........	Elective 2	Elective	3	3	0	0	20	0	30	50	-

	S. No.	Course Code	Course Name	Type/area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
Elective 2	1	PTE5301	Polymer Degradation	Elective	3	3	0	0	20	0	30	50	-
	2	PTE5303	Polymer recycling		3	3	0	0	20	0	30	50	-
	3	PTE5305	Environment assessment of polymer		3	3	0	0	20	0	30	50	-
	4	PTE5307	Green Polymers		3	3	0	0	20	0	30	50	-

Modified

S. No.	Course Code	Course Name	Type/area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
4	PTE5301/5303/.........	Elective 2	Elective	3	3/2	0	0/2	20/15	0/25	30/20	50/40	-

	S. No.	Course Code	Course Name	Type/area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
Elective 2	1	**PTE5301**	Polymer Degradation	Elective	3	2	0	2	**15**	**25**	**20**	40	-
	2	PTE5303	Polymer recycling		3	3	0	0	20	0	30	50	-
	3	**PTE5305**	Environment impact assessment of polymer		3	3	0	0	20	0	30	50	-
	4	PTE5307	Green Polymers		3	3	0	0	20	0	30	50	-

(b) Page no. 31, Course codes and Names need to be rectified in Elective -4

Existing

Course code	Course name
PTE 5406	Adhesive and coating Technology
PTE5408	Tyre Technology
PTE 5410	Paint Technology

Modified

Course code	Course name
PTE 5406	Polymer Adhesives
PTE5408	Paint and Coating Technology
PTE5410	Tyre Technology

(c) Only practical classes are proposed in Elective 9

Existing

	S. No.	Course Code	Course Name	Type/area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
Elective 9	1	PTE6201	Practical training in Industry		2	2	0	0	20	0	30	50	
	2	PTE6203	Research Exploration	Elective	2	2	0	0	20	0	30	50	
	3	PTE6205	Special lectures in polymers and Industrial Visits		2	2	0	0	20	0	30	50	

Modified

	S. No.	Course Code	Course Name	Type/area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
Elective 9	1	PTE6201	Practical training in Industry		2								
	2	PTE6203	Research Exploration	Elective	2								
	3	PTE6205	Special lectures in polymers and Industrial Visits		2								

Syllabus for Bachelor of Arts (Hons.) Economics

B.A. (Hons.) Economics program at the DTU's East Delhi Campus aims at providing in depth knowledge of Economics to the students. The program is designed as per the varying interests and career ambitions in the emerging areas of economics. The three years program is structured in 6 semesters.

Criteria for Assessment

All theory courses have internal assessment of 25 marks and end semester examination of 75 marks. For the courses related to projects, internal assessment is 50 marks and external examination is 50 marks. The courses related to Lab have 40 marks as internal assessment and 60 marks for external examination. The internal assessment of the students (out of 25 marks) will be done on the basis of following suggestive components: class tests/individual presentation/viva-voce/group discussion/ attendance etc.

The Project shall carry 100 marks i.e., marks equivalent to one course and it shall be pursued by every student under the supervision of one internal supervisor. The Internal Supervisor shall award marks out of 50 and the External Examiner shall award marks out of 50. The External Examiner shall be appointed by the University.

First Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 101	Introductory Microeconomics	Core Discipline	5	1/0	6
BA 102	Mathematical Methods for Economics – I	Core Discipline	5	1/0	6
BA 103	Environmental Studies	Ability Enhancement Course	2	0	2
BA 1xx	Generic Elective– 1	Elective Course	5	1/0	6
Total			17	3	20

Second Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 111	Introductory Macroeconomics	Core Discipline	5	1/0	6
BA 112	Mathematical Methods for Economics – II	Core Discipline	5	1/0	6
BA 113	English Communication	Ability Enhancement Course	2	0	2
BA 1xx	Generic Elective– II	Elective Course	5	1/0	6
Total			17	3	20

Third Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 201	Intermediate Microeconomics - I	Core Discipline	5	1/0	6
BA 202	Intermediate Macroeconomics - I	Core Discipline	5	1/0	6
BA 203	Statistical Methods for Economics	Core Discipline	5	1/0	6
AE xxx	Ability Enhancement Elective-I	Ability Enhancement Course	2	0	2
BA 2xx	Generic Elective– III	Elective Course	5	1/0	6
Total			22	4	26

Fourth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 211	Intermediate Microeconomics – II	Core Discipline	5	1/0	6
BA 212	Intermediate Macroeconomics – II	Core Discipline	5	1/0	6
BA 213	Introductory Econometrics	Core Discipline	5	1/0	6
AE xxx	Ability Enhancement Elective-II	Ability Enhancement Course	2	0	2
BA 2xx	Generic Elective– IV	Elective Course	5	1/0	6
Total			22	4	26

Fifth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 301	Indian Economy – I	Core Discipline	5	1/0	6
BA 302	Development Economics – I	Core Discipline	5	1/0	6
BA 3xx	Discipline Specific Elective Course - I *	Elective Course	5	1/0	6
BA 3xx	Discipline Specific Elective Course – II *	Elective Course	5	1/0	6
Total			20	4	24

*From List of Group - I

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Sixth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 311	Indian Economy – II	Core Discipline	5	1/0	6
BA 312	Development Economics – II	Core Discipline	5	1/0	6
BA 3xx	Discipline Specific Elective Course – III *	Elective Course	5	1/0	6
BA 3xx	Discipline Specific Elective Course – IV *	Elective Course	5	1/0	6
Total			20	4	24

*From List of Group – II

Generic Elective – I

BA 104   Financial Markets and Institutions

BA 105   Financial Management

BA 106   Financial Accounting

Generic Elective – II

BA 114   Business Communication

BA 115   Customer Relationship Management

BA 116   Organizational Development

Generic Elective – III

BA 204   Marketing Management

BA 205   Sales and Distribution Management

BA 206   Investment Management

Generic Elective – IV

BA 214   Human Resource Management

BA 215   Training and Development

BA 216   Compensation Management

Group-I Discipline Specific Elective (BA 3xx)	Group-II Discipline Specific Elective (BA 3xx)
BA 303: Economics of Health and Education	BA 313: Political Economy-II
BA 304: Applied Econometrics	BA 314: Comparative Economic Development (1850-1950)
BA 305: Economic History of India (1857-1947)	BA 315: Financial Economics
BA 306: Topics in Microeconomics-I	BA 316: Topics in Microeconomics-II
BA 307: Political Economy-I	BA 317: Environmental Economics
BA 308: Money and Financial Markets	BA 318: International Economics
BA 309: Public Economics	BA 319: Dissertation/Project

Generic Elective – III

BA 204: Marketing Management
5-1-0

Course Objective

The objective of this course is to familiarize the students with the foundation terms and concepts that are commonly used in marketing. It also identifies the essential elements for effective marketing practice. This course will teach the students about complete relationship between marketing and other management functions.

Unit I

Introduction to Marketing: Nature, Scope and Importance of Marketing, Basic concepts, Marketing Environment, Consumer Behavior, Market Segmentation, Targeting and Positioning.

Unit II

Product: Product Levels, Product Mix, Product Strategy, Product Development, Product Lifecycle and Product Mix. Pricing Decisions: Designing Pricing Strategies and Programmes, Pricing Techniques.

Unit III

Place: Meaning & importance, Types of Channels, Channels Strategies, Designing and Managing Marketing Channel, Retailing, Physical Distribution, Marketing Logistics and Supply Chain Management.

Unit IV

Promotion: Promotion Mix, Push vs. Pull Strategy; Promotional Objectives, Advertising- Meaning and Importance, Types, Media Decisions, Promotion Mix, Personal Selling- Nature, Importance and Process, Sales Promotion – Purpose and Types; Publicity and Public Relations- Definition, Importance and Methods. Emerging Issues in Marketing: Integrated Marketing, Online Marketing, Online Payments, Rural Marketing, Social Marketing, Green Marketing (Introductory aspects only).

Text Books

1. P. Kotler, P.Y. Agnihotri and E.U. Haque, Principles of Marketing- A South Asian Perspective, Pearson Education, 2012.

2. V.S. Ramaswamy and S. Namkumar, Marketing Management Global Perspective: Indian Context, McMillan, Delhi, 2013.

BA 115: Customer Relationship Management
5-1-0

Course Objective

The objective of this course is to enable the students to understand the importance of satisfying the customer in today's competitive world.

Unit I

Introduction to CRM: Definition and concepts of CRM, Components of CRM, Understanding the goal of CRM and Customer Touch Points.

Unit II

CRM Process: Introduction and Objectives of a CRM Process; an Insight into CRM and e- CRM/ online CRM, The CRM cycle i.e. Assessment Phase; Planning Phase; The Executive Phase; Modules in CRM. 4C's (Elements) of CRM Process, CRM Process for Marketing Organization, CRM Affiliation in Retailing Sector.

Unit III

Developing CRM Strategy: Role of CRM in business strategy, Managing Customer communications, ECRM- Meaning and Features, Differences between CRM and ECRM.

Unit IV

CRM Implementation: Choosing the right CRM Solution; Framework for Implementing

CRM: a Step-by-Step Process: Five Phases of CRM Projects; Development of Customizations; Beta Test and Data Import; Train and Retain; Roll out and System Hand-off; Support.

Text Books:

1. E. Peelen, and B. Rob, Customer Relationship Management, Pearson Education India, 2013.

2. F. Buttle, Customer Relationship Management, Routledge, 2015.

Reference Books

1. A. Jon, N.L. Petouhoff, and S. Kalia, Customer Relationship Management, Pearson Education, 2013.

2. P. Greenberg, CRM at the Speed of Light, Tata McGraw Hill, 2010.

3. J.K. Bhasin, Customer Relationship Management, Dreamtech Press, 2012.

4. V. Kumar and R. Werner (2012), Customer Relationship Management, Springer, 2012.

Appendix B

Current Norms for conduct of BA 319: Dissertation/Project course in BA (Hon) Economics

Procedure for conduct and evaluation for B.A Project / Dissertation will be as follows:

1. The course will be offered in the final year of B.A program and its total duration one semester. It will be offered during the Final Year, in the VI Semester.
2. Head of the department shall appoint a project coordinator on the advice of BOS from amongst the faculty members of the department, who will act as the course coordinator.
3. Students can conduct the project, either individually or in group. However the number of students in a group will generally not exceed four.
4. The project coordinator will invite proposal from faculty members and students and finalize the project problems allotted to various groups by January 21st, in the sixth semester, in every Even Semester of the academic year.
5. An "L-T-P" loading of 0-0-4 will be shown in the timetable of students in the sixth semester. However no teacher will be assigned for these periods and their supervisors will monitor the progress of students.
6. The evaluation will be based on mid-semester examination and end semester examination with a weightage 40% and 60% respectively.
7. Mid- and End-semester Examination will include report submission, presentation and/or oral viva voice. For this purpose, suitable committees will be constituted by the BOS for the evaluation of the report, presentation and oral viva voice. The project examination committees will award marks to individual students and forward them to project coordinator who'll maintain these records.
8. The end semester examination will be carried out at the end of sixth semester within 10 days of the last theory paper. For this purpose, a suitable examination committee will be appointed by the BOS in consultation with the project coordinator, with at least one external examiner.
9. In case an examiner from outside the university, is not available faculty members of the university from outside the department may be appointed as the external examiner after taking his/her consent.
10. The student will be required to submit a final dissertation/project report to the project coordinator, at least three days before the date of the final project examination
11. The final examination may be in the form of demonstration in the laboratory and/or viva depending on the nature of the project.

Syllabus for Bachelor of Arts (Hons.) Economics

B.A. (Hons.) Economics program at the DTU's East Delhi Campus aims at providing in depth knowledge of Economics to the students. The program is designed as per the varying interests and career ambitions in the emerging areas of economics. The three years program is structured in 6 semesters.

Criteria for Assessment

All theory courses have internal assessment of 25 marks and end semester examination of 75 marks. For the courses related to projects, internal assessment is 50 marks and external examination is 50 marks. The courses related to Lab have 40 marks as internal assessment and 60 marks for external examination. The internal assessment of the students (out of 25 marks) will be done on the basis of following suggestive components: class tests/individual presentation/ viva-voce/group discussion/ attendance etc.

The Project shall carry 100 marks i.e., marks equivalent to one course and it shall be pursued by every student under the supervision of one internal supervisor. The Internal Supervisor shall award marks out of 50 and the External Examiner shall award marks out of 50. The External Examiner shall be appointed by the University.

First Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 101	Introductory Microeconomics	Core Discipline	5	1/0	6
BA 102	Mathematical Methods for Economics – I	Core Discipline	5	1/0	6
BA 103	Environmental Studies	Ability Enhancement Course	2	0	2
BA 1xx	Generic Elective– I	Elective Course	5	1/0	6
Total			17	3	20

Second Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 111	Introductory Macroeconomics	Core Discipline	5	1/0	6
BA 112	Mathematical Methods for Economics – II	Core Discipline	5	1/0	6
BA 113	English Communication	Ability Enhancement Course	2	0	2
BA 1xx	Generic Elective– ii	Elective Course	5	1/0	6
Total			17	3	20

Third Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 201	Intermediate Microeconomics - I	Core Discipline	5	1/0	6
BA 202	Intermediate Macroeconomics - I	Core Discipline	5	1/0	6
BA 203	Statistical Methods for Economics	Core Discipline	5	1/0	6
AE xxx	Ability Enhancement Elective-I	Ability Enhancement Course	2	0	2
BA 2xx	Generic Elective– III	Elective Course	5	1/0	6
Total			22	4	26

Fourth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 211	Intermediate Microeconomics – II	Core Discipline	5	1/0	6
BA 212	Intermediate Macroeconomics – II	Core Discipline	5	1/0	6
BA 213	Introductory Econometrics	Core Discipline	5	1/0	6
AE xxx	Ability Enhancement Elective-II	Ability Enhancement Course	2	0	2
BA 2xx	Generic Elective– IV	Elective Course	5	1/0	6
Total			22	4	26

Fifth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 301	Indian Economy – I	Core Discipline	5	1/0	6
BA 302	Development Economics – I	Core Discipline	5	1/0	6
BA 3xx	Discipline Specific Elective Course - I *	Elective Course	5	1/0	6
BA 3xx	Discipline Specific Elective Course – II *	Elective Course	5	1/0	6
Total			20	4	24

*From List of Group - 1

Sixth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BA 311	Indian Economy – II	Core Discipline	5	1/0	6
BA 312	Development Economics – II	Core Discipline	5	1/0	6
BA 3xx	Discipline Specific Elective Course – III *	Elective Course	5	1/0	6
BA 3xx	Discipline Specific Elective Course – IV *	Elective Course	5	1/0	6
Total			20	4	24

*From List of Group – II

Generic Elective – I

BA 104   Financial Markets and Institutions

BA 105   Financial Management

BA 106   Financial Accounting

Generic Elective – II

BA 114   Business Communication

BA 115   Customer Relationship Management

BA 116   Organizational Development

Generic Elective – III

BA 204   Marketing Management

BA 205   Sales and Distribution Management

BA 206   Investment Management

Generic Elective –IV

BA 214   Human Resource Management

BA 215   Training and Development

BA 216   Compensation Management

Group-1 Discipline Specific Elective (BA 3xx)	Group-II Discipline Specific Elective (BA 3xx)
BA 303: Economics of Health and Education	BA 313: Political Economy-II
BA 304: Applied Econometrics	BA 314: Comparative Economic Development (1850-1950)
BA 305: Economic History of India (1857-1947)	BA 315: Financial Economics
BA 306: Topics in Microeconomics-I	BA 316: Topics in Microeconomics-II
BA 307: Political Economy-I	BA 317: Environmental Economics
BA 308: Money and Financial Markets	BA 318: International Economics
BA 309: Public Economics	BA 319: Dissertation/Project

B.B.A. Program

B.B.A. program at DTU's East Delhi Campus aims to provide adequate basic understanding about management education amongst the students and to prepare students to understand the business environment. This program aims at holistic development of the students. The three years program is structured in 6 semesters.

Criteria for Assessment

All theory courses have internal assessment of 25 marks and end semester examination of 75 marks. For the courses related to projects, internal assessment is 50 marks and external examination is 50 marks. The courses related to Lab have 40 marks as internal assessment and 60 marks for external examination. The internal assessment of the students (out of 25 marks) will be done on the basis of following suggestive components: class Tests/ individual presentation/viva-voce/ group discussion/ attendance etc.

The Project shall carry 100 marks i.e., marks equivalent to one course and it shall be pursued by every student under the supervision of one internal supervisor. The Internal Supervisor shall award marks out of 50 and the External Examiner shall award marks out of 50. The External Examiner shall be appointed by the University.

Syllabus for Bachelor of Business Administration

First Semester

Code No.	Paper	Discipline	L	T/P	Credits
BBA 101	Principles of Management	Foundation Course – Compulsory	4	-	4
BBA 102	Business Mathematics	Core Discipline	4	-	4
BBA 103	Financial Accounting	Core Discipline	4	-	4
BBA 104	Business Economics	Core Discipline	4	-	4
BBA 105	Computer Application	Skill-based	4	-	4
BBA 106	Computer Application Lab	Skill-based	-	2	2
GE xxx	Generic Elective – I	Elective Course	4	-	4
	Total		24	2	26

Second Semester

Code No.	Paper	Discipline	L	T/P	Credits
BBA 111	Business Environment	Core Discipline	4	-	4
BBA 112	Business Statistics & Operations Research	Core Discipline	4	-	4
BBA 113	Business Laws	Core Discipline	4	-	4
BBA 114	E-Commerce	Core Discipline	4	-	4
BBA 115	Business Communication	Core Discipline	2	-	2
BBA 116	E-Commerce-Lab	Skill-based	-	2	2
GE xxx	Generic Elective – II	Elective Course	4	-	4
	Total		22	2	24

Third Semester

Code No.	Paper	Discipline	L	T/P	Credits
BBA 201	Organization Behavior	Core Discipline	4	-	4
BBA 202	Marketing Management	Core Discipline	4	-	4
BBA 203	Business Ethics and Corporate Social Responsibility	Core Discipline	4	-	4
BBA 204	Management Accounting	Core Discipline	4	-	4
BBA 205	Environmental Science* (NUES)	Skill-based	2	-	2
GE xxx	Generic Elective – III	Elective Course	4	-	4
Total			22	-	22

*NUES: Non University Examination System

Fourth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BBA 211	Human Resource Management	Core Discipline	4	-	4
BBA 212	Business Policy & Strategy	Core Discipline	4	-	4
BBA 213	Research Methodology	Core Discipline	4	-	4
BBA 214	Management Information System	Core Discipline	4	-	4
BBA 215	Research Methodology – Lab	Skill Based	-	2	2
GE xxx	Generic Elective – IV	Elective Course	4	-	4
Total			20	2	22

Note: At the end of the Fourth Semester all the students shall have to undergo Summer Training for Eight Weeks.

Fifth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BBA 301	Income-tax Law and Practice	Core Discipline	4	-	4
BBA 302	Financial Management	Core Discipline	4	-	4
BBA 303	Entrepreneurship Development	Core Discipline	4	-	4
BBA 304	Summer Training Report & Viva Voice	Skill-based	-	6	6
BBA 305	Discipline Specific Elective-I	Elective Course	4	-	4
BBA 306	Discipline Specific Elective-II	Elective Course	4	-	4
Total			20	6	26

Sixth Semester

Code No.	Paper	Discipline	L	T/P	Credits
BBA 311	Project Management	Core Discipline	4	-	4
BBA 312	International Business Management	Core Discipline	4	-	4
BBA 313	Project Report and Viva-Voce	Skill-based	-	6	6
BBA 314	Discipline Specific Elective-III	Elective Course	4	-	4
BBA 315	Discipline Specific Elective-IV	Elective Course	4	-	4
	Total		16	6	22

Generic Electives / Interdisciplinary Course (Choose Any FOUR)

1. GE001 Tax Planning
2. GE002 Econometrics
3. GE003 Production & Operations Management
4. GE004 India's Diversity
5. GE005 Indian Economy
6. GE006 Digital Marketing Analytics

DISCIPLINE SPECIFIC ELECTIVE COURSE: A Student would be free to choose any FOUR papers from ONE group. The COURSE offers FOUR groups viz. Finance (DSE - I), Marketing (DSE - II) , Human Resource (DSE - III) and Management of Global Business (DSE – IV)

S. No.	DSE - I (Finance)	DSE - II (Marketing)	DSE - III (Human Resource)	DSE – IV (Management of Global Business)
1.	International Finance	Consumer Behaviour	HRD: Systems & Strategies	International Trade Policy & Strategy
2	Investment Banking & Financial Services	Personal Selling & Sales Force Management	Training & Development	Global Business Environment
3	Investment Analysis & Portfolio Management	Advertising & Brand Management	Management of Industrial Relations	Transnational & Cross Cultural Marketing
4	Project Appraisal	Retail Management	Performance & Compensation Management	International Distribution & Supply Chain Management
5	Business Analysis & Valuation	Distribution & Supply Chain Management	Counselling & Negotiation Skills for Managers	International Accounting & Reporting System
6	Financial Modelling & Derivatives	Marketing of Services	Cross Cultural HRM	Multinational Business Finance
7	Strategic Corporate Finance	International Marketing	Talent & Knowledge Management	International Joint Ventures, Mergers & Acquisitions

GENERIC ELECTIVES

Choose any four among given generic electives.

GE 001: Tax Planning   4-0-0

Course Objective: The objective of this course is to acquaint the students with the tax structure for individuals and corporates and also its implications for planning.

Unit I

Income tax concepts: Previous Year, Assessment Year, Person, Assessee, Income (including agricultural income), Residential Status and their incidence of tax, Gross Total Income, Total Income; Income which do not form part of total income, Tax Evasion, Tax Avoidance.

Unit II

Computation of Income under the head Salary, Computation of Income under the Head: House Property and Profits and gains from Business or Profession. Computation of Income under the Head: Capital gains and Income from other sources.

Unit III

Clubbing of Income, Set-off and carry-forward of losses, Deductions from gross total income as applicable to an individual and Business Units; Computation of total income and tax liability of an individual and Business Units, Procedure for assessment: E-filing of return, Introduction to the concept of Goods and Services Tax (GST) and Direct Tax Code (DTC).

Unit IV

Meaning of Tax Planning and Management; Nature, scope and justification of corporate tax planning; Computation of taxable income and tax liability of companies: Minimum Alternative Tax, Introduction to tax planning with reference to financial decisions; tax planning with reference to amalgamation or de-merger of companies (only theory)

Text Books:

- V. K. Singhania, "Student Guide to Income Tax", Taxmann Publications Pvt. Ltd., 2013.

- G. Ahuja and R. Gupta, "Simplified Approach to Corporate Tax", Flair Publications Pvt. Ltd., 2016.

GE 002: Econometrics   4-0-0

Course Objective: This course will enable the students to analyze quantitatively the economic information for its real-life application.

Unit I

Introduction to Econometrics; Basics of Probability; Classical Two Variable Linear Regression Model: Types of Data : Time Series, Cross Section and Panel Data. Concept of Population Regression Function (PRF) and Sample Regression Function (SRF): With classical assumption least square estimation, BLUE, properties of estimator. Analysis of variance and R squared. Understanding the residuals/error term. Assumptions of the model. Expectation and standard errors of the regression coefficients and the error term. Gauss Markov Theorem. Confidence intervals and tests on population regression coefficients,

variance of population disturbance term, and forecasts. Testing the significance of the model as a whole. Testing the normality assumption.

Unit II

Multiple Regression Model: The three variable case. Derivation of the coefficients. Correlation. Additional assumptions. Adjusted R square. Confidence intervals and testing of the regression coefficients. F and t tests for structural stability, contribution and justification of an explanatory variable.

Unit III

Relaxing the Assumptions of the Classical Linear Model: Multicollinearity: The problem. Detection. Solution. Heteroscedasticity: The problem. Detection. Solution. GLS. Autocorrelation: Problem. Tests for detection. Solutions. Specification Errors: Omission of a variable, Inclusion of irrelevant variable, tests for detecting errors, errors in explanatory and dependent variable

Unit IV

Other Functional Forms: Regressions in deviation form and through the origin. The log-log, log-lin, lin-log, reciprocal, log-reciprocal models with application. Dummy variables & Introduction to panel data: Intercept dummy variables, slope dummy variables, Interactive dummy variables. Dummies for testing the presence of seasonal trends. Use of dummies in fixed and random effects.

Text Books:

- C. Dougherty, "Introductory Econometrics", 4th ed., Oxford University Press, 2011.

- D. Gujarati, D. Porter and S. Gunasekar, "Basic Econometrics", 5th ed., McGraw Hill, 2011.

- R. Ramanathan, Introductory Econometrics with Applications", 5th ed., Thomson, South Western, 2002.

GE 003: Production and Operations Management   4-0-0

Course Objective: To understand the production and operation function and familiarize students with the technique for planning and control.

Unit I

Introduction to Production & Operations Management: Definition, need, responsibilities, key decisions of OM, goods vs. services. Operations as a key functional area in an organization. Operation Strategies: Definition, relevance, strategy formulation process, order qualifying and order winning attribute. Maintenance Management: Need of maintenance management, equipment life cycle (Bathtub curve), measures for maintenance performance (MTBF, MTTR and availability). Lean production: Definition of lean production, lean Demand Pull logic, waste in operations, elements that address elimination of waste, 2 card kanban Production Control system.

Unit II

Forecasting-Definition, types, qualitative (grass roots, market research and delphi method) and quantitative approach (simple moving average method, weighted moving average and single exponential smoothing method), forecast error, MAD. Scheduling: Operation scheduling, goals of short term scheduling, job sequencing (FCFS, SPT, EDD, LPT, CR) & Johnson's rule on two machines, Gantt charts.

Unit III

Process Selection: Definition, Characteristics that influence the choice of alternative processes (volume and variety), type of processes- job shop, batch, mass and continuous, product-process design Matrix and Services design matrix, technology issues in process design, flexible manufacturing systems (FMS), computer integrated manufacturing (CIM). Layout Decision: Layout planning – Benefits

of good layout, importance, different types of layouts (Process, Product, Group technology and Fixed position layout). Assembly line balancing by using LOT rule; Location Decisions & Models: Facility Location – Objective, factors that influence location decision, location evaluation methods- factor rating method. Capacity Planning: Definition, measures of capacity (input and output), types of planning over time horizon. Decision trees analysis

Unit IV

Aggregate Planning: Definition, nature, strategies of aggregate planning, methods of aggregate planning (level plan, chase plan and mixed plan, keeping in mind demand, workforce and average inventory), Statistical Quality control: Variations in process (common & assignable causes), Control charts: Variable measures (mean and range chart), Attribute measures (proportion of defects and no. of defects) using control tables. Elementary Queuing Theory: Poisson- Exponential Single Server Model with Infinite Population.(question based on M/M/1.

Text Book:

- B. Mahadevan, "Operations Management Theory & Practice", Pearson Education, 2009.

- E. S. Buffa and R. K. Sarin, "Modern Production Operations Management", 8th edition, John Wiley, 2007.

GE 004: India's Diversity   4-0-0

Course Objective: The objective of the paper is to understand the bases of India's diversity and its linkages with the people, livelihood, occupational diversity and socio-economic challenges. Further, it aims at understanding the diversity and its implications for the business.

Unit I

Recognizing, Accommodating and valuing diversity - Challenges and dilemmas posed by diversity and drive for homogenization; Sources of dilemma and tension—immigration, competition for limited resources; - Regional bases of India's diversity: regional approach to understanding diversity in terms of India's topography, drainage, soil, climate, natural vegetation, rural and urban settlements - Social diversity in India: Peopling , demography, languages, castes, ethnicity, religions, sects, family, kinship and social institutions; socio-cultural regions

Unit II

People, Livelihood and Occupational Diversity - Traditional livelihoods and their nature - agriculture, crafts, industry and services; - Region, occupation and employment

Unit III

Linkages between Diversity and India's Socio-economic challenges - Regional variations in terms of geographic and socio-economic factors· trends and emerging options; - Food insecurity, economic inequalities and poverty, environmental degradation and sustainable development.

Unit IV

Diversity and Business: Indian Consumers and marketing; Rural and Urban context, Diversity, manufacturing, industry and services; - Diversity and Innovation; - Workforce diversity and management

Text Books:

- A.R. Desai, "Rural Sociology in India", Popular Prakashan Ltd., 2011.

- V.K. Kaul, "Innovation Revolution: Harnessing India's Diversity", Yojana, November 2014.

- V.K. Kaul, "India's Diversity: From Conflict to Innovation, Social Science and Human Research", June 2014.

- V. K. Kaul, "India's Diversity and Globalisation: Unifying Forces and Innovation, Social Science and Research Network", June 2014.

- F. Martin-Alcazar, P.M. Romero-Fernandez, G. SanchezGardy, "Transforming Human Resource Management Systems to Cope with Diversity", Journal of Business Ethics, 2012, vol. 107, pp. 511-531.

- N. Grover, "Cultural Geography: Form and Process", Concept Publishing Company, 2004.

- D. E. Sopher, "An Exploration of India-Geographical Perspectives on Society and Culture", PHI Press, 1980.

- B. Aitken, "Seven Sacred Rivers", Penguin India, 2000.

- M. Gadgil, R. Guha, "Ecology and Equity: The use and abuse of nature in contemporary India", Penguin, 1995.

- V.K. Kaul, "Managing Diversity in Business Organization and Management, Pearson Education", 2012.

- T. Kochan, K. Bezrukova, R. Ely, S. Jackson, A. Joshi, K. Jehn, J. Leonard, D. Levine and D. Thomas, "The Effects of Diversity on Business Performance: Report of the diversity Research Network", Human Resource Management, 2003, vol. 42, no. 1, pp. 3-21.

GE 005: Indian Economy   4-0-0

Course Objective: To help the students to understand the basics of Indian economy and to catch up with economic changes occurring at national and international levels.

Unit I

Nature of Indian Economy: The need for Economic Development, causes of under development, determinates of development, National Income of India-estimates, Interregional variations of national income, NITI Aayog (National Institution for Transforming India).

Unit II

Human Resources and Economic Development – Demographic Features of Indian population, size and growth of population and economic development. Problem of over population. Human development Index. New Economy Policy; - Privatization, Liberalization, Globalization. Unemployment problem in India; Problem of Poverty.

Unit III

Industrialization- Growth and problems of major industries-Iron and Steel, Cotton Textiles, Cement, Sugar and Petroleum. Industrial policy. Small scale industries-Problems and policy.

Regional imbalances, Parallel Economy. India's foreign trade and balance of payment.

Unit IV

Indian Finance System: Mobilization of resources for development, Fiscal policy. Economic Planning- Importance of planning for Economic development, Salient features of India's five years plans priorities-target achievements, failures, factors affecting successful implementations of plans.

Text Books:

- R. Datt, and K.P.M. Sundhram, "Indian Economy", Sultan Chand & Sons, 2013.

- I.C. Dhingra, "Indian Economy", Sultan Chand & Sons, 2014.

- R. Singh, "Indian Economy", McGraw Hill Education, 2015.

- S.K. Mishra and V.K. Puri, "Indian economy", Himalaya Publishing House, 2015.

- N. Banik, "The Indian Economy: A Macroeconomic Perspective", Sage India Publisher, 2015.
- U. Kapila, "Indian Economy: Performance and policies", Academic Foundation, 2015.

GE 006: Digital Marketing Analytics 4-0-0

Course Objective: The aim of the course is to aid students in understanding digital marketing methods from the viewpoint of several parties such as analysts, consumers or entrepreneurs and to inculcate the fundamental concepts of digital marketing. The course includes knowledge of various tools of the trade such as social media listening, search analytics, audience analysis and content analysis along with concepts of return on investment.

Unit I

Introduction: Understanding the Digital Media Landscape: Digital Media Types, Paid & Owned Media; Understanding Digital Analytics Concepts: Owned & Earned Social Metrics, Demystifying Web Data, Searching for the Right Metrics, Paid & Organic Searches, Aligning Digital and Traditional Analytics, Primary Research, Traditional Media Monitoring, Traditional CRM Data, The Reporting Time Line, The Reporting Template.

Unit II

Tools of the Trade: Social Media Listening and Search Analytics: Tools: Identification, Data Capture, Spam Prevention, Integration with Other Data Sources, Cost, Mobile Capability, API Access, Consistent User Interface, Workflow Functionality, Historical Data, Understanding Social Media Engagement Software, Easy-to-Navigate User Interface, Reliability, Robust Analytics Dashboards, Mobility, CRM Hooks.

Social Governance, Monitoring Platform Integration, Social Media Listening Tools: Social Media Listening Evolution, Present Day, Understanding Sysomos, Search Analytics Tools: Basics of Search, Search Analytics Use Cases, Free Tools.

Unit III

Tools: Content Analysis: Content Analysis Tools: Content Audit and its Checklist, Real-Time Analytics, Optimizing Content Distribution & Content Consumption.

Unit IV

Search Analysis and Return on Investment: Search Analysis: Search Analytics for Digital Strategy, Content Strategy, Planning and Paid Advertising. Return on Investment: Defining ROI, Return on Engagement (ROE), Return on Influence, Return on Experience, Properly Tracking ROI, Understanding the Top-Down Revenue Measurement Approaches, Utilizing Bottom-Up Measurement Models.

Text Books

- C. Hemann and K. Burbary, Digital Marketing Analytics: Making sense of consumer data in a digital world, Que Publishing, 2013.
- R. Venkatesan and P. Farris, Cutting-Edge Marketing Analytics: Real World Cases and Data Sets for Hands On Learning, Pearson Education, 2014.
- W.L. Winston, Marketing Analytics: Data-Driven Techniques with Microsoft Excel, Wiley, 2014.
- S. Sorger, Marketing Analytics: Strategic Models and Metrics, Admiral Press, 2013.
- M. Sponder and G.F. Khan, Digital Analytics for Marketing, Routledge, 2017.

BBA 304: Summer Training Report & Viva Voice 0-0-6

Each student shall undergo practical training of eight weeks during the vacations after fifth semester in an approved business / industrial / service organization and submit at least two copies of the Summer Training Report to the Director / Principal of the Institution before the commencement of the end-term Examination.

Discipline Specific Elective Course

BBA 305: DSE-I Finance

BBA 305 1: International Finance 4-0-0

Course Objective: The objective of this paper is to equip the students with the techniques that can help them in managing the financial issues in international environment. This course will help them to manage MNCs in more effective manner.

Unit -I

Introduction: concept of International trade, International Business, International Finance and differences among them. Theories of International trade, International trade financing in India, Balance of payments (of India) International Monetary System: Different types of Exchange rate mechanisms- the gold standard, the gold exchange standard, The Bretton Woods System, Current monetary system, European Monetary Union. IMF and World Bank.

Unit -II

Foreign Exchange Management: Forex market – Wholesale and Domestic market, Quotations- direct, indirect and cross currency; various kinds of transactions and their settlement dates, forward rates, Swaps, Quotes for various kinds of Merchant transactions; Early delivery, extension or cancellation of Forward contracts. Exchange Rate determination and Forecasting:

Purchasing power parity and Interest rate parity, relationship between PPP and IRP, reasons for deviation from PPP and IRP; models of exchange rate forecasting- forward rate as an unbiased predictor, the Demand- Supply approach, the monetary approach, the Asset approach, the portfolio balance approach, other models.

Unit -III

Foreign Exchange Exposures: Financial Accounting and Foreign Exchange- Alternative Currency Translation Methods, Statement of Financial Accounting, Standards No.8, Statement of Financial Accounting Standards No.-52, Transaction Exposure, Managing Accounting Exposure- Managing Transaction and Translation Exposure, Designing a Hedging Strategy, Measuring and managing Economic Exposure- Foreign Exchange Risk and Economic Exposure, Identifying Economic Exposure, Calculating Economic Exposure, Operational Measure of Exchange Risk. Multinational Financial System- Value of the Multinational Financial System, Inter- company Fund- Flow Mechanisms: Cost and Benefits, Designing a Global Remittance Policy, Transfer Pricing and Tax Evasion. Issue of GDR, ADR Euro bonds and Foreign bonds.

Unit IV

International Investment Management: International Portfolio Investment- Issues in Foreign Investment Analysis, International Bond Investing, Strategies for Direct Investment, Bond Investment and Portfolio Investment, Optional International Asset Allocation. International project appraisal- IRR and APV methods; Managing Political Risk- Measuring Political Risk, Country Risk Analysis, Managing Political Risk, Post expropriation policies. Multinational Working Capital Management: Current Asset Management for the Multinational- International Cash Management (Netting, pooling, leading and lagging), Accounts Receivables Management, Inventory Management.

Text Books:

- PG Apte, "International Finance", Tata Mcgraw Hill, 2010.
- A. C. Shapiro, "Multinational Financial Management", Prentice Hall, 2008.
- D. L. Maurice, "International Finance- The Markets and Financial Management of Multinational Business", Tata Mcgraw Hill, 1990.

BBA 305 2: Investment Banking and Financial Services   4-0-0

Course Objective: The objective of this paper is to explain different aspects of Investment banking, mergers and acquisition and the detailed SEBI guidelines on issue management.

Unit - I

Introduction: An Overview of Indian Financial System, Investment Banking in India, Recent Developments and Challenges ahead, Institutional structure and Functions of Investment / Merchant Banking; SEBI guidelines for Merchant Bankers, Registration, obligations and responsibilities of Lead Managers, Regulations regarding Continuance of association of lead manager with an issue.

Unit II

Issue Management: Public Issue: classification of companies, eligibility, issue pricing, promoter's contribution, minimum public offer, prospectus, allotment, preferential allotment, private placement, Book Building process, designing and pricing, Green Shoe Option; Right Issue: promoter's contribution, minimum subscription, advertisements, contents of offer document, Bought out Deals, Post issue work & obligations, Investor protection, Broker, sub broker and underwriters.

Unit III

Leasing and Hire Purchase :Concepts of leasing, types of leasing – financial & operating lease, direct lease and sales & lease back, advantages and limitations of leasing, Lease rental determination; Finance lease evaluation problems (only Lessee's angle), Hire Purchase interest &Installment, difference between Hire Purchase & Leasing, Choice criteria between Leasing and Hire Purchase mathematics of HP, Factoring, forfaiting and its arrangement, Housing Finance : Meaning and rise of housing finance in India, Fixing the amount of loan, repricing of a loan, floating vs. fixed rate, Practical problems on housing finance.

Unit IV

Venture Capital: Concept, history and evolution of VC, the venture investment process, various steps in venture financing, incubation financing. Insurance: concept, classification, principles of insurance, IRDA and different regulatory norms, operation of General Insurance, Health Insurance, Life Insurance. Credit Ratings: Introduction, types of credit rating, advantages and disadvantages of credit ratings, Credit rating agencies and their methodology, International credit rating practices Securitization: concept, securitization as a funding mechanism, Traditional and non- traditional mortgages, Graduated payment mortgages (GPMs), Pledged-Account Mortgages (PAMs), Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets, Securitization in India.

Text Books:

- M.Y. Khan, "Financial Services", Tata McGraw –Hill, 2004.
- H.R. Machiraju, "Indian Financial System", Vikas Publishing House, 2010.
- J.C. Verma, "A Manual of Merchant Banking", Bharath Publishing House, 2001.
- K. Sriram, "Hand Book of Leasing, Hire Purchase & Factoring", ICFAI, Hyderabad, 1992.
- E. C. Trevor Watkins & M. Wright, "Marketing of Financial Services", Heinemann Professional, 1990.

BBA 305 3: Investment Analysis and Portfolio Management 4-0-0

Course Objective: The aim of this course is to provide a conceptual framework for analysis from an investor's perspective of maximizing return on investment – a sound theoretical base with examples and references related to the Indian financial system.

Unit I

Basics of risk and return: concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds : present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis: EIC framework; Economic analysis: Leading lagging & coincident macro-economic indicators, Expected direction of movement of stock prices with macroeconomic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry; Company analysis.

Unit II

Share valuation: Dividend discount models- no growth, constant growth, two stage growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows- circuit filters. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends: resistance, support, consolidation, momentum- Charts: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup

& saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk, Three forms of EMH and implications for investment decisions. (No numerical in EMH and technical analysis).

Unit III

Portfolio analysis: portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, Traditional portfolio management for individuals: Objectives, constraints, time horizon, current wealth, tax considerations, liquidity requirements, and anticipated inflation, Asset allocation: Asset allocation pyramid, investor life cycle approach, Portfolio management services: Passive Index funds, systematic investment plans. Active – market timing, style investing.

Unit IV

Capital asset pricing model (CAPM): Efficient frontier with a combination of risky and risk free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds :Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures.

Text Books :

- D. E. Fischer and R. J. Jordan, "Security Analysis & Portfolio Management", Pearson Education, 1995.

- W. F. Sharpe. G. J. Alexander & J. Bailey. "Investments", Prentice Hall of India, 1998.

BBA 305 4: Project Appraisal 4-0-0

Course Objective: To explain identification of a project, feasibility analysis including market, technical and financial appraisal of a project. Understand the relevance of alternative project appraisal techniques, financial structuring and financing alternatives. This course intends to involve students to apply appraisal techniques for evaluating live projects

Unit I

Appraisal : an introduction, Project appraisal and evaluation , Project cycle, Project cycle management , Private and Public sector Projects/ commercial / National probability; Identification of investment opportunities – industry analysis review of project profiles, – feasibility study , Project identification and formulation , Generation of Project ideas, Basic Principals of Project Analysis Entrepreneurship – concept, Theory and perspective.

Unit II

Market Analysis : Market analysis of a project, Need for market analysis, Demand and supply analysis, Collection analysis, primary / secondary data, Forecasting techniques. Technical appraisal of a project , Business and Technology Acquisition and management of technology.

Unit III

Investment appraisal: Introduction and techniques, DCF and non DCF methods, Sensitivity Analysis, Financial needs of a Project, Investment criteria, Project Appraisal parameters of select Financial Institutions. Social cost benefit analysis – value added concept, social surplus indirect impact of projects. rationale of SCBA, Efficiency and Equity in Project Appraisal, UNIDO approach, Little Mirlees Approach, Project Appraisal of Indian Plans.

Unit IV

Project risk assessment – Risk and Sensitivity Analysis, Taxonomy of Risks, probabilistic cash flow approaches – application of simulation techniques; Monitoring and Evaluation of a Project - PERT / CPM, Monitoring mechanism, Evaluation ad Lessons, Preparation of project report - Case Analysis.

Text Books:

- H. R. Machiraju, "Introduction to Project Finance", Vikas Publishing House, 2001
- C. Prasanna, "Project Preparation Appraisal Budgeting and Implementation", Tata McGraw, 1987.

BBA 305 5: Business Analysis and Valuation 4-0-0

Course Objective: This Paper will enable the students to analyze the health of a company through their annual reports and will equip them to understand what an asset is worth and what determines that value.

Unit I

Analysis of Corporate Financial Statements: Income statements and Balance sheets through ratio analysis and analyzing the Chairman's statement, Directors' report, management discussion & analysis, report on corporate governance, auditor's report to evaluate the financial soundness of the company.

Unit II

Cash Flows: Firm cash flows, Earnings, Tax effect, Reinvestment needs; Equity cash flows: Dividend, Forecasted Cash flows, terminal value estimation approaches. Equity discounted cash Flow Models-Dividend discount models, extensions of DDM; free cash flow to equity model

Unit III

Introduction to Valuation: Approaches to valuation, Discounted Cash Flow, Relative Valuation, Role of valuation; Discounted Cash

flow Valuation: Estimating discount rates-cost of equity, cost of equity to cost of capital; Valuation of an asset with guaranteed cash flows, introducing uncertainty into valuation (valuing an asset with default risk & equity risk), valuing an asset with an infinite life.

Unit IV

Firm Valuation Models: Cost of capital approach, adjusted present value approach, EVA, Capital structure and firm value. Relative valuation-popularity and potential pitfalls; reconciling relative and discounted cash flow valuation Equity Multiples; Value Multiples; Valuation of different kinds of companies. Value of Synergy; operating and financial synergy, Cash and tax benefits, debt capacity, Evidence on synergy, common errors in valuing synergy; Valuing Real options

Text Books:

- G. Foster, "Financial Statement Analysis", Pearson Education Pvt Ltd, 2nd ed., 2008.

- A. Damodaran, "Damodaran on Valuation, Security Analysis for investment and Corporate Finance", Wiley India Pvt. Ltd, 2nd ed., 2008.

- P. Chandra, "Corporate Valuation and Value Creation", 1st ed. Tata McGraw Hill, 2011.

BBA 305 6: Financial Modeling and Derivatives   4-0-0

Course Objective: To equip students with principles and techniques of Financial modeling along with various Financial Derivatives including Greeks & Exotic Options.

Unit I

Introduction: Financial Time Series and Their Characteristics: Asset Returns; Distributional Properties of Returns; Review of Statistical Distributions and Their Moments, Distributions of Returns, Multivariate Returns, Likelihood Function of Returns and Empirical Properties of Returns.

Unit II

Linear Time Series Analysis and Its Applications: Stationarity; Correlation and Autocorrelation Function; White Noise and Linear Time Series; Simple Autoregressive Models, Properties of AR , MA, ARMA and ARIMA Models, Goodness of Fit; The basic Concepts of Stochastic Process.

Unit III

Financial Derivatives: Introduction, various underlying and strategies: Forwards and Futures, Interest rate futures and currency futures; Determination of forward and futures prices; Options and related terminology, Calculating the pay-off from options and diagrammatic representation.

Unit IV

Pricing of Options- Binomial model and Black-Scholes model; trading strategies involving options; Exotic Options; Introduction to Swaps, Interest rate swaps, currency swaps, cross currency swaps; Forward rate agreements (FRA). Interest rate caps, floors. collars. The basic concepts of Greek Letters: Delta, Theta & Gamma and relationships among them.

Text Books:

- S. T. Ruey, "Analysis of Financial Time Series", John Wiley, 2nd ed, 2005.

- J. C. Hull, "Options, Futures and Other Derivatives", Pearson Education, 9th ed., 2015.

BBA 305 7: Strategic Corporate Finance   4-0-0

Course Objective: The objective of this paper is to know the details of corporate finance and the strategies involved in the corporate decisions. It will enable the students to steer the corporate in better manner.

Unit-I

Introduction to strategic corporate finance: Strategy Vs Planning, significance of strategy in financial decisions, Different types of financial strategy for Shareholders Wealth Maximization, overall corporate value addition and Economic Value Addition. Strategic Cost Management: Traditional costing Vs Strategic Costing, Relevant costs Vs Irrelevant costs, Different types of strategic costing and their relevance- Target Costing, Activity based Costing, Life Cycle Costing, Quality Costing, Zero Based Budgeting, Strategic cost reduction techniques and value chain analysis. Alternative sources of financing – alternative sources of financing, Different approach to infrastructure projects financing- Public Private Partnership (PPP) and its relevance.

Unit-II

Management Buy-outs: Establishing feasibility of the buy-out, Negotiating the main terms of the transaction with the vendor including price and structure, Developing the business plan and financial forecasts in conjunction with the buy-out team for submission to potential funders, negotiations with potential funders so that the most appropriate funding offers are selected. Management Buy-ins: Management Buy-in/Buy-outs ("BIMBOs"), Vendor-initiated buy-outs/buy-ins. Valuing Real assets in the presence of risk: tracking portfolios and Real Asset valuation, Different Approaches of Valuing Real Assets, Capital Budgeting and Strategic policy Real options: Financial and real options compared, various types of real options, the Black-Scholes model, Decision tree analysis, application of Real options, Drawbacks of Real options

Unit-III

Financial Distress and Restructuring: Meaning of Bankruptcy, Factors leading to bankruptcy, symptoms and predictions of bankruptcy, reorganization of distressed firms,

liquidation of firms. Company disposals: retirement sale or the sale of a non-core subsidiary, planned exit, forceful retirement and other disposals. Exit strategy- most appropriate exit route, valuation, timing of sale and tax planning opportunities, identification of potential purchasers, approaching the potential purchaser, negotiate with potential acquirers and selection of a preferred purchaser, calculation of the various tax implications. Fundraising: identification of different sources of development capital, determination of capital structure and factors affecting the capital structure, cost of capital and cost saving strategy, production of a business plan and financial forecasts to enable potential funders to assess the proposition. Due Diligence: financial due diligence for both purchasers and financial institutions, good quality "added value" due diligence advice.

Unit-IV

Company Valuation: an overview of valuation, valuation principles and practices more, the impact of "what if" scenarios, the key financial and commercial factors affecting the business. Value enhancement tools & techniques, the link between valuation and corporate finance Other strategic issues: managing credit ratings, and setting dividend and share repurchase policy, problem of too much cash. The issues of stock liquidity and illiquidity, Strategic risk management, the substitutability of capital structure and risk management choices, such as process control efforts, financial, physical, and operational hedging, value-based management.

Text Books:

- A. Damodaran, "Corporate finance theory and practice", John Willey & sons, Inc, 4th Ed., 2014.

- G. P. Jakhotia, "Strategic Financial Management", Vikas Publication, 2000.

BBA 306: DSE-II Marketing

BBA 306 1: Consume Behaviour
4-0-0

Course Objective: The course on Consumer behaviour equips students with the basic knowledge about the issues and dimensions of consumer behaviour and with the skill and ability to analyze consumer information and develop consumer behaviour oriented marketing strategies.

Unit I

Consumer Behaviour: Nature, scope & application: Importance of consumer behaviour in marketing decisions, characteristics of consumer behaviour, role of consumer research, consumer behaviour- interdisciplinary approach. Introduction to 'Industrial Buying Behaviour' Market Segmentation: VALS 2 segmentation profile.

Unit II

Consumer Needs & Motivation: Characteristics of motivation, arousal of motives, theories of needs & motivation: Maslow's hierarchy of needs, McLelland's APA theory, Murray's list of psychogenic needs, Bayton's classification of motives, self-concept & its importance, types of involvement. Personality & Consumer Behaviour: Importance of personality, theories of personality- Freudian theory, Jungian theory, Neo-Freudian theory, Trait theory: Theory of self- images; Role of self-consciousness. Consumer Perception: Concept of absolute threshold limit, differential threshold limit & subliminal perception: Perceptual Process: selection, organization & interpretation. Learning & Consumer Involvement: Importance of learning on consumer behaviour, learning theories: classical conditioning, instrumental conditioning, cognitive learning & involvement theory. Consumer Attitudes: Formation of attitudes, functions performed by attitudes, models of attitudes: Tri-component model, multi-attribute model, attitude towards advertisement model: attribution theory.

Unit III

Group Dynamics & consumer reference groups: Different types of reference groups, factors affecting reference group influence, reference group influence on products & brands, application of reference groups. Family & Consumer Behaviour: Consumer socialization process, consumer roles within a family, purchase influences and role played by children, family life cycle. Social Class & Consumer behaviour: Determinants of social class, measuring & characteristics of social class. Culture & Consumer Behaviour: Characteristics of culture, core values held by society & their influence on consumer behaviour, introduction to sub-cultural & cross-cultural influences. Opinion Leadership Process: Characteristics & needs of opinion leaders & opinion receivers, interpersonal flow of communication.

Unit IV

Diffusion of Innovation: Definition of innovation, product characteristics influencing diffusion, resistance to innovation, adoption process. Consumer Decision making process: Process- problem recognition, pre-purchase search influences, information evaluation, purchase decision (compensatory decision rule, conjunctive decision, rule, Lexicographic rule, affect referral, disjunctive rule), post-purchase evaluation; Situational Influences Models of Consumer Decision making: Nicosia Model, Howard-Sheth Model, Howard- Sheth Family Decision Making Model, Engel, Kollat& Blackwell Model, Sheth Newman Gross Model of Consumer Values.

Text Books:
- L.G. Schiffman & L. L.Kanuk, "Consumer Behaviour". Prentice Hall Publication. 3rd ed., 2012.

- M. R. Solomon, "Consumer Behaviour – Buying, Having and Being", Pearson Prentice Hall, 2013.
- R. D. Blackwell, P. W. Miniard, & J. F. Engel, "Consumer Behaviour", Cengage Learning, 10th ed., 2010.

BBA 306 2: Personal Selling & Sales Force Management   4-0-0

Course Objective: To familiarize the students with the concepts of sales management and to equip them with the various tools required to be a success in the various techniques essential for sales staff management. To help them differentiate the nuances of personal, organizational and personal selling.

Unit I

Introduction: Introduction to Personal Selling; functions of a sales person, qualities of an effective Sales Person; Personal Selling situations.

Unit II

Theories of Selling: AIDAS, Right Set of circumstances, Buying formula theory.

Unit III

The Selling Process: Preapproach – acquiring product knowledge, acquiring competition and market knowledge, Identifying and qualifying prospects – sources of prospecting, conditions for qualification, Opening a sale – methods of approaching, Sales presentation – presentation strategies and methods, Sales demonstration – planning effective demonstration, use of sales tools, Handling objection – types of objections, determining hidden objections, strategies for handling objections, Closing a sale – trial close, closing techniques, Post sales follow up.

Unit IV

Introduction to sales force management: Objectives of Sales management, Role of a sales manager; Managing Sales force – Recruitment, Selection, Training, Compensation and evaluation of sales force; Sales Territory Coverages: Sales Territory Concept, Reasons for establishing sales territories, procedures for selling up sales territories.

Text Books:
- Still, Cundiff & Govani, "Sales Management", Prentice Hall of India, 2007.
- C. Futrell, "Fundamentals of Selling", McGraw Hill, 13th ed., 2013.

BBA 306 3: Advertising and Brand Management   4-0-0

Course Objective: To equip the students with the nature, purpose & complex constructions in the planning and execution of a successful advertising program. The course will expose student to issues in brand management, faced by firms operating in competitive markets.

Unit I

Advertising need & importance: Definition & growth of modern advertising, advertising & the marketing mix, types & classification of advertisement, advertising spiral; Social & economic aspects of advertising; Marketing communication models: AIDA, hierarchy of effect, innovation adoption model, action first model, quick decision model; Planning framework of promotional strategy

Unit II

How advertising works: Exposure, salience, familiarity, low involvement, central route & peripheral route & cognitive learning; Positioning strategies ; Associating feelings with a brand; Developing brand personality ; Creating copy strategies: Rational & emotional approaches, selection of an endorser, creative strategy & style- brand image, execution, USP, common touch & entertainment, message design strategy, format & formulae for presentation of appeals (slice of life, testimonials, etc.), different types of copy; Art & layout of an advertisement: Principles of design, layout stages, difference

BBA 306 5: Distribution & Supply Chain Management   4-0-0

Course Objective: This course would help students develop an understanding about the role of marketing channels, distribution and supply chain, key issues of supply chain and the drivers of supply chain performance. The course would acquaint the students with various concepts.

Unit I

The channel system: Rationale for marketing channel structures, Composition of marketing channels, Channel Environment.

Unit II

Distribution – Basic concept, Transportations, Inventory, Warehousing, Managing logistics.

Unit III

Concepts and importance of a Supply Chain (SC), Key issues of Supply Chain Management, Competitive and SC strategies, Achieving strategic fit.

Unit IV:

Dynamics of supply chain: Supply Chain Integration, Push-based, Pull-based and Push-Pull based supply chain, Demand Forecasting in a Supply Chain, Managing inventory in SC environment: Transportation in SC environment.

Unit V:

Strategic Alliances, Third party and fourth party logistics, Retailer- Supplier partnerships (RSP), Supplier evaluation and selection, Use of best practices and Information Technology (IT) in Supply Chain Management.

Text Books

- J. B. Ayers, "Handbook of supply chain management", 2nd ed., Florida: Auerbach Publication, 2006.
- R. H. Ballou and S. K. Srivastava, "Business logistics and supply chain management", 5th ed., New Delhi: Pearson Education, 2008.
- S. Chopra and P. Meindl, "Supply chain management: Strategy, planning and operation", 3rd ed., New Delhi: Pearson Education, 2007.

BBA 306 6: Marketing of Services   4-0-0

Course Objective: The course is designed to equip students with the knowledge of marketing of all types of services.

Unit I

The emergence of service economy: contributory factors, consumption pattern analysis, economic transformation unique aspects of services: goods, services, products, managerial challenges

Unit II

Marketing mix: concept of value and value drivers, extended framework Service marketing system: production, marketing, human resources, sequential analysis.

Unit III

Service system positioning: service delivery process, blueprinting Service buying behaviour; difference in perspective, risk analysis, decision process.

Unit IV

Service marketing strategy; segmentation, targeting and positioning, market innovation Competitive differentiation; competitive advantage and value chain analysis

Unit V

Service quality; concept, technical and functional quality. Service quality models and measurement Demand and supply imbalances management; challenges and strategies; Service culture; managing by values, recovery and empowerment; Relationship building: relationship marketing. bonding and life time value Service industries: insurance, banking, air transportation, courier, education etc.

Text Books:

- R. P. Fisk, S. J. Grove and J. John, "Interactive services marketing. New York. Houghton Mifflin, 2007.
- R. Shanker, "Services Marketing: The Indian perspective", Excel Books, 2002.

BBA 306 7: International Marketing 4-0-0

Unit I

Framework of international marketing .Intra firm & environmental factors, social cultural, economic, political & legal aspects, Difference between domestic marketing, International marketing, Definition & concept.

Unit II

Policy framework, Indian Trade Policy, Recent trends in Indian foreign trade, Basic steps in starting an export business – An overview of licensing regulations & Procedures.

Unit III

International Marketing Decisions - Product planning for export manufacturing firms & export houses. Identifying foreign markets, market research overseas. Market entry. Export pricing-International terms, payment terms. Distribution logistics for export, foreign sales agent selection & appointment. Promotion of products/ services abroad- overview, merchandising, Trade fairs/exhibition

Unit IV

Institutional infrastructure for export in India, Export Assistance.

Unit V

Introduction to Export documentation and procedures, framework, pre-shipment & post-shipment documents, Role of ITPO in export promotion, quality control & pre- shipment inspection, Labelling/packing, Marking of consignments, Marine/cargo insurance etc.

Text Books:

- RL. Varshney and B. Bhattacharya, "International marketing management", Sultan Chand & Sons, 2015.
- W.J. Keegan, "Multinational Marketing Management", Prentice Hall, 1974.

Text Books:

- C. Tamer, K. Gary, "International Business: Strategy, Management and the New Realities", Pearson Education, 2012.
- K. Aswathappa, "International Business", McGraw Hill Education, 2012.
- P. K. Sinha, "International Business Management", Excel Books, 2012.
- S. Singh, "International Business", Galgotia Publishing Company, 2013.

BBA 313: Project Report & Viva Voce   0-0-6

During the sixth semester each student shall undertake a project to be pursued by him / her under the supervision of an Internal Supervisor to be appointed by the Director / Principal. The project should preferably be based on primary data. Both the subject and the name of the Supervisor will be approved by the Director / Principal of the Institution.

BBA 314: DSE-III Human Resource

BBA 314 1: HRD: Systems & Strategies   4-0-0

Course Objective: The course gives an overview of the need for HRD and HRD practices which can develop and improve an Organization's systems and strategies leading to an optimal HRD climate.

Unit I

Human Resource Development (HRD): Concept, Origin and Need, Relationship between human resource management and human resource development; HRD as a Total System; Activity Areas of HRD : Training, Education and Development: Roles and competencies of HRD professionals.

Unit II

HRD Process: Assessing need for HRD; Designing and developing effective HRD programs; Implementing HRD programs; Evaluating HRD programs.

Unit III

HRD Interventions: Integrated Human Resource Development Systems, Staffing for HRD; Physical and Financial Resources for HRD. HRD and diversity management; HRD Climate; HRD Audit.

Unit IV

HRD Applications: Coaching and mentoring, Career management and development; Employee counselling; Competency mapping, High Performance Work Systems, Balanced Score Card, Appreciative inquiry. Integrating HRD with technology.

Unit V

Evaluating the HRD Effort; Data Gathering; Analysis and Feedback; Industrial relations and HRD. HRD Experience in Indian Organizations, International HRD experience, Future of HRD.

Text Books:

- T. V. Rao and U. Pareek, " Designing and Managing Human Resource Systems", Oxford and IBH Publication Ltd, 2003.
- R. P. Lynton, and U. Pareek, "Training for Development", Vistaar publication, 1992.
- J. M. Werner, R. L. DeSimone, "Human resource development", South Western, 2011.

BBA 314 2: Training & Development   4-0-0

Course Objective: To familiarize the students with the concept and practice of training and development in the modern organizational setting.

Unit I

Organization vision & plans, assessment of training needs, setting training objectives, designing training programmes, Spiral model of training.

Unit II

Tasks of the training function: Building support, overall training capacity, developing materials, strategic planning, networking, designing training programmes.

Unit III

Training methods: On the job training, job instruction training, apprenticeship, coaching, job rotation, syndicate method, knowledge based methods, lecture, conferences, programmed learning, simulation methods, case study, vestibule training, laboratory training, in-basket exercise, experiential methods, sensitivity training, e- training.

Unit IV

Management Development Programme Methods:-Understudy, Coaching, Action Learning, Role Play, Management Games, Seminars, University related programmes, special projects, behavioural modelling, job rotation, case study, multiple management, sensitivity training. Post training: Training evaluation, Training impact on individuals and organizations, Evaluating Programmes, Participants, Objectives.

Unit V

Organisational Development (OD): Definition Foundations of OD, Managing the OD Process, Action Research and OD. OD Interventions: Overview of OD Interventions, Team Interventions Inter-group and Third-Party Peacemaking Interventions. Comprehensive OD Interventions, Structural Interventions and the Applicability of OD, Training Experiences. Issues in Consultant –Client Relationships, System Ramifications, Power, Politics and OD

Text Books:

- L. Rolf and P. Udai, "Training & Development", Prentice Hall, 1992.
- S. K. Bhatia, "Training & Development", Deep Publishers, 2008.

BBA 314 3: Management of Industrial Relations   4-0-0

Course Objective: To acquaint students with concepts of Industrial Relations and various legislations related to Labour Welfare and Industrial Relations.

Unit I

Concept of industrial relations, aspects of industrial relations, conflict and cooperation, parties in industrial relations, workers employers and government, trade unions, objectives collective bargaining.

Unit II

Workers participation in management, levels of participation, mode of participation. Works Committee, Joint Management councils, Worker Director, Grievance Procedure, Quality Circles.

Unit III

Trade Union Act 1926, Immunity granted to Registered Trade Unions, Recognition of Trade Unions. The Industrial Employment (Standing

Orders) Act 1946, scope, coverage, certification process, modification, interpretation, and enforcement. The Industrial Disputes Act 1947, forum for settlement of disputes, instruments of economic coercion, strikes, lockouts and closure.

Unit IV

Salient features, coverage of employees and employers, rules and benefits relating to The Payment of Wages Act 1936, The Payment of Gratuity Act 1972, The Minimum Wages Act 1948, and The Payment of Bonus Act 1965.

Unit V

The Factories Act 1948, definition, approval, licensing and registration, health and welfare measures, employment of women and young persons, leave with wages and weekly holidays.

Unit VI

The salient features, coverage of employees and employers, and benefits under The Provident Fund and Miscellaneous Provisions Act 1952 and Employees Pension Scheme and Employees State Insurance Act 1948.

Text Books:

- S. C. Srivastava, "Industrial Relations and Labour Laws", Vikas Publishing House, 6th Ed., 1982.
- T. N. Chhabra, "Industrial Relations and Labour Laws", Dhanpat Rai Publishing House, 2015.

BBA 314 4: Performance & Compensation Management   4-0-0

Course Objective: To familiarize students about concepts of performance and compensation management and how to use them to face the challenges of attracting, retaining and motivating employees for better performance.

Unit I

Introduction- Concept, Philosophy, History from performance appraisal to performance development. Objectives of performance management system; Performance management and performance appraisal; Performance Management process: Performance planning, Process and Documentation of Performance appraisal, Appraisal Interview, Performance Feedback and Counselling.

Unit II

Performance management and reward systems. Performance Coaching, Mentoring and Counselling, Competency development, Use of technology and e-PMS, International Aspects of PMS. Performance systems trends, Ethical Perspectives in performance appraisal.

Unit III

Introduction to Job Evaluation. Methods of Job Evaluation. Company Wage Policy: Wage Determination, Pay Grades, Wage Surveys, Wage Components. Modern trends in compensation - from wage and salary to cost to company concept, Comparable worth, broadbanding, competency based pay.

Unit IV

Incentives plans for production employees and for other professionals. Developing effective incentive plans, pay for performance,. Supplementary pay benefits, insurance benefits, retirement benefits, employee services benefits. Benefits & Incentive practices in Indian industry. Wages in India: Minimum wage, fair wage and living wage. Methods of state regulation of wages. Wage differentials & national wage policy Regulating payment of wages, wage boards, Pay commissions, dearness allowances, linking wages with productivity,. Special compensation situations: International compensation-managing variations. Expatriate Pay.

Text Books:

- G. Milkovich, J. Newman and B. Gerhart, "Compensation", McGraw Hill, 2010.

- T. J. Bergman , "Compensation Decision Making", Harcourt, Fort Worth, 2001.

- R. Henderson, "Compensation Management in a Knowledge based world", Prentice Hall, 10th Ed., 2005.

BBA 314 5: Counselling & Negotiation Skills for Management
4-0-0

Course Objective: The objective of this course is to provide insights into handling behavioural issues at work place by developing counselling skills. It is also intended to facilitate an understanding of the structure and dynamics of negotiation.

Unit I

Counselling: Introduction, Approaches to Counselling, Goals and Process of Counselling; Counselling Procedures and Skills, Organizational Application of Counselling Skills.

Unit II

Changing Behaviours through Counselling; Specific Techniques of Counselling; Role conflicts of Managers and Counselling. Application of Counselling in Specific Organizational Situations: Dealing with problem Subordinates; Performance Management; Alcoholism and Other Substance Abuse. Ethics in Counselling.

Unit III

Negotiation: Introduction, Nature and need for negotiation, negotiation process. Types and styles of negotiation; strategies and tactics; barriers in effective negotiation, Communication Style, Breaking Deadlocks.

Unit IV

Role of trust in negotiations; negotiation and IT; ethics in negotiation; cultural differences in negotiation styles; gender in negotiations; context of mediation; negotiation as persuasion.

Text Books:

- K. Singh, "Counselling Skills for Managers", PHI, 2015

- M. Carroll, "Workplace Counseling", Sage Publication, 1996.

BBA 314 6: Cross Cultural Human Resource Management
4-0-0

Course Objective: - To explore the concepts and techniques of the essential elements of cross cultural HRM and to enable the students to recognize its critical issues .The course aims to understand HRM concerns in the cross cultural scenario.

Unit I

Introduction to concepts of culture and nationality, Impact of culture on international business environment, Hofsted's approach, advantages and disadvantages PCN, TCN,HCN, Expatriate adjustment process, Impact of cultural issues on flexibility and work life balance. Recruitment and Selection, Approaches to multinational staffing.

Unit II

Managing diversity: diversity and organizational culture, Approaches to managing diversity, Diversity management programme. Training: cross cultural training, Cultural assimilators, Diversity training. Cross cultural team building

Unit III

Performance appraisal: Criteria for performance appraisal, Variables that influence expatriate performance appraisal. Compensation:

Objectives of expatriate compensation plan. Approaches to expatriate compensation: Going rate approach, Balance sheet approach .Cultural impact on compensation policy

Unit IV

Repatriation: Process, Causes of expatriate failure, Problems of repatriation. Cross border Mergers and Acquisitions: HRM perspective. International industrial relations: Labour unions and MNC, Employee relations in MNC, Response of labour unions to MNC.

Text Books:

- P. J. Dowling and A. D. Engle, "International HRM", Thomson Learning, 4th Ed., 2004.
- M. J. Browaeys and R. Price, "Understanding cross cultural management", Prentice Hall, 3rd Ed., 2016.

BBA 314 7: Talent & Knowledge Management   4-0-0

Course Objective - To prepare students for talent and knowledge management efforts in organizations. It aims at enabling students to gain insights in concepts and application of talent and knowledge management in organizations. The course aims at understanding basic elements, processes, approaches and strategies of managing talent and knowledge in organizations.

Unit I

Meaning and importance of talent management, Talent management Grid, Creating talent management system, Strategies of talent management. Competency model, Competency mapping, Role of leaders in talent management, Talent management and competitive advantage.

Unit II

Elements of knowledge management, Advantages of knowledge management, Knowledge management in learning organizations. Types of Knowledge: Tacit and Explicit .Managing knowledge workers.

Unit III

Knowledge management process, Approaches to knowledge management: Knowledge management solutions, Knowledge creation, Knowledge sharing, Knowledge dissemination, Knowledge management life cycle, Nonaka's model of knowledge. Knowledge capturing techniques: Brainstorming, Protocol analysis, Consensus decision making, Repertory grid, Concept mapping.

Unit IV

Knowledge management strategies: Aligning individual needs with organization, Reward systems for knowledge management, Knowledge audit, Benchmarking, Balance score card, Gap analysis.

Text Books:

- L. A. Berger, D. Berger, "Talent management handbook", McGraw Hill New York, 2003.
- E. M. Awad and H. M. Ghaziri, "Knowledge management", Pearson education International, 2008.

BBA 315: DSE-IV Management of Global Business

BBA 315 1: International Trade: Policies and Strategies   4-0-0

Course Objective: The paper aims to provide a thorough understanding of the basis for international trade and strategies. The role of the global institutional structure and trade strategies of developing countries and trade partners of India will be studied.

Unit I

Review of Economic Theory on International Trade: Basis for international trade; gains from trade; distributional issues, policy instruments and their impact, political economy. Trends in Global Trade and Balance of Payments with special reference to India: Historical roots of today's international trade, Composition, origin and destination of global exports and imports, Trade in invisibles, Balance of payments: current account and capital account, Capital flows and foreign exchange revenues, External Debt.

Unit II

The Global Institutional Structure: GATT (General Agreement on Trade and Tariffs), WTO (World Trade Organization), Regional Trade Blocks and Trade Agreements.

Unit III

India's Industrialization Strategy and International Trade: Review of Economic planning strategies and issues: early phase; the 1970s and 1980, Policies since 1991, Exim policy, structure of tariffs and restrictions, currency depreciation and convertibility, Export Promotion Zones.

Unit IV

Experience of Select Developing Countries: Analysis of the trade strategy and the policy framework in two select large countries and comparison with India, Impact of trade on growth, agriculture, inequality, poverty, and other developmental indicators Case Studies on Trade Strategies of Emerging Economics- China and ASEAN (Association of South East Asian Nations).

Text Books:

- D. E. Connor, "Encyclopedia of the Global Economy: A guide for students and researchers", New Delhi: Academic Foundation, 2006.

- B. Debroy, D. Chakraborty and D. Chakraborty, "The Trade Game: Negotiation trends at WTO and concerns of developing countries, New Delhi : Academic Foundation", 2006.

- P.R. Krugman, M. Obstfeld and M. Melitz, International Economics, 8th ed., Pearson Education, 10th Ed., 2015.

BBA 315 2: Global Business Environment   4-0-0

Course Objective: To get the students acquainted with the present economic environment in India and abroad. To enable the students understand the various issues involved in the macro management of the economy.

Unit I

Introduction. Concept of Economic Environment; Nature and scope. Macro variables: Income, Employment, Money Supply, Price Level, Interest rates, Saving and Investment. Movement and Interrelationship between different variables. Trends in Macro variables in India.

Unit II

Institutional Framework of Economic Environment: Role of state; State Vs Markets. Fiscal Policy; Concept &Implications. Monetary

Policy; Concept & Implications. Commercial Policy; Concept & Implications.

Unit III

Structure of Indian Economy: Growth Strategy in plans. Industrial Policy. Public sector & Private sector Monetary Policy. Fiscal Policy. Infrastructure Development. Issues in Indian Economy: Poverty, Unemployment, Regional Dimensions, Productivity & Modernisation, Environment & Sustainable Development, Human Resource Development.

Unit IV:

Open Economy Management. Balance of payments. Role of Foreign Trade &Policy. Role of Foreign Capital &Policy. Exchange Rate Policy and Exchange Controls. External Debt; International Linkages: Globalisation: Concept, Implications, Policy. Regional Integration: EU, etc. World Trade Organization. World Bank, IMF, etc. Other Emerging Economies: China, Brazil, Russia. Global Orientation of Indian Economy: Growth and evolution of Indian MNC's, Current crises in US/Europe/Asia and its impact on economic growth of India. SAARC, ASEAN and India.

Text Books:

- B. Jalan, "The Indian Economy: Problems and Prospects", Penguin, 2012.

- V.K. Puri, "Indian Economy", Himalya Publishing House, 2008.

| **BBA 315 3: Transnational & Cross Cultural Marketing** | **4-0-0** |

Course Objective: The purpose of this paper is to provide an understanding of the impact of cultural differences on global marketing. The methods of price decisions in international markets shall also be taught.

Unit I

Global Marketing, the scope and challenge of international marketing, the Global Manager, importance of Global Markets, development of Global Marketing. Cultural and social forces, definition of culture, cultural values, language and communication. Cultural differences. impact of social and cultural environment on marketing industrial and consumer products.

Unit II

Developing a global vision through marketing research. Scope of international marketing research. Problems: Collecting primary data, Use & non-availability of secondary data. Multicultural research-Research on internet. Estimating market demand, problems in analyzing and interpreting research information. Responsibility for conducting marketing research, communicating with decision makers.

Unit III

Outsourcing Research, developing a Global Information System, Global Product Strategies, Product Design, Packaging and Labeling, Warranty and Service Policies, New Product Development, Global Strategies for Services & Brands, Marketing Services including Social Marketing.

Unit IV:

Pricing decisions: Global Pricing Framework, Pricing Basics, Marginal Cost Pricing and its importance, Transfer Pricing, Counter trade, Systems Pricing, Pricing and Positioning. price quotation – preparation of quotations. Promotion Decisions: Promotions – international advertising – sales promotion in international markets – international advertising – direct mailing – personal selling – exhibition – generic promotions in international marketing

Text Books:

- P. R. Cateora and J. L. Graham, "International Marketing", Tata McGraw Hill, 17th Ed., 2015.

- F. Cherunillam, "International Marketing", Himalaya Publishing House, 2012.

BBA 315 4: International Supply Chain Management   4-0-0

Course Objective: To familiarize the students with the essential elements of the Supply Chain Management. Strategic issues in the International Supply Chain Management and logistics network configuration along with performance measurement and evaluation shall be studied thoroughly.

Unit I

Introduction to Supply Chain Management- Concepts, Objectives and functions of Supply Chain Management, Issues in Supply Chain Management; Managing networks and relationships; Sourcing Internationally, Subcontracting within an International Dimension, International Distribution Management: Types of Intermediaries, Channel Selection and Management.

Unit II

Strategic issues in Supply Chain – Strategic Partnership, Logistics Management: Concept, Objective and Scope, Transportation, Warehousing, Inventory Management, Packing & Unitization, Control & Communication, Role of Information Technology in Logistics, Logistics Service Firms and Third Party Logistics, Logistics in Maximizing profitability and cash flow, 3PL (Third Party Logistics), 4PL(Fourth Party Logistics), Reverse Logistics.

Unit III

Logistics Network Design for Global Operations Global Logistics Network Configuration, Orienting International Facilities: Considerations and Framework, Trade-offs Associated with each Approach, Mapping the different Approaches, Capacity Expansion Issues; Information Management for Global Logistics: Characteristics of Logistics Information and Telecommunication Systems, Capabilities and Limitations.

Unit IV:

Performance Measurement and Evaluation in Global Logistics: Operations and Logistics Control: Key Activities Performance Information, Measuring Performance in Functional Integration, Measuring Performance in Sectoral Integration Global Supply Chains and their societal, business, and cultural contexts and impacts. Perspectives for business, social science, engineering, and legal environment, Drivers for economic globalization (labor costs, resources, regulation, etc.), Influence on world and national economies, Design of Supply Chains.

- A. Rushton, P. Croucher and B. Peter Baker, "Handbook of Logistics and Distribution Management", Kogan Page Pub. 4th Ed., 2010.

- M. Christopher, "Logistics and Supply Chain Management", Pearson Education, 5th Ed., 2016.

BBA 315 5: International Accounting & Reporting System   4-0-0

Course Objective: - To develop skill and competencies of various practices in the International Accounting and Reporting Systems. A comparative perspective of the accounting standards and practices across the different countries is the focus of the course.

Unit I

Global accounting standard: Meaning, needs, benefits of accounting standards, types of accounting standards, Argument for and against Global accounting standards, Concept of Harmonization and Convergence, Obstacles in Harmonization and Convergence, Suggestions for increased convergence and harmonization.

Unit II

International Accounting Standard Committee (IASC): Objectives, Working, Composition of IASC, Reasons of Failure of IASC, IAS-I (Presentation of Financial Statements), Process of developing International Accounting Standards. International Accounting Standard Board (IASB): Creation of IASB, Organizational Structure, Standard Setting Procedures, enforcement powers of IASB and Achievements of IASB.

Unit III

International Financial Reporting Standards (IFRS): Main feature, Uses and objectives of IFRS, IFRS issued by IASB, Principle based vs. Rule based standards, Fair Value Accounting (FVA), Public sector and iFRS.

Unit IV

A Comparative Perspective of Accounting: Accounting Standards & Practices in Europe, USA, Asia and UK, Reporting & Disclosure Practices across countries, Global Accounting Standards and International Convergence.

Text Books:

- Frederick, D.S. Choi and G. Mueller, "International Accounting", Englewood Cliffs. Prentice Hall, 2007.

- H. L. Radebaugh, S. J. Gray and E. L. Black, "International Accounting and Multinational Enterprises", Wiley Publications, 1981.

BBA 315 6: Multinational Business Finance   4-0-0

Course Objective: The course has been designed to familiarize the students with International Monetary System and Financial Institutions. Functioning of the Foreign Exchange Markets and, Financial Management of a multinational firm will be the essential component of this course.

Unit I

Multinational Business Finance – MNCs (Multinational Corporations) and transnational corporations, Difference between domestic and International financial management, Motivations for International finance. International Monetary System - The Gold standard, The Bretton Woods system, the flexible exchange, alternative exchange rate system, the European monetary system, Euro and its implications for Indian banking, International Financial Institutions – International Monetary Fund (IMF), Asian Development Bank (ADB), International Bank for Reconstruction and Development (IBRD), Bank for International Settlement (BIS) and Organization for Economic Cooperation and Development (OECD).

Unit II

The Foreign Exchange Markets: Introduction, types: Global and Domestic market, spot market and forward market; rates: direct and indirect

quotations, bid-ask spread; Functions of the Foreign Exchange Markets; determination of forward premiums and discounts, interest arbitrage – covered interest arbitrage and interest parity theory – forecasting of foreign exchange rates.

Unit III

Financial management of the Multinational Firm – Cost of Capital and Capital Structure of a Multinational Firm – determining capital structure components, Cost of capital for MNCs (Multinational Corporations) and Domestic Firms, Multinational capital budgeting Problems and issues in foreign investment analysis.

Unit IV

Payment Systems: Payment terms and financing international trade, international flow of funds and portfolio investment in India, FDI (Foreign Direct Investment) vs. FIIs (Foreign Institutional Investors), investment strategies of FIIs in India, FIIs and volatility, impact of FIIs investment on stock markets and public policy. Netting (with numericals), pooling, leading and lagging as international payment settlement.

Text Books:

- C. A. Shapiro, "Multinational Financial Management", Wiley, 2014.

- A. Buckley, "Multinational Finance", 5th ed., Pearson Education, 2004.

- M. Vij, "International Financial Management", 3rd ed. Excel Books, N3, 2010.

- M. Levi, "International Finance", McGraw Hill Inc., 4th ed., New York, New Delhi, 2005.

- J. Madura, "International Financial Management", 10th ed., Cengage Learning, 2009.

BBA 315 7: International Joint Ventures, Mergers & Acquisitions
4-0-0

Course Objective: This course is designed to provide an understanding of the essential elements of Joint Ventures, Mergers and Acquisitions with the basic methods of valuation, post- merger valuation, methods of payment and financing options at global level.

Unit I

Joint Ventures: Concept & Meaning of Joint Ventures, Need & Types of Joint Ventures, Structures & Problems faced in Joint Ventures, Joint Ventures and Strategic Alliance. Some relevant case study of successful and failed joined ventures.

Unit II

Mergers and Acquisitions: Introduction to mergers, types of mergers, theories of mergers & acquisitions; Cross-border mergers and acquisitions, issues and challenges in cross border M&A. Handling cross-culture and taxations issues in cross-brder M&A. Analysis of Post-Merger Performance. Demerger, types of demerger, reverse merger, buyback of shares, leverage buy-out strategy, merger strategy - growth, synergy, operating synergy, financial synergy, diversification. Takeover and its types, takeover strategy, takeover bids, legal framework for mergers and acquisitions, leverages and buyouts.

Unit III

Deal Valuation and Evaluation: Factors affecting valuation basics, methods of valuation, cash flow approaches, economic value added (EVA), sensitivity analysis, valuation under takeover regulation, valuation for slump sale, cost-benefit analysis and swap ratio determination

Unit IV:

Post-Merger Evaluation: Financial Evaluation of Mergers & Acquisitions, Impact on shareholders' Wealth; Methods of payment and financing options in mergers & acquisitions, financing decision, Merger, Acquisition and Competition law 2002, SEBI (Securities & Exchange Board of India) Takeover Code 2011 and criteria for negotiating friendly takeover.

Text Books:

- M. Gupta, "Contemporary Issues in Mergers and Acquisitions", Himalaya Publishing, 2010.

- S. Sundarsanam, "Creating Value from Mergers and Acquisitions", 1st ed., Pearson Education, 2006.

- S. Ramanujan, "Mergers: The New Dimensions for Corporate Restructuring", McGraw Hill, 1999.

- R. Narayankar, "Merger and Acquisitions Corporate Restructuring, Strategy and Practices", 2nd ed., International Book House Pvt. Ltd, 2013.

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Seat Matrix for M.Tech (Full Time/Part Time) Programme in Power Electronics and Systems (PES) from the academic year 2020 onwards

Category	Department/Branch	EE /PES	
		(F/T)	(P/T)
General	Open	09	05
	PD	01	01
Total Gen Seats		**10**	**06**
SC	SC	4	02
	SC-PD	--	--
Total SC Seats		**04**	**02**
ST	ST	01	01
	ST-PD	--	--
Total ST Seats		**01**	**01**
OBC	OBC	05	01
	OBC-PD	01	--
Total OBC Seats		**06**	**01**
EWS Seats		**01**	**01**
Total Seats		**22**	**11**
Sponsored (SFT)		**05**	--

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DELHI TECHNOLOGICAL UNIVERSITY
SCHEME OF TEACHING AND EVALUATION
MASTER OF TECHNOLOGY IN POWER ELECTRONICS AND SYSTEMS

The following alphanumeric coding scheme has been adopted

Core Courses XXXYMN

Elective Courses XXXYCMN

XXX abbreviates a particular M. Tech. program, Y – (5 for M. Tech. 1 st year, 6 for M. Tech. 2 nd year),

C – credit of the course (4/3/2),

MN – Subject code (Odd number for odd semester and even number for even semester courses

Semester-I

	S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE	Total Credits
Group A	1	PES501	Modelling of Electrical Systems	Core	4	3	0	2	15	25	20	40	-	
Group A	2	PES503	Power Electronics Converters	Core	4	3	0	2	15	25	20	40	-	
Group B	3	PES5401/5403/	Elective 1	Elective	4	3	0	2	15	25	20	40	-	17
Group B	4	PES5301/5303/	Elective 2	Elective	3	3	0	0	20	-	30	50	-	
Group B	5	PES5201/5203/ .... /UEC5201/5203/	Elective 3/ University Elective I	Elective	2	2	0	0	20	-	30	50	-	

Semester-II

	S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE	Total Credits
Group C	1	PES502	Advanced Power Semiconductor Devices and Magnetics	Core	4	3	0	2	15	25	20	40	-	17
Group C	2	PES504	Controller Design for Power Electronic Converters	Core	4	3	0	2	15	25	20	40	-	

Semester-III

Group	S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE	Total Credits
Group D	3	PES5402/5404/	Elective 4	Elective	4	3	0	2	15	25	20	40	-	
	4	PES5302/5304/	Elective 5	Elective	3	3	0	0	20	-	30	50	-	
	5	PES5202/5204/ ..../ UEC5202/5204/	Elective 6/ University Elective II	Elective	2	2	0	0	20	-	30	50	-	12

Group	S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE	Total Credits
				Track 1										
Group E	1	PES651	Research Project	Core	12	0	0	12	0	-	0	100	0	12
				Track 2										
	1	PES601	Major Project I	Core	3	3	0	0	0	-	40	60	-	
	2	PES6401/6403/	Elective 7	Elective	4	3	0	2	15	25	20	40	-	
	3	PES6301/6303/	Elective 8	Elective	3	3	0	0	20	-	30	50	-	
	4	PES6201/6203/	Elective 9	Elective	2	2	0	0	20	-	30	50	-	12

Semester-IV

Group	S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE	Total Credits
				Track 1										
Group F	1	PES652+B22	Research Project	Core	12	0	0	12	0	-	0	100	0	12
				Track 2										
	1	PES602	Major Project II	Core	12	0	0	12	0	-	0	100	0	12

LIST OF ELECTIVES :

Elective 1

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES5401	Flexible AC Transmission and Distribution	Elective	4	3	0	2	15	25	20	40	-
2	PES5403	Electrical Drives and Systems		4	3	0	2	15	25	20	40	-
3	PES5405	Switch Mode Power Converters		4	3	0	2	15	25	20	40	-
4	PES5407	Distributed Generation Systems		4	3	0	2	15	25	20	40	-

Elective 2

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES5301	Multipulse and Multilevel Converters	Elective	3	3	0	0	20	-	30	50	-
2	PES5303	Special Electromechanical System		3	3	0	0	20	-	30	50	-
3	PES5305	Advanced Digital Signal Processing		3	3	0	0	20	-	30	50	-
4	PES5307	Power Electronics for Photovoltaic and Wind Energy Systems		3	3	0	0	20	-	30	50	-

Elective 3

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES5201	SEMINAR		2	2	0	0	2	-	100	-	-
2	PES5203	Renewable Energy Systems	Elective	2	2	0	0	20	-	30	50	-
3	PES5205	AC and DC Microgrids		2	2	0	0	20	-	30	50	-
4	PES5207	Reliability Analysis of Power Electronic Converters		2	2	0	0	20	-	30	50	-

Elective 4

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES5402	Advanced Topics on Power Electronics Converter		4	3	0	2	15	25	20	40	-
2	PES5404	Mechatronics and Vehicular Power Electronics	Elective	4	3	0	2	15	25	20	40	-
3	PES5406	Power Quality*		4	3	0	2	15	25	20	40	-
4	PES5408	Grid-Connected Power Converter and Systems		4	3	0	2	15	25	20	40	-

Elective 5

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES5302	Minor Project		3	0	0	-	-	40	-	-	60
2	PES5304	High/Medium Voltage DC Transmission	Elective	3	3	0	0	20	-	30	50	-
3	PES5306	Electric Traction		3	3	0	0	20	-	30	50	-
4	PES5308	Energy Storage System		3	3	0	0	20	-	30	50	-
5	PES5310	Pulsed Power Electronics and Nuclear Energy		3	3	0	0	20		30	50	-

Elective 6

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES5202	Standards for Microgrid Application and Control		2	2	0	0	20	-	30	50	-
2	PES5204	Energy Management System	Elective	2	2	0	0	20	-	30	50	-
3	PES5206	Machine Learning*		2	2	0	0	20	-	30	50	-
4	PES5208	PMU and Advanced Metering*		2	2	0	0	20	-	30	50	-
5	PES5210	Electric Vehicle and E-mobility		2	2	0	0	20	-	30	50	-

Elective 7

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES6401	Smart Grid and Distribution Automation		4	3	0	2	15	25	20	40	-
2	PES6403	Non-Linear Control of Power Electronic Converter	Elective	4	3	0	2	15	25	20	40	-
3	PES6405	Energy Efficiency Auditing and Loss Reduction		4	3	0	2	15	25	20	40	-
4	PES6407	Thermal Design for Heat Sink, Thermoelectrics and EMI/EMC		4	3	0	2	15	25	20	40	-

Elective 8

S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
1	PES6301	SCADA and Energy Management*		3	3	0	0	20	-	30	50	-
2	PES6303	Energy, Environmental Economics and Energy Policy	Elective	3	3	0	0	20	-	30	50	-
3	PES6305	Power Line Communication and Control Applications		3	3	0	0	20	-	30	50	-
4	PES6307	Optimization Techniques		3	3	0	0	20	-	30	50	-

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	S.No.	Course Code	Course Name	Type/Area	Cr	L	T	P	CWS	PRS	MTE	ETE	PRE
Elective 9	1	PES6201	Condition Monitoring, System Modelling& Forecasting	Elective	2	2	0	0	20	-	30	50	-
	2	PES6203	Electricity Market and Regulations*		2	2	0	0	20	-	30	50	-
	3	PES6205	Digital Communication*		2	2	0	0	20	-	30	50	-
	4	PES6207	Industrial Safety		2	2	0	0	20	-	30	50	-
	5	PES6209	Artificial Intelligence*		2	2	0	0	20	-	30	50	-

* Syllabus Same as M.Tech (PSY)/M.Tech(C&I) Syllabus

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First Year M.Tech (PES) I Semester

PES-501 Modelling of Electrical Systems

Lectures: - 3 Hrs per week
Practicals: - 2 Hrs per week

Pre-requisites: Nil

Reference frames, Electrical network terminology, Mesh networks, Rotating machines in quasi holonomic and nonholonomic reference frame, Generalised machine, Generated voltage, Impedance matrix, Inductance and torque matrix, Flux linkage and flux density matrices, Rotation matrix, Electromagnetic torque, Elimination of axes, Analysis using revolving field theory, Transformation from the stationary to rotating reference frame and vice-versa; Electrical machines in rotating reference frames, voltage equation, torque and inductance matrix in nonholonomic and holonomic reference frames, Impedance matrix of second generalised machine, voltage and torque equation transformation from second generalised machine to first.

Modelling of three phase Induction machine and synchronous machine in quasi-holonomic and holonomic frames, sequence impedances, Elimination of field and damper winding, torque in salient pole machine, determination of d-q axis reactances, under transients, with and without damper windings; State modelling of Electrical Machines, Voltage and torque equation under acceleration, Motional impedance matrix of generalized machine.

Transformer under sequence reference frame, Sequence reference frame, Impedance matrix, Δ-Y or Y-Δ transformers, measurement of positive, negative and zero sequence impedance, model under faults.

Analysis of Static Power converters, Modelling of AC-DC thyristorised converter, DC-DC PWM Converters, AC Voltage controller and single and three phase Pulsed and PWM inverters (3 ph -3 wire and 3 ph - 4 wire).

Text Books/Reference Books:

1. A.K. Mukhopadhyay, *Matrix Analysis of Electrical Machines*, New Age International Pvt. Ltd, 1996.
2. Paul Krause, Oleg Wasynczuk, Scott Sudhoff and Steven Pekark, *Analysis of Electric Machinery and Drive Systems*, IEEE Press, John Wiley & Sons, 2013.
3. William H. Kersting, *Distribution System Modeling and Analysis*, CRC Press, 2001.
4. Charles V. Jones, *Unified Theory of Electrical Machines*, Plenum Press, 1968.

PES-503 Power Electronics Converters

Lectures: - 3 Hrs per week
Practicals: - 2 Hrs per week

Pre-requisites: Nil

AC-DC Converters: Single phase diode rectifier with and without filter capacitor, Phase control, Single phase Semi converter & fully controlled converter, Three phase rectifier with and without capacitor filter, Three phase semi controlled & fully controlled converters with passive load impedance, twelve pulse converter, Power factor improvement methods, effect of source inductance, Pulse-Width Modulation (PWM) controlled rectifier circuits, design of converter circuits.

DC to AC Converters (Inverters): Principle of operation, performance parameters, single phase half and full bridge inverters and Three-Phase naturally commutated controlled bridge inverter, Three-Phase step - wave inverter circuits, Voltage control of single phase inverters: single/multiple pulse/SPWM/ modified SPWM methods, Voltage control of three phase inverter, SPWM/third harmonic included PWM/Space vector modulation, Harmonic reduction, Current source inverter, Comparison between VSI & CSI. Introduction to multilevel inverters, Diode clamped multi level inverters; Neutral point clamped multilevel inverters, Flying capacitor multilevel inverters, Applications.

AC to AC Converters : Single and three phase AC voltage controllers, Thyristor controlled reactors(TCR), Static VAr compensator (SVC), Thyristor controlled series capacitor (TCSC), Phase-Controlled Cycloconverters, Matrix Converters.

DC-DC Converters: Principle of operation, analysis of step-down and step-up converters, classification of PWM choppers, Analysis of two and four quadrant PWM choppers, Cúk and Sépic converters.

Text Books/Reference Books:

1. Ned Mohan, Tore. M. Undeland and William. P Robbins, *Power Electronics: Converters, Applications and Design,* John Wiley and Sons, 2003.
2. Daniel W. Hart, *Power Electronics,* Tata McGraw-Hill Education, 2011.
3. Marian P. Kazmierkowski, R. Krishnan and Frede Blaabjerg, *Control in Power Electronics,* Academic Press, 2002.
4. William Shepherd and Li Zhang Power, *Power Converter Circuits,* Marcel Dekker Inc., 2004.
5. Fang Lin Luo, Hong Ye and Muhammad H. Rashid, *Digital Power Electronics and Applications,* Elsevier (USA), 2005.
6. Robert W. Erickson, *Fundamentals of Power Electronics,* Kluwer Academic Publishers, 2001.
7. Barry W Williams, *Power Electronics: Devices, Drivers, Applications, and Passive Components,* McGraw Hill.
8. Marian K. Kazimierczuk, *Pulse-width Modulated DC–DC Power Converters,* John Wiley & Sons.
9. Muhammad H. Rashid and Hasan M. Rashid, *"SPICE for Power Electronics and Electric Power",* CRC Press.

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PES-5401 Flexible AC Transmission and Distribution Systems

Lectures: - 3 Hrs per week

Pre-requisites: Nil

Practicals: - 2 Hrs per week

Concept of reactive power control, methods of voltage control, AC Transmission Line and Reactive Power Compensation- Uncompensated Transmission Line: Loadability characteristics of O/H lines, on open – circuit, uncompensated transmission line under load, effect of line length, load power, p.f. on voltage and reactive power, mare power & stability.

Compensation of Lines: Objectives of compensation, types of compensation – surge impedance compensation, line length compensation, compensation by sectioning, passive & active compensators, uniformly distributed fixed compensation, its effect on voltage control, line charging reactive power, uniformly regulated shunt compensation, passive shunt compensation Dynamic Performance of Transmission Lines-Dynamics of ac Power Systems and the effect of reactive power control.

Static Compensation: Principle, properties, types – TCR, TSC etc. Sub synchronous Resonance: Introduction, methods of controlling SSR. Synchronous Condensers: Introduction, characteristics, and its operation, Unified Power Flow Controller, Interphase Power Controller, Reactive Power Management:

Custom Power Devices, Structure and Control of Power Converters, Solid State Limiting, Breaking and Transferring Devices, Networking type devices, Shunt and Series compensation, DSTATCOM, Voltage control and current control, 3Ph-3Wire system, 3 Ph - 4 Wire systems, Series devices, Selection of components, Design of the system, Insertion and desertion techniques, DVR, Capacitor supported and power supported, Neutral compensation.

Estimation and computation of parameters, The synchronous reference frame PLL under unbalanced and Distorted grid conditions. The Decoupled Double synchronous Reference Frame PLL (DDSRF-PLL), The double synchronous Reference Frame, The decoupling network, Analysis of DDSRF, Structure and responses of the DDSRF-PLL. The Double Second- order Generalized integration PLL (DSOGI-PLL), structure of the DSOGI, Relation between the DSOGI and the DDRF, The PLL for the DSOIG-PLL, Load Compensation using DSTATCOM, Realization and Control of DSTATCOM, Series Compensation of Power Distribution System, Unified Power Quality Conditioner- Left side and Right side.

Text Books/Reference Books:

1. N.G. Hingorani, Gyugi, *Understanding Facts, Concepts, Technology of Flexible AC Transmission Systems*, IEEE Press, 1999.
2. T.J.E. Miller, *Reactive Power Control in Electric Systems*, John Wiley & Sons, 1982.
3. Arindam Ghosh, Gerard Ledwich, *Power Quality Enhancement Using Custom Power Devices*, Springer US, 2002.

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PES-5403 Electrical Drive Systems

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - 2 Hrs per week

Introduction, Energy Conversion in Electric Drives, Electric drives – an overview, Motor/mechanical load matching, Load dynamics and stability, Multiquadrant operation, Electric drives configurations, Electric motors for drives; Power Electronic Converters for Drives.

DC Motor Drives: Basic topologies, Performance equations-, d-q model, Steady state motor characteristics, Transient operation for constant flux, P.M. brush motor transients, Transient operation for variable flux, Speed / excitation transfer function, Controlled Rectifier Fed D.C. Brush Motor Drives, Chopper-Controlled D.C. Brush Motor Drives, Closed Loop Motion Control in Electric Drives, The cascaded motion control, Torque loop, Speed loop, Digital position control, Positioning precision, State - space motion control, Torque perturbation observers, Path tracking, Force control, Sliding - mode motion control, Motion control by fuzzy logic, etc.

Induction Motor Drives: The stator and its travelling field, the inductance matrix, phase coordinate model, space phasor model, space phasor diagram for electrical transients, Electrical transients with flux linkages as variables, Complex Eigen values for electrical transients, Electrical transients for constant rotor flux, Motoring, generating, braking, Speed control methods, Vector control -general flux orientation, General current decoupling, Parameter detuning effects in rotor flux orientation current decoupling, Direct versus indirect vector current decoupling, A.C. versus D.C. current controllers, Voltage decoupling, Voltage and current limitations for the torque and speed control range, Impressing voltage and currents through PWM, Switching state voltage vectors, Indirect vector A.C. current control, Flux observers for direct vector control with motion sensors, Indirect vector synchronous current control with speed sensor - a case study, Flux and speed observers in sensor less drives: Performance criteria, A classification of speed observers, Speed estimators, Rotor slots ripple speed estimators, Direct torque and flux control (DTFC), Feedback linearized control.

Synchronous Motor Drives: Phase coordinate model, space phasor(d-q) model, PM-SM drives, Rectangular current control(Brushless D.C. motor drives), Rectangular current control system, Extending the torque - speed domain, Vector control, Optimum i_d - i_q relationships, The indirect vector current control, Indirect voltage and current vector control, Fast response PM-SM drives, surface PM rotor motors with predictive control, Direct torque and flux control (DTFC) of PM-SMs, The stator flux and torque observer, Sensorless control of PM-SMs, Initial rotor position detection, Reluctance synchronous motor (RSM) drives.

Switched Reluctance Motor (SRM) Drives: Construction and functional aspects, Average torque and energy conversion ratio, The peak kW/kVA ratio, commutation windings, SRM modelling, The flux-current-position curve fitting, SRM drives, Drive with position sensor, High grade (servo) drives, Sensor less SRM drives, The voltage -current model based position - speed observer.

Text Books/Reference Books:

1. Ion Boldea I., S. A. Nasar, *Electric Drives*, CRC Press, 2006.
2. G. K. Dubey, *Fundamentals of Electrical Drives*, CRC Press, 2002.
3. Ramu Krishnan, *Electric Motor Drives: Modeling, Analysis, and Control*, Prentice Hall, 2001

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PES-5405 Switch Mode Power Converters

Lectures: - 3 Hrs per week
Practicals: - 2 Hrs per week

Pre-requisites: Nil

Introduction: Classification of Power Supplies, Voltage Regulators: Types and characteristics, Topologies of PWM DC–DC Converters, Relationships among Current, Voltage, Energy, and Power, Electromagnetic Compatibility.

Design and Analysis of Non-Isolated DC-DC Converters: Buck in CCM, Boost in CCM, Buck-Boost in CCM; DCM Analysis of Buck, Boost and Buck-Boost Converter; Cuk Converter; Sepic Converter; Discontinuous mode of operation and Boundary conditions : Buck, Boost and Buck-Boost; Applications.

Design and Analysis of Isolated Power Supplies: Flyback converter in CCM and DCM mode; Advantage and Disadvantages of Flyback Converter; Forward PWM DC–DC Converter in CCM and DCM mode; Multiple-output Converters, Bidirectional Converter, Ringing in Flyback Converter, Forward Converter with Synchronous Rectifier, Converters with Active Clamping, Two-Switch Converters.

Design and Analysis of PWM Half-bridge, Full-bridge & Push-Pull PWM DC–DC Converter in CCM, DC Analysis of PWM Converters for DCM, Comparison of PWM DC–DC Converters.

Soft-switching DC–DC Converters: Zero-voltage-switching DC–DC Converters, Buck ZVS Quasi-resonant DC–DC Converter, Boost ZVS Quasi-resonant DC–DC Converter, Zero-current-switching DC–DC Converters, Boost ZCS Quasi-resonant DC–DC Converter, Multi resonant Converters.

Small-Signal Models of PWM Converters for CCM and DCM: Introduction to small signal modeling, Average model at ideal switching network in CCM and parameters, Linear models of power converters, average modeling in DCM, input and output impedance in open loop control, Feedback Controller design and impedance calculations.

Text Books/Reference Books:

1. Marian K. Kazimierczuk, *Pulse-width Modulated DC–DC Power Converters*, John Wiley & Sons, 2008.
2. Christophe Basso, *Switch-Mode Power Supplies Spice Simulations and Practical Designs*, Mc-Graw Hill, 2008.
3. Abraham Pressman, Keith Billings and Taylor Morey, *Switching Power Supply Design*, Mc Graw Hill, 2009.
4. Steven M. Sandler, "Switch-Mode Power Supply Simulation: Designing with SPICE", McGraw-Hill, 2005.
5. Keng C. Wu, *Switch-Mode Power Converters: Design and Analysis*, Elsevier Science Publishing, 2005.
6. K. Kit Sum, *Switch Mode Power Conversion*, Marcel Dekker, 1984.
7. Fang Lin Luo and Hong Ye, *Synchronous and Resonant DC/DC Conversion Technology, Energy Factor, and Mathematical Modeling*, CRC Press, 2005.

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PES-5407 Distributed Generation Systems

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - 2 Hrs per week

Distributed Generation: Purpose of Distributed Generation, Sizing and Siting, Demand-Side Management, Optimal Location of Distributed Energy Sources.

Alternative Sources of Energy: Renewable Sources of Energy, Planning and Development of Integrated Energy, Grid-Supplied Electricity, Load Distributed Generation, Calculation of Electricity Generation Costs, Sustainability, Modern Electronic Controls of Power Systems

Wind Power Plants: Appropriate Location; Evaluation of Wind Intensity; General Classification of Wind Turbines; System TARP–WARP; Generators and Speed Control Used in Wind Power Energy, **Photovoltaic Power:** Electricity Generation by Photovoltaic Effect, Solar Cell Output Characteristics and equivalent model, Applications of Photovoltaic Solar Energy - Residential and Public, Economical Analysis of Solar Energy. **Power Plants with Fuel Cell:** Fuel Cell Commercial Technologies and practical Issues for Generation of Electricity, Stacking Low- and High Temperature Fuel Cells, Constructional Features of various fuel cells: Proton Exchange Membrane Fuel Cells and Solid Oxide Fuel Cells, Advantages and Disadvantages, Equivalent Circuit of Fuel Cell, Aspects of Hydrogen as Fuel Future Perspectives. **Biomass-Powered Microplants:** Fuel from Biomass, Factors Affecting Biodigestion, Characteristics of Biodigesters, Construction of Biodigester, Generation of Electricity Using Biogas.

Microturbines: Princples of Operation of Microturbine, Fuel Control, Electrical-Side Structure, Control-Side Structure, Efficiency and Power of Microturbines, Site Assessment for Installation of Microturbines.

Induction Generators: Principles of Operation; Representation of Steady-Operation; Power and Losses Generated in Self-Excited Induction Generator; Frequency, Speed, and Voltage Controls; Load Control Versus Source Control for Induction Generators; The Danish Concept; Variable-Speed Grid Connection Control by the Load Versus Control by the Source, Economical Aspects.

Integration of Alternative Sources of Energy: Principles of Power Injection Converting Technologies; Power Converters for Power Injection into the Grid; Active and Reactive Power Control Approach; Integration of Multiple Renewable Energy Sources; Islanding and Interconnection Control; DG Control and Power Injection.

Text Books/Reference Books:

1. Gary L. Johnson, *Wind Energy Systems*, Prentice Hall, 1985.
2. Thomas Ackermann, *Wind Power in Power Systems*, John Wiley & Sons, Ltd, 2012.
3. Stefan C.W. Krauter, *Solar Electric Power Generation, Photovoltaic Energy Systems*, Springer, 2006.

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PES-5301 Multipulse and Multilevel Converters

Lectures: - 3 Hrs per week

Practicals: - Nil

Pre-requisites: Nil

Introduction to Harmonics, Multipulse Methods & Transformer: Voltage Distortion, Current distortion, Effects Of Negative Sequence Voltages, Effects of pre-existing harmonic Voltages, Different Circuit Topologies, Multipulse Methods, Multipulse Transformer Basics, Determining Phase Shift, Discussion of Vector representation; Doubly-Wound Multiphase transformers: Delta/Wye, Delta Zigzag/Fork, Delta /Polygon (Analysis, polygon Voltages and phase Shift, polygon Winding Currents), Delta/Delta/ Double Polygon, delta/Hexagon, Auto-Wound Transformer, Auto Connected Polygon (Design Analysis, Determination Of Line Input Current, Auto polygon Formulas, Auto-connected Fork, Differential Delta Connection, Differential fork connection, Delta/Wye With Center Tapped Delta, Transformer Primaries In Series

Current-Control Transformer: Interphase and Current control Transformer, Combining Two Or More Converters, Effects Of Interphase transformer Saturation, Paralleling by an Autotransformer, Current-Balancing Transformer (Zero Sequence Effects, ZSBT for 18 Pulses Operation), Harmonic Blocking Current Transformers, Multipulse Circuit Performance, Commutation Effects, AC line Reactance, 12 pulse with different type of Transformers, 18 Pulse with Fork Step – down Transformer, Eighteen- pulse converter, tests on other topologies, Field Test Results and their analysis.

Multilevel Voltage Source Converters: PWM, Modulation Schemes, Space Vector Modulation, Dwell Time Calculation, Switching Sequence, Spectrum Analysis, Even-Order Harmonic Elimination, Discontinuous Space Vector Modulation, Cascaded H-Bridge Multilevel Inverters, Carrier Based PWM Schemes, Phase-Shifted Multicarrier Modulation, Level-Shifted Multicarrier Modulation, Comparison Between Phase- and Level-Shifted PWM Schemes, Staircase Modulation. **Diode-Clamped Multilevel Inverters:** Converter Configurations, Switching State, Commutation, Space Vector Modulation, Switching Sequence Design, Inverter Output Waveforms and Harmonic Content, Neutral-Point Voltage Control, Effect of Motoring and Regenerative Operation, Feedback Control of Neutral-Point Voltage, High-Level Diode - Clamped Inverters, Carrier-Based PWM, NPC/H-Bridge Inverter.

PWM Current Source Converters: PWM Current Source Inverter, Trapezoidal Modulation, Selective Harmonic Elimination, Space Vector Modulation, SVM Versus TPWM and SHE, Parallel Current Source Inverters (Inverter Topology, Space Vector Modulation for Parallel Inverters, Effect of Medium Vectors on dc Currents, dc Current Balance Control), PWM Current Source Rectifiers,

Text Books/Reference Books:

1. Derek A. Paice, *Power Electronic Converter Harmonics, Multipulse Method for Clear Power,* IEEE Press.
2. Bin Wu, *High Power Converters and AC Derives,* IEEE Press, 2006.
3. N. Mohan, T. M. Undeland, et al., *Power Electronics - Converters, Applications and Design,* 3rd edition, John Wiley & Sons, New York, 2003.
4. GE Toshiba Automation Systems, A New Family of MV Drives for a New Century—DURA BILT 5i MV, Product Brochure, 50 pages, March 2003.

PES-5303 Special Electromechanical Systems

Lectures: - 3 Hrs per week

Pre-requisites: Nil

Practicals: - Nil

Wound Rotor and Self-Excited Induction Generators: Equivalent Circuit, Phasor Diagrams, Operation at the Power Grid, Operation at Zero Slip, Autonomous Operation, Brushless Exciter Mode, Self-Excited Induction Generators, Steady-State Performance, Second-Order Slip Equation Methods, SEIGs with Series Capacitance Compensation, Performance Sensitivity Analysis, For Constant Speed and Unregulated Prime Movers, Pole Changing SEIGs, Unbalanced Operation of Three-Phase SEIGs, Transients, Parallel Connection, Stator Converter Controlled Induction Generators (SCIGs), Grid Connected SCIGs, Grid Connection and Four-Quadrant Operation of SCIGs, Stand-Alone Operation, Parallel Operation, Operation with DC Voltage Controlled Output, Dual Stator Winding for Grid.

Induction Starter/Alternators (ISAs), Permanent-Magnet-Assisted Reluctance Synchronous Starter/Alternators (PM-RSM) for HeVs : Essential Specifications, Topology Aspects, Space-Phasor Model and Characteristics, Vector Control, DTFC, Design Issues for Variable Speed, Measures for Wide Constant Power Range, PM-RSM, Topologies, Flux Distribution, d–q Model of PM-RSM, Steady-State Operation at No Load and Symmetric Short-Circuit Generator, Design Aspects for Wide Speed Range Constant Power Operation, Power Electronics for PM-RSM, Control of PM-RSM, State Observer for Motion Sensorless Control, Initial and Low Speed Rotor Position Tracking.

Switched Reluctance Generators and Permanent Magnet Synchronous Generator Systems: Practical Topologies and Principles of Operation, The kW/Peak kVA Ratio, SRG Modeling, The Flux/Current/Position Curves, Design Issues, Motor and Generator Specifications, Converters for SRGs, Control of SRG, Rotor Position and Speed Observers for Motion-Sensorless Control, Standstill Position Estimation, Permanent Magnet Synchronous Generator Systems, Practical Configurations and their Characterization, Distributed vs. Concentrated Windings, Airgap Field Distribution, The d–q Model of PMSG, Circuit Model of PMSG with Shunt Capacitors and AC Load, Utilization of Third Harmonic, Autonomous PMSGs with Controlled Constant Speed, Grid-Connected Variable-Speed PMSG System, The PM Genset with Multiple Outputs, Super-High-Speed PM Generators, Power Electronics Control Issues, Methods for Testing PMSGs, Medium-Power Vehicular Electric Generator Systems. Transverse Flux and Flux Reversal Permanent Magnet Generator Systems, Flux Reversal Generator (FRG) Control.

Linear Motion Alternators (LMAs): Introduction, LMA Principle of Operation, The Motion Equation, PM-LMA with Coil Mover, Multipole LMA with Coil Plus Iron Mover, PM-Mover LMAs, The Tubular Homopolar PM Mover Single-Coil LMA, The Flux Reversal LMA with Mover PM Flux Concentration, PM-LMAs with Iron Mover, The Flux Reversal PM-LMA Tubular Configuration, The Analytical Model, Control of PM-LMAs, Electrical Control, The Spark-Ignited Gasoline Linear Engine Model, Note on Stirling Engine LMA Stability, Progressive-Motion LMAs for Maglevs with Active Guideway, Magneto hydrodynamic (MHD) Linear Generators, Super Conducting Machines.

Text Books/Reference Books:

1. Ion Boldea, *Variable Speed Generators*, CRC Press, 2nd Edition, 2015.
2. Fitzerald, Kinglay, Umans, *Electrical Machniary*, Tata Mc Graw Hill, 2004
3. Rakosh Das Begamudre, *Electro Mechanical Energy Conversation with Dynamics of Machines*, New Age International, 2003.
4. Hughes, A., *Electric Motors and Drives*, Newnes, 1994.
5. Leonhard, W., *Control of Electrical Drives*, Springer-Verlag, Berlin Heidelberg New York, Tokyo, 2 Edition, 1990.

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PES-5305 Advanced Digital Signal Processing

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Digital Signal Processing Fundamentals: Review of DSP Fundamentals; FIR filterdesign by windowing; Adaptive filtering techniques; Fourier analysis of signal using FFT; Introduction to Real time DSP and TMS320F2407/TMS320C6XXX/ADMC401, Architecture,; Instruction set; Addressing modes; Simple Assembly programs; Real time digital FIR filter; Real time LMS adoptive filers; Real time frequency domain processing.

Digital Control Systems: Review of difference equations and Z—transforms, Z-transfer function (Pulse transfer function), Z- Transforms analysis, sampled data systems, Stability analysis (Jury's Stability Test and Bilinear Transformation), Pulse transfer functions and different configurations for closed loop Discrete-time control systems.

Modern Control Theory: State model for continuous time and discrete time systems, Solutions of state equations (for both continuous and discrete systems), Concepts of controllability and observability (For both continuous and discrete systems), Pole Placement by state feedback (for both continuous and discrete systems), Full order and reduced order observes (for both continuous and discrete systems), Dead beat control by state feedback, Optimal control problems using state variable approach, State Regulator and output regulator, Concepts of Model reference control systems, Adaptive Control systems and design.

Text Books/Reference Books:

1. Oppenheim and Schafer, *Digital Signal Processing*, Prentice Hall.
2. Proakis J, *Digital Signal Processing*, Prentice Hall.
3. Rulph Chassaing and Donald Reay, *Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK*, John Wiley and Sons.
4. Samuel Stearns, *Digital Signal Processing with examples in MATLAB*, CRC Press
5. Ogata. K., *Modern Control Engineering*, PHI

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PES-5307 Power Electronics for Photovoltaic and Wind Energy Systems

Lectures: - 3 Hrs per week

Pre-requisites: Nil

Practicals: - Nil

Photovoltaic (PV) Power: PV Cell Technologies: Single-Crystalline Silicon, Polycrystalline and Semi-crystalline, Thin Films, Amorphous Silicon, Spheral, Organic, Concentrated Cells; Module and Array; Building Integrated PV Systems (BIPV); PV Energy Maps.

Wind Power System: System Components, Yaw Control, Speed Control, Turbine Rating, Electrical Load Matching, Variable-Speed Operation, System Design Features, Constant Tip-Speed Ratio and Peak Power Tracking Scheme for Maximum Power Operation, Variable-Speed Wind-Power System Based on Doubly-Fed Asynchronous Machines, DC-Bus Voltage Regulation by Controlled DC-Voltage Power, Environmental Aspects

Solar Photovoltaic Power System- Equivalent electrical circuit of PV cell and Array, Open Circuit Voltage and Short Circuit Current, i-v and p-v Curves, Sun Angle, Shadow Effect, Temperature Effect, Effect of Climate, Electrical Load Matching, Sun Tracking; Peak Power Point Operation, PV System Components

Power Electronics: Voltage Source Converters(VSC), Voltage and Current control, PWM techniques, Parallel operation of VSCs, Grid Interface Controls - Voltage & Frequency Control, Battery Charge/Discharge Converters, Power Shunts, Voltage Current and Power Relations Component, Design for Maximum Efficiency, Static and Dynamic Bus Impedance, Voltage Regulation and Ripple, Harmonics, Power Quality and its problems, Renewable Capacity Limit, Systems Stiffness, Interfacing Standards.

Stand-Alone PV system, Wind Stand-Alone, Hybrid with Diesel and Fuel Cell, Mode Controller, Load Sharing, System Sizing, Grid-Connected System-Interface Requirements, Synchronizing with Grid, Inrush Current, Synchronous Operation, Load Transients, Safety, Operating Limit, Voltage Regulation, Stability Limit, Energy Storage and Load Scheduling, Utility Resource Planning, Grid Integration of Wind Energy Systems, Wind Energy Converters(WEC) Types, Energy Conversion, Power Limitation, Speed Control, Power Curves of WECs, Grid Integration , Types of Common Grid Coupling, Energy, Reactive Power Management in Wind Parks, Power Quality on WECs, Offshore Wind Energy, Wind Park Design, Transmission Types,

Energy Management, Storage and Communication, Grid Integration of Photovoltaics and Fuel Cells, PV Inverter Types, Plant, Grid Interfacing and Islanding Detection, Power Quality, Grid-connected Applications, Plant Economy, Energy Delivery Factor, Initial Capital Cost, Availability and Maintenance, Energy Cost Estimates, Sensitivity Analysis, Effect of Wind Speed Variations, Effect of Tower Height, Profitability Index, Wind Farm Screening Chart, PV Park Screening Chart, Stand-Alone PV Versus Grid Line, Hybrid Economics.

Text Books/Reference Books:

1. Bin Wu, Yongqiang Lang, Navid Zargari, Samir Kouro, *Power Conversion and Control of Wind Energy Systems,* IEEE Press.
2. Marian P. Kazmierkowski, R Krishnan and Frede Blaabjerg, *Control in Power Electronics",* Academic Press.
3. William Shepherd and Li Zhang Power, *Power Converter Circuits,* Marcel Dekker.
4. Fang Lin Luo, Hong Ye and Muhammad Rashid, *Digital Power Electronics and Applications,* Academic Press.

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PES-5203 Renewable Energy Systems

Lectures: - 2Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Introduction to energy systems and resources, Current Energy Requirements, Conventional Energy and environmental implications, Introduction to renewable energy sources – solar, wind, small hydro, biomass, geothermal and ocean energy and their advantages and disadvantages.

Solar Energy: Solar radiation and its measurement, Solar thermal Collectors – Flat Plate and Concentrating Collectors, Solar Thermal Conversion System and applications, Basic of Photovoltaic cell, Equivalent Cell Equation, Array Design, Peak Power Point Operation, Power Electronics for PV System: Off-Grid and Grid-Connected Power Control and Management Systems.

Wind Energy: Wind mills and wind turbine systems, Classification of wind machines: Horizontal & Vertical axis configuration. **Analysis of Wind Regimes:** Wind Shear and Turbulence Effects, Statistical model for Wind data analysis. Aerodynamics of winds, Wind Speed Monitoring, Betz limit, Aerofoil sections and their characteristics, Estimation of power output and energy production, Wind Energy Conversion System: Components, characteristics and applications.

Biomass Energy: Production and Classification of Biomass, Characteristics of Biomass fuel, Biomass Conversion Routes, Biochemical conversion of biomass for energy production, Anaerobic digestion, Types of digesters, Liquid Biofuel, Chemical Conversion of biomass for energy production, Synthesis Biofuel, Thermo-chemical conversion of biomass: Biomass-gasification, Biomass based power plant, Basis of selecting the site for plant installation. **Ocean Energy:** Ocean energy resources, Principles of ocean thermal energy conversion systems, ocean thermal power plants, Principles of ocean wave energy conversion and tidal energy conversion.

Hydropower: Introduction to Hydropower, Classification of Hydropower Plants, Small Hydropower Systems: Overview of micro, mini and small hydro systems, Advantages and Disadvantages of Hydropower, Selection of site for hydroelectric plant, Hydrological cycle, Essential elements of a hydroelectric power plant, Components of Hydropower Plants, Hydraulic Turbines: Types and Operational Aspects, Types of generators, Dam and Spillway, Surge Chambers, Penstock, Tailrace. **Other Sources:** Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; Magneto-hydro-dynamic (MHD) energy conversion, Hydrogen Energy, Fuel Cell.

Text Books/Reference Books:

1. Godfrey Boyle, *Renewable Energy: Power for a Sustainable Future,* Oxford University Press, 2012.
2. Mukund R. Patel, *Wind and Solar Power System,* CRC Press, 2nd Edition, 2005.
3. R. Strzelecki; G. Benysek, *Power Electronics in Smart Electrical Energy Networks,* Springer, 2008.
4. Mital KM., *Biogas Systems, Principle and Applications,* New Age International Ltd., 1996.
5. J W Twidell & A D Weir, *Renewable Energy Resources,* ELBS, 2006.

PES-5205 AC and DC Microgrids

Lectures: - 2 Hrs per week
Practicals: - Nil

Pre-requisites: Nil

Microgrid Concept as a Means to Integrate Distributed Generation, Status Quo and Outlook of Microgrid Applications, Market Models for Microgrids, Case Study of Microgrid Projects in Europe and USA

Case Study: War of Currents, Types of Microgrids, Mathematical analysis of AC vs DC microgrid system, Advantages and Disadvantages of AC Microgrid, Advantages and Disadvantages of DC Microgrid, Applications of AC and DC Microgrids

Architecture of AC Microgrid, Converter Topologies and Modulation Strategies, AC Microgrid Protection

AC Microgrid Control Issues, Synchronisation techniques and power flow control in grid connected mode, Control of VSC in islanding mode, Supervisory Control for AC Microgrid, Virtual Inertia Control

Concept of DC Microgrid, Architecture of DC Microgrid, Interfacing Converter for DC Microgrid, Primary-Secondary-Tertiary Control for DC Microgrid

Text Books/Reference Books:

1. Nikos Hatziargyriou, *Microgrids: Architectures and Control*, IEEE Press, John Wiley & Sons, 2014.
2. Tomislav Dragicevic, Amjad Anvari - Moghaddam, Juan C. Vasquez, Josep M. Guerrero, *DC distribution systems and microgrids*, IET, 2018.
3. Suleiman M. Sharkh, Mohammad A. Abusara, Georgios I. Orfanoudakis, Babar Hussain, *Power Electronic Converters for Microgrids*, IEEE Press, John Wiley & Sons, 2014.
4. Rajeev Kumar Chauhan, Francisco Gonzalez-Longatt, Bharat Singh Rajpurohit, Sri Nivas Singh, *DC microgrid in residential buildings*, IET, 2018.

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PES-5207 Reliability Analysis of Power Electronics Converters

Lectures: - 2 Hrs per week

Pre-requisites: Nil

Practicals: - Nil

Concept of Reliability in Power Electronic System, Requirement of reliability for power electronic application, Reliability engineering in power electronics, Challenges and opportunities for research on power electronics reliability

Reliability of power electronic packaging, Modelling for the lifetime prediction of power semiconductor modules, Lifetime modelling and prediction of power devices, Reliability of DC-link capacitors in power electronic converters, Minimization of DC-link capacitance in power electronic converter systems

Reliability of power conversion systems in photovoltaic applications, Reliability of High-Power Converters, Reliability of power supplies for computers

Faults in Microgrids, Protection Schemes in Microgrids

Text Books/Reference Books:

1. Frede Blaabjerg, Henry Shu-hung Chung, Michael Pecht, Huai Wang, *Reliability of Power Electronic Converter System*, IET, 2015.
2. Antonio Carlos Zambroni de Souza, Miguel Castilla, *Microgrids design and implementation*, Springer, 2019.

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First Year M.Tech (PES) II Semester

PES-502 Advanced Power Semiconductor Devices and Magnetics

Lectures: - 3 Hrs per week
Practicals: - 2 Hrs per week

Pre-requisites: Nil

Power Diodes: Basic Structure, I-V and switching characteristics, Breakdown Voltages and Control, On-state Losses, Reverse Recovery Transients, Schottky Diodes, Snubber Design. **Thyristors:** Basic Structure, V-I and switching characteristics, Transient analysis, dv/dt and di/dt limitations, Snubber Design, Gate drive requirements. **Triacs:** Basic structure, V-I Characteristics, Snubber Design. **Gate Turn-off Thyristor (GTO):** Basic Structure, operation, switching characteristics, transient analysis. **Power BJTs:** Basic Structure, I-V and switching characteristics, Breakdown Voltages, secondary breakdown and its control, FBSOA and RBSOA Curves, Losses, Transient analysis, Snubber Design.

Power MOSFETs: Basic Structure, HexFet structure, V-I and switching characteristics, Resistive Switching Specifications, Clamped Inductive Switching Specifications, Transient Analysis, Switching Losses, Effect of Reverse Recovery Transients on Switching Stresses and Losses - di/dt and dv/dt limitations, Gating Requirements, FBSOA and RBSOA Curves, Snubber design.

Transistors (IGBTs): Basic Structure and Operation, Parasitic Diode and Latch up, IGBT Switching Characteristics, Resistive Switching Specifications, Clamped Inductive Switching Specifications, Transient analysis, Current Tail, FBSOA and RBSOA Curves, Switching Losses, Overcurrent and Short Circuit Protection, Snubber Design.

New power semiconductor devices: MOS Gated Thyristors, MOS Controlled Thyristors or MOS GTOs, Base Resistance controlled Thyristors, Emitter Switched Thyristor, etc.

Thermal design of power electronic equipment: Heat transfer by conduction, transient thermal impedance, heat transfer by radiation and convection, Heat Sink Selection.

Magnetics: Fundamentals of Magnetics, Types of Magnetic Materials, Magnetization Processes, Hysteresis Loop, Comparison and Applications of the Core Materials, Ferrite Core Losses with Non-Sinusoidal Voltage Waveforms, Steinmetz Equation, Insulation Requirements and Standards, Self-inductance and Mutual Inductance, Inductor Design.

Text Books/Reference Books:

1. Ned Mohan, Tore. M. Undeland and William. P Robbins, *Power Electronics converters, Applications and Design*, John Wiley and Sons, 2003.
2. G. Massobrio, P. Antognetti, *Semiconductor Device Modeling with Spice*, McGraw-Hill, 2nd Edition, 2010.
3. B. Jayant Baliga, *Power Semiconductor Devices*, PWS Publication, 2nd Edition, 2019.
4. V. Benda, J. Gowar, and D. A. Grant, "Discrete and Integrated Power Semiconductor Devices: Theory and Applications", John Wiley & Sons, 2nd Edition, 1999.
5. Barry W Williams, *Power Electronics: Devices, Drivers, Applications, and Passive Components*, McGraw Hill, 1987.
6. Alex Van den Bossche and Vencislav Cekov Valchev, *Inductors and Transformers for Power Electronics*, CRC Press, Taylor & Francis Group, 1st Edition, 2005.
7. L Umanand and S R Bhat, *Design of Magnetic Components for Switched Mode Power Converters*, New Age International, 1st Edition, 1992.

PES-504 Controller Design for Power Electronic Converter

Lectures: - 3 Hrs per week

Pre-requisites: Nil

Practicals: - 2 Hrs per week

Architecture of DC-DC Converters, Small Signal Modelling of basic electrical circuits

AC equivalent Circuit Modelling, Perturbation and Linearization, State Space Averaging techniques

Circuit Averaging and Average Circuit Modelling, Development of Canonical Circuit Model, Modelling of Pulse Width Modulator.

Converter Transfer Functions, Bode Plot of converter transfer functions.

Compensator Design for Voltage Controller for Non-Isolated DC-DC Converters (Buck, Boost, Buck-Boost, Cuk, Sepic), Compensator Design for Voltage Controller for Isolated DC-DC Converters (Flyback, Forward, Full Bridge), Stability Analysis, PID Controller

Compensator Design for Current Controller for Non-Isolated DC-DC Converters (Buck, Boost, Buck-Boost, Cuk, Sepic), Compensator Design for Current Controller for Isolated DC-DC Converters (Flyback, Forward, Full Bridge), Stability Analysis, PID Control, Hysteresis Control.

Non-Linear Control of Non-Isolated Converter - Adaptive Control, Tracking Control, Sliding Mode Control.

Text Books/Reference Books:

1. Robert W. Erickson, Dragan Maksimovic, *Fundamentals of Power Electronics*, Kluwer Academic Publishers, 1997.
2. Ned Mohan, Tore. M. Undeland, William. P. Robbins, *Power Electronics – Converter, Application and Design*, John Wiley & Sons, 2003.
3. M. K. Kazimierczuk, *Pulse-Width Modulated DC-DC Power Converters*, John Wiley & Sons. 2015.
4. Slotine J.J.E, W. Li, *Applied Non-Linear Control*, Prentice Hall Inc., 1991.
5. V. Ramanarayanan, Asif Sabanovich, Slobodan Cuk, *Thesis- Sliding Mode Control of Power Converters*, 1989.

PES-5406   Power Quality

Lectures: - 3 Hrs per week

Practicals: - 2 Hrs per week

Pre-requisites: Nil

Overview of Power Quality: Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves, Power quality problems, Poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage, power quality standards. Single phase static and rotating AC/DC converters, Three phase static AC-DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, Pulse modulated devices, Adjustable speed drives.

Measurement and Analysis Methods: Voltage, Current, Power and Energy measurements, power factor measurement and definitions, event recorders, Measurement Error – Analysis, Analysis in the periodic steady state, Time domain method, Frequency domain methods: Laplace, Fourier and Hartley transform, The Walsh transform, Wavelet Transform.

Analysis and Conventional Mitigation Methods: Analysis of Power outages, Analysis of unbalance: Symmetrical components of phasor quantities, instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion : On – line extraction of fundamental sequence components fro measured samples, Harmonic indices, Analysis of voltage sag: Detorit Edition sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of Voltage flicker, Reduced duration and customer impact of outgas, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

Power Quality Improvement: Utility- Customer interface-Harmonic filter: passive, Active and hybrid filter – Custom power devices: Network reconfiguring Devices, Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC-Control strategies- Q theory, modified P-Q theory, Synchronous detection method–custom power park – status of a application of power devices.

Text Books/Reference Books:

1. Arindam Ghosh, *Power Quality Enhancement Using Custom Power Devices*, Kluwer Acadamic Publishers.
2. G. T. Heydt., *Electric Power Quality*, Stars in a Circle Publications, 2nd Edition.
3. J. Arrillaga, N.R. Watson, S. Chen, *Power System Quality Assessment*, John Wiley & sons, New York.
4. Math H. J. Bollen, *Understanding Power quality problems*, IEEE Press, New York
5. E. Acha, Manuel Madrigal, *Power system Harmonics*, John Wiley & sons, New York.
6. Moreno – Murioz (Ed), Power *Quality (Mitigation Technologies in Distribution Environment)* Springer, 2007.
7. George J. Wakileh, *Power System Harmonics*, Springer.]
8. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, *Power Quality: Problems and Mitigation Techniques*, John Wiley & Sons

PES-5404 Mechatronics and Vehicular Power Electronics

Lectures: - 3 Hrs per week
Practicals: - 2 Hrs per week

Pre-requisites: Nil

Introduction to Mechatronics, definition, key issues, evolution, elements, mechatronics approach to modern engineering design.

Sensors and Transducers, Types, displacement, position, proximity and velocity sensors, signal processing, data display. Actuation Systems, Mechanical types, applications, electrical types, applications, pneumatic and hydraulic systems, applications, selection of actuators

Control Systems, Types of controllers, programmable logic controllers, applications, ladder diagrams, microprocessor applications in mechatronics, programming interfacing, computer applications

Recent Advances, Manufacturing mechatronics, automobile mechatronics, medical mechatronics office automation, case studies.

Basic Power Electronic Converters: Stability and requirement in vehicular dynamics, Constant Power Loads and their characteristics, Concept of negative impedance stability in DC/DC Converter with Constant power loads. Vehicular AC Distribution System, Hybrid (DC and AC) Vehicular Systems with Constant Power Loads, Electric and Hybrid-Electric Propulsion Systems, Modeling of Hybrid Vehicles, Dynamic Modeling of Batteries and Supercapacitors, Electric Power Links, Torque Couplers.

Hybrid Electric Vehicle, Plug-In Hybrid, Series Hybrid, Parallel Hybrid, Series and Parallel Hybrid, Regenerative Braking, Brake Cooling, Aerodynamic Drag, and Regenerative Braking and Coasting, Time and Stopping Distance, Regenerative Braking Integrated with Conventional Hydraulic System, Directional Stability.

Text Books/Reference Books:

1. Rajesh Rajamani, *Vehicle Dynamics and Control*, Springer, 2006
2. Uwe Kiencke and Lars Nielsen, Automotive *Control Systems For Engine, Driveline, and Vehicle*, Springer, 2005.
3. Ali Emadi, Mehrdad Ehsani, John M. Miller, *Vehicular Electric Power Systems: Land, Sea, Air and Space Vehicles*, Marcel Dekker, 2004.
4. SystemsLino Guzzella, Antonio Sciarretta, *Vehicle Propulsion*, Springer, 2007.

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PES-5402 Advanced Topic on Power Electronics Converters

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - 2 Hrs per week

Multiple-Quadrant Choppers, Fundamental Pump Circuits, Developed Pump Circuits, Transformer-Type Pumps, Double/Enhanced Circuit (DEC), Development of DC/DC Conversion Technique, Fundamental Converters, Transformer Type Converters Developed Converters, Zero-Current-Switching Quasi-resonant Converters, Zero-Voltage-Switching Quasi-Resonant Converters, Zero-Transition Converters, The Fifth Generation Converters, The Sixth Generation Converters, Categorize Prototypes and DC/DC Converter Family Tree.

Voltage-Lift Converters - Self-Lift Cúk Converter, Self-Lift SEPIC, Enhanced Self-Lift Converter, Variations of Currents and Voltages, Discontinuous Mode, Stability Analysis, Multiple-Lift Circuits, Double Output Converters, Super-Lift Luo-Converters. **Cascade Boost Converters** - Boost Circuit, Two-Stage Boost Circuit, Three-Stage Boost Circuit, Higher Stage Boost Circuit, Additional Series Circuits, Single and Double Stage Double Boost Circuit, Three-Stage Double Boost Circuit, Higher Stage Double Boost Circuit, Triple Boost Circuit, Two-Stage Triple Boost Circuit, Higher Stage Triple Boost Circuit, Multiple Boost Circuits.

Multiple Quadrant Operating Converters - Quadrant I, II, III and IV, Circuit Description, Variations of Currents and Voltages, Discontinuous Region, Switched Component Converters, Switched Capacitors DC/DC Converters, Switched Inductor Four-Quadrant DC/DC Converter, Continuous Mode, Discontinuous Mode. **Multiple-Lift Push-Pull Switched-Capacitor Converters** - Re-Lift Circuits, Higher Order Lift Circuit, Multiple-Lift Push-Pull Switched-Capacitor Converters, Integrated Switch Mode Power Converters.

Multiple-Quadrant Soft-Switch Converters & Synchronous Rectifier-Multiple-Quadrant DC/DC ZCS Quasi-Resonant Converters, Multiple-Quadrant DC/DC ZVS Quasi Resonant Converter, Multiple-Quadrant Zero-Transition DC/DC Converters, Design Considerations, Flat Transformer Synchronous Rectifier, Active Clamped Synchronous Rectifier Converter, Double Current Synchronous Rectifier Converter, Zero-Current-Switching Synchronous Rectifier Converter, Zero-Voltage-Switching Synchronous Rectifier Converter, Multiple Energy-Storage Element Resonant Power Converters, Two-Element RPC, Three-Element RPC, Four-Element RPC, Bipolar Current and Voltage Source, Bipolar Voltage Source, Input Impedance, Current Transfer Gain, Operation Analysis.

Text Books/Reference Books:

1. Fang Lin Luo & Hong Ye, *Advanced DC/DC Converters*, CRC Press, 2004.
2. Ali Emadi, Alireza Khaligh, Zhong Nie& Young Joo Lee, *Integrated Power Electronic Converters and Digital Control*, CRC Press, 2009.

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PES-5408 Grid Connected Power Converter and Systems

Lectures: - 3 Hrs per week

Practicals: - 2 Hrs per week

Pre-requisites: Nil

Grid Connected Converters: The grid connected converter-key element in the grid integration of Wind Turbine (WT) and Photovoltaic (PV) system, Grid Connected Inverter Structures, Inverter structure derived from H-bridge topology, full bridge inverter, H5 inverter (SMA), HERIC inverter, REFU inverter, Inverter NPC Topology, neutral point clamped (NPC) half-bridge inverter, H-bridge based boost PV inverter with high frequency transformer, PV String Inverters, Three phase PV inverters.

Grid Connectivity Requirement and Synchronization : International regulations, IEEE 1547, IEC 61727, VDC 0126-1-1, IEC 61000, EN 50160, voltage quality, Response to abnormal Grid condition and resynchronization, Power quality, current harmonics, average power factor; Anti-islanding requirements and standards: IEEE 1547/UL 1741, IEC 6211 and VED 0126-1-1; Grid synchronization techniques for single phase systems, Grid synchronization using Fourier Analysis, phase-locked loop, Phase Detection based on in-quadrature signals, signal generation, Adaptive filters, etc. for Islanding Detection, Non detection Zone, Passive islanding detection methods, OUF-OUV Detection, Phase jump detection(PJD), Harmonic detection (HD), Passive method evolution, Active islanding detection methods, Frequency Drift Methods, Voltage Drift Methods, Grid Impedance Estimation, PLL-Based Islanding Detention, Comparison of active Islanding Detection Methods, Synchronous reference frame PLL under unbalanced grid conditions, Decoupled Double synchronous Reference Frame PLL(DDSRF-PLL), Double Second-order Generalized integration PLL(DSOGI-PLL) and structure of the DSOGI.

Grid Converter Structures and Control: Power configurations, Grid Power Converter Topologies, single- cell (VSC–CSC), Multicell, Grid control, Active power Control Under Normal Operation, Power curtailment, Frequency control, Reactive power control, Discussion of Harmonization of Grid Code, local voltage control, inertia emulation(IE), Power oscillation damping(POD), L- filter and LCL-filter inverter, AC and DC Voltage Control, DC Link Voltage Management, PQ Open-Loop control, synchronous frame and stationary frame VOC, Virtual flux based control, Direct Power Control, Linear current control, Modulation Techniques, single phase, Operating limits of controllers.

Control of Grid Converters under Grid Fault: Overview of Control Techniques for grid connected converter under Unbalance Grid voltage Conditions, Control structures for Unbalanced Current Injection, Power control under unbalanced grid conditions, instantaneous active reactive control (IARC), Positive and negative sequence control (PNSC), Average active-reactive control (AARC), balanced positive control (BPSC), Flexible positive and negative sequence control (FPNSC), Flexible Power control with current limitation, locus of the current vector under unbalanced grid conditions.

Text Books/Reference Books:

1. Remus Teodorescu, Marco Liserre, Pedro Rodríguez, Frede Blaabjerg, *Grid Converters for Photovoltaic and Wind Power Systems*, John Wiley & Sons, 2011.
2. Ali Keyhani, Mohammad N. Marwali, Min Dai, *Integration of Green and Renewable Energy in Electric Power Systems*, John Wiley & Sons, 2010.
3. Ryszard Strzelecki and Grzegorz Benysek, *Power Electronics in Smart Electrical Energy Networks*, Springer, 2008.
4. Amirnaser Yazdani and Reza Iravani, *Voltage Source Converters in Power systems: Modeling, Control, and Applications*, John Wiley and Sons, 2010.

PES-5304 High/Medium Voltage DC transmission Systems

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Introduction: A more Flexible Power Grid, Power Electronics Control, Thyristor-Based CSC Transmission, VSC Transmission, Multi-terminal HVDC, Comparison of AC and DC Transmission Lines, The Impact of Distributed Generation, The Effect of Electricity Deregulation; HVDC Transmission Systems.

HVDC Conversion - Basic CSC Operating Principles, Effect of Delaying the Firing Instant, The Commutation Process: Analysis of the Commutation Circuit, Power Factor and Reactive Power, Characteristic Harmonics, Multi-Pulse Conversion, DC Ripple Re-injection, Uncharacteristic Harmonics and Interharmonics, Control System Imperfections, Firing Asymmetry, Magnification of Low- Order Harmonics, Harmonic Reduction by Filters; Voltage Source Conversion, VSC Operating Principles, Converter Components, Comparison of LCC and VSC, Analysis of the CSC Waveforms, The Re-injection Concept with Self-Commutation, Application to VSC, Application to CSC.

Line-Commutated CSC Transmission and their developments in Line Commutated HVDC schemes: Line-Commutated CSC Transmission, The Line-Commutated HVDC Converter, Structure of the HVDC Link, DC System Configurations, Control and Operation, AC–DC System Interactions, Voltage Interaction, Dynamic Voltage Regulation, Dynamic Stabilisation of AC Systems, Controlled Damping of DC -Interconnected Systems, Damping of Sub-Synchronous Resonances, Active and Reactive Power Coordination, Transient Stabilisation of AC Systems, AC–DC–AC Frequency Interactions, DC Link Response to External Disturbances: Response to AC System Faults, Response to DC Line Faults, Reliability of LCC Transmission; Capacitor Commutated Conversion, Tuned AC Filters, Active DC Side Filters, STATCOM-Aided DC Transmission.

VSC Transmission, Multi-Level VSC and CSC Transmission: VSC Transmission, Power Transfer Characteristics: Current Relationships, Structure of the VSC Link: VSC-HVDC Cable Technology, VSC DC System Control, Assistance During Grid Restoration, HVDC Light Technology, Potential for Multi-Terminal Sub-Transmission Systems, **Multi-Level VSC Transmission:** Power Flow Considerations, DC Link Control Characteristics, Independent Reactive Power Control, **Multi-Level CSC Transmission.**

Text Books/Reference Books:

1. Arrillaga J., Liu Y.H., Watson N.R., *Flexible Power Transmission The HVDC Options*, John Wiley & Sons, 2007.
2. Sood Vijay K., *HVDC and FACTS Controllers Applications of Static Converters in Power Systems*, Kluwer Academic Publishers, 2004.
3. Kimbark, E.W., *Direct Current Transmission*, Wiley Interscience, New York, 1971.
4. Padiyar, K. R., *HVDC Power Transmission Systems – Technology and System Interactions*, New Delhi-Eastern, 1990.
5. Adamson, C. and Hingorani, N.G., *High Voltage Direct Current Power Transmission*, Garraway, London, 1960.

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PES-5306 Electric Traction

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Types of electric traction, system of track electrification, Traction mechanics-types of services, speed time curve and its simplification, average and schedule speeds, Tractive effort specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence, ideal   speed   torque characteristics of Traction motors.

Salient features of traction drives, Series-parallel control of dc traction drives (bridge traction) and energy saving, Power Electronic control of dc & ac traction drives, Diesel electric traction.

Constructional and Design aspects of DC single phase and 3-phase I.Ms for Electric traction, constraints and comparison w.r.t. commercial machines, problem associated with voltage rises, Temporary Interruption of supply, commutation of current rush, Ability of motors to withstand current rushes.

Solid-state device controllers for DC Traction motors used for starting, speed control and electric braking in Electric traction for main line and suburban services, Controllers for 1-phase Traction motors, trends in main line railways using polyphase I.M.s and their controllers, Electric braking requirements and thyristorised controllers.

Battery operated vehicles for city service, Light weight batteries, Diesel-Electric Traction systems for main line service and controllers, Soft starting of Traction motors, Conservation of Electrical energy.

Text Books/Reference Books:

1. A. T. Dover, *Electric Traction*, Sir ISAAC Pitman Publisher, 4th Edtion, 1965.
2. G. K. Dubey, Dorodla, Joshi and Sinha, *Thyristorised Power Controllers*, Wiley Eastern Ltd., 1st edition, 1986.
3. M. S. Berde, *Thyristor Engineering (Power Electronics)*, Khanna Publishers, 9th Edition, 2005.
4. Prakash, *Modern Electric Traction.*

PES-5308 Energy Storage System

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Battery: Energy Storage Parameters; Lead–Acid Batteries-Constructional Features, Charge–Discharge Cycles, Operating Limits, Maintenance and Sizing, Types, Applications; Performance measurement, storage density, energy density, and safety issues in Lead-Acid, Nickel-Cadmium, Zinc Manganese dioxide batteries, Modern batteries as Zinc-Air, Nickel Hydride, Lithium Battery, Flow Batteries.

Ultracapacitors/Supercapacitors: Double-Layer Ultracapacitors, High-Energy Ultracapacitors, Rating, Size & Applications; Supercapacitors - Basic components, Types of electrodes and electrolytes, Advantages and Disadvantages, Comparison with battery systems, applications in public transport vehicles, private vehicles, and consumer electronics; Aspects of energy density, power density, price, and market.

Fuel Cell: Fuel cells for direct energy conversion, physical interpretation of the Carnot efficiency factor, electrochemical energy converters, power outputs, maximum intrinsic efficiency of an electrochemical converter. Types of fuel cells: Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, Alkaline fuel cell and Phosphoric fuel cell; Advantages and Disadvantages

Other Storages: Pumped Hydroelectric Energy Storage, Storage Capabilities of Pumped Systems, Compressed Air Energy Storage, Storage Heat, Energy Storage as an Economic Resource.

Flywheels: Advanced Performance of Flywheels, Applications of Flywheels, Design Strategies, Superconducting Magnetic Storage System, SMES System Capabilities, Developments in SMES Systems.

Power Electronics For Charging Control -Basic operation and modeling of power electronic devices applied in power transmission and distribution systems for electrical vehicles, various types of power electronics circuits used in energy processing; analysis and design of power converter circuits such as AC-DC, AC-AC, DC-DC and DC-AC converters; applications of power electronics circuit in electrical vehicles charging; methods of protection of power semiconductor devices and calculation of power device losses.

Text Books/Reference Books:

1. M. Broussely and G. Pistoia, Eds, *Industrial Applications of Batteries: From Cars to Aerospace and Energy Storage*, Elsevier, Amsterdam, 2007.
2. M. Broussely, G.A. Nazri and G. Pistoia,Eds., *Lithium Batteries – Science and Technology*, Kluwer Academic Publishers, Boston, USA, 2004.

PES-5310 Pulsed Power Electronics & Nuclear Energy Systems

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Introduction to Nuclear Physics, Basics atomic structure, mass energy equivalence, Interaction of radiation with matter, fission and fusion, Energy released in reactions, Particle Accelerators, Electrical & Magnetic Forces, High Voltage Machines, Linear Accelerators, Cyclotron, Betatron, Synchrotron, Collider, Spallation, Separators, Mass Spactrography, Separation of Deuterium, Detectors.

Heat generation and heat removal from the reactor, steam-cycles, types of Thermal Reactors, Nuclear power plant layout, Type of Reactors, Isotope Production and Consumption, Breeding & Uranium resources, Fusion reactors, Comparison of Fusion reactors, Magnetic and Inertial confinement machines, Other Fusion concepts.

Nuclear power station operation, Types of Pumps, Condensate booster, Feed water pump, Sodium Pump, Instrumentation and control, Irradiation effects, effects of temperature, Fuel cycles, instability, reactor control, start up and shunt down, reactor safety, reactor power level measurement, safety circuits, Radiation Shielding.

Pulse Discharge Capacitors, Types of Generators, Transformers, Transformers using long lines, Basic Pulsed-Power Energy Transfer Stage, Inductive Energy Storage, Power and Voltage Multiplication, Rotors and Homopolar Generators, Gas Switches, Magnetic switches, Summery, Mechanical Interrupters, Superconducting Opening Switches, Plasma Opening Switches, Voltage adding, cumulative Pulse Lines, KALIF, PBFA 2 and the Z- Machine, RHEPP.

Semiconductor closing switches, Types of thyristors, Semiconductor Opening Switches(SOS), Operation of SOS diodes, SOS-diode-based nanosecond pulse devices, Pulse power generators in circuits with magnetic elements, Properties of magnetic elements in pulsed fields, Generation of nanosecond high-power pulses, Magnetic generators using SOS diodes, Long lines with nonlinear parameters, Formation of electromagnetic shock waves due to induction drag, Generation of nanosecond high-power pulses with the use of electromagnetic shock waves.

LCSB, Cathodes, Explosive electron emission from a triple junction, Metal-dielectric cathode designs , Physical processes in LCSB diodes, Designs of LCSB accelerators, AEB, Principle of operation of diodes, Device of electron guns for MICD's The cathode plasma in a magnetic field, Formation of electron beams, Dense Electron Beam & their focusing, diode operation, Focusing of electron beams, High-power x-ray pulses, high-power pulsed gas lasers, generation of high-power pulsed microwaves, generation of ultrawideband radiation pulses.

Text Books/Reference Books:

1. Raymond Murray, *Nuclear Energy: an introduction to the concepts, systems, & applications*, Butterworth Heinmann, 2009.
2. Gennady A. Mesyats, *Pulsed Power*, Springer, 2005.
3. Samuel Glasstone & Alexander Sesonske, *Nuclear Reactor Engineering: Reactor Systems Engineering*, Chapman& Hall, 1994.
4. Ronald Allen Knief, *Nuclear engineering: theory and technology of commercial nuclear power*, Taylor & Francis, 1992.
5. J. Kenneth Shultis & Richard E. Faw, *Fundamentals of Nuclear Science and Engineering*, CRC Press, 2008.
6. Hansjoachim Bluhm, *Pulsed Power Systems: Principles and Applications*, Springer, 2006.

PES-5202 Standards for Microgrid Application and Control

Lectures: - 2Hrs per week

Pre-requisites: Nil

Practicals: - Nil

Overview of smart grids, smart grid related organizations, smart grid in developed nations like United States, Europe, Japan and China, Influence of Renewable Energy generation on smart grid, important standards for power grid (communication, energy management system and tele protection)

Standards for electric storage, distributed energy sources (DER's) and e – mobility / electric vehicles (batteries, grid to vehicle (G2V) and vehicle to grid (V2G)), standards for energy consumption – metering infrastructure and automation standards

Communication standards for microgrid, communication requirement in smart grid, standards and protocols for communication, IP in smart grid, wired and wireless communication in microgrids.

Security and safety for microgrids, threats and vulnerabilities for smart grid , standards for safety (IEC 62351, IEC 61508), levels of safety, network interoperability, cyber security, future of smart grids

Text Books/Reference Books:

1. Takuro Sato, Daniel M. Kammen, Zhenyu Zhou, Martin Macuha, Jun Wu, Muhammad Tariq, Solomon Abebe Asfaw, *Smart Grid Standards – Specifications, Requirements and Technologies*, Wiley & Sons, 2015.
2. Mathias Uslar, Michael Specht, Christian Danekas, JornTrefke, Sebastian Rohjans, Jose M Gonzalez, Christine Rosinger, Robert Bleiker, *Standardization in Smart Grids*, Springer Publications, 2013.

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PES-5204 Energy Management System

Lectures: - 2 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Intermittencies in renewable energy systems, microgrid and electric vehicle fundamentals and requirement of energy systems, energy systems and management technologies, Integration of Energy Storage systems in microgrids.

Modeling of energy storage systems (Battery, Fuel cell, Ultra capacitor, flywheel), equivalent circuit models and parameter identifications, Super capacitors and Ultra capacitors as energy storage device, transient/dynamic matching of energy storage system.

Battery state of charge (SoC) and State of Energy (SoE) estimation, Battery state of health (SoH) estimation using experimental method, model based method, joint estimation method, and dual estimation method, Battery state of power (SoP) estimation using instantaneous SoP and continuous SoP estimation method.

Battery balancing techniques, Battery sorting, battery passive balancing, battery active balancing, battery active balancing systems. Battery management systems in electric vehicles, typical structures of BMS, future generation of BMS

Text Books/Reference Books:

1. Rui Xiong and Weixiang Shen, *Advanced Battery Management Technologies for Electric Vehicles*, Wiley & Sons, 1st Edition, 2019.
2. Jingshan Li, Shiyu Zhou, Yehui Han, *Advances in Battery manufacturing, service and management systems*, Wiley & Sons, 2017.

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PES-5210 Electric Vehicles and E-Mobility

Lectures: - 2 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Evolution and introduction to e-vehicle, socio- ecological impact of e-vehicle over fuel driven vehicle, components of EV, basic EV architectures.

Forces and their affects over vehicle dynamics [Aerodynamic forces, Rolling resistance, Gradient resistance], formulation of dynamic equation, tire dynamics for vehicle movement, torque-speed, power-speed characteristics, performance analysis- Acceleration, Braking , power and energy analysis, braking distance calculation.

Selection of motor drive and its sizing, selection of HEV's architectures, fundamentals of regenerative braking, control of HEV's for maximum energy recovery.

Power electronics converters - (Non-isolated and Isolated) and storage systems for EV application.

Levels of charging (AC/DC charging), standards- CCS and Chademo, charging architectures, onboard, off board, wireless power transfer..

Text Books/Reference Books:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, *Modern Electric, Hybrid Electric and Fuel Cell Vehicles-Fundamentals, Theory and Design Second Design*, 2005.
2. Iqbal Husain, *Electric and Hybrid Vehicles- Design Fundamentals*, 2nd Edition, 2011.
3. G. R. C. Mouli, J. Kaptein, P. Bauer and M. Zeman, *Implementation of dynamic charging and V2G using Chademo and CCS/Combo DC charging standard*, 2016 IEEE Transportation Electrification Conference and Expo (ITEC), Dearborn, MI, 2016.
4. M. Yilmaz and P. T. Krein, *Review of Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles*, in IEEE Transactions on Power Electronics, vol. 28, no. 5, pp. 2151-2169, May 2013.

Second Year M.Tech (PES) III Semester

PES-6401 Smart Grid and Distribution Automation

Lectures: - 3 Hrs per week

Pre-requisites: Nil

Practicals: - 2 Hrs per week

Introduction: Structure and Fundamental Problems of Electrical Power Systems, Principles of Electrical Power Control, Classical Power Theory & Instantaneous Power Theory Power, Distributed Generation and Energy Storage Benefits to Grids, Damping of the System Oscillations, Fully Integrated Power System; **Distributed Generation and Microgrid:** Active distribution network, Configuration and Interconnection of Microgrids, Technical and economical advantages and challenges, Dynamic interactions of Microgrid, Ride through, Grid Synchronization.

Distributed Energy Resources : Variable and Adjustable Speed Generation Systems (SEIG & DFIG), Wind energy conversion systems (WECS), Grid Integration of Wind Energy Systems, Reactive Power Requirements, Power Fluctuations and Harmonics, Grid Integration of Photovoltaics and Fuel Cells, Dynamics of Small-scale hydroelectric power generation; **Microgrid and Active Distribution Network Management System :** Network management needs, Micro generation control, Energy storage, Regulation and load shifting, Source controller and EMS with protection, Demand-side Management.

Protection issues for Microgrids: Different islanding scenarios, Protection issues of stand-alone Microgrid, Parallel operation issues and protection requirements, Distribution transformer protection, Under/overvoltage protection, Under/Over frequency protection, Unbalanced loading, Loss of mains protection, Rate of change of frequency.

Power Electronic Interfaces: Overview of Power converter and Controls, PWM Rectifiers, Two level and Multi-level Converters, Neutral Point Clamped Voltage Source Converter (VSC), Space Vector PWM, Z-source Converters, Grid-Imposed Frequency VSC System - Control in $\alpha\beta$ & dq-frames, D-STATCOM, Integration and Interconnection Concerns, Voltage and Current Control of a 3-Phase 4 Wire distributed Interface Converters in Islanded Mode.

Power Quality and Reliability issues of Distributed Generation (DG): Power quality disturbances, Existing power quality improvement technologies, Load compensation, Voltage regulation, Harmonic Filtration and Balancing of the Voltage in Three-wire Systems, Dynamic Voltage Restorer, Primary & Secondary DG system with power quality support, Soft grid-connected DG, DG with intermittent solar PV/wind generator, Controllers with Energy-storage Systems.

SCADA and Active Distribution Networks: Existing Distributed Network operator (DNO) SCADA systems and its Control, Requirement of Communication in Microgrids, Distributed control system (DCS), Sub-station communication standardisation, smart transformers, Online Condition monitoring, SCADA communication and architecture, Automated Meter Reading, Operational issues of Serial Communication, Broadband Powerline Communiation, Optical & Wireless Communication.

Text Books/Reference Books:

1. S. Chowdhary, P. Crossley, *Microgrids and Active Distribution Network*, IET 2009
2. Nick Jenkins, Nicolas Jenkins, *Embedded Generation*, 2000.
3. R. Strzelecki, G. Benesek, *Power Electronics in Smart Electrical Energy Networks*, Springer.
4. Amirnaser Yazdani& Reza Iravani, *Voltage Sourced Converters in Power Systems: Modeling, Control, and Applications*, John Wiley & Sons, Inc., 2010.

PES-6403 Non Linear Control of Power Electronic Converters

Lectures: - 3 Hrs per week

Practicals: - 2 Hrs per week

Pre-requisites: Nil

Introduction to nonlinear systems and their behavior, Analysis of nonlinear systems using perturbation theory, phase plane trajectories, Describing functions, Lyapunov&Pupov's methods.

Nonlinear control design techniques – tracking control, deadbead control, passivity based control, Feedback linearization, input-state and input-output linearization, design issues for MIMO nonlinear systems.

Modeling and state space averaging of power electronic converters (buck, boost, buck – boost, cûk and sepic converter), small signal analysis of power electronic converters (buck, boost, buck – boost, cûk and sepic converter)

Non linear control of basic power converters (buck, boost, buck – boost, cûk and sepic converter) like adaptive -(MRAC, self tuning, gain scheduling control), adaline, tracking control .

Text Books/Reference Books:

1. Hassan. K. Khalil, *Non linear systems*, Prentice Hall Inc., 2002
2. Slotine J.J.E and W. Li, *Applied nonlinear control*, Prentice Hall Inc., 1991.
3. Mohler R.R., *Nonlinear systems: Dynamics and Control*, Prentice Hall Inc., 1991.
4. Adrian Ioinovici, *Power Electronics and Energy Conversion Systems: Fundamentals and Hard-switching Converters*, John Wiley & Sons Ltd., 2013 .
5. Marian P. Kazmierkowski, R Krishnan and Frede Blaabjerg, *Control in Power Electronics*, Academic Press, 2002.
6. V. Ramanarayanan, Asif Sabanovich and Slobodan CûK, *Thesis - Sliding Mode Control of Power Converters*, 1989.
7. Shankar Sastry, Marc Bodson, *Adaptive Control- Stability, Convergence and Robustness*, Prentice Hall Inc., 2011.

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PES-6405 Energy Efficiency, Auditing and Loss Reduction

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - 2 Hrs per week

Electrical system & Electric Motors: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment and leakage test, factors affecting the performance and savings opportunities

Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System- Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower and Energy Efficient Technologies- Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities assessment of cooling towers Different types of Energy Efficient Technologies.

Energy AUDIT-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

Loss Reduction- losses, Techniques, Advantages of loss reduction.

Text Books/Reference Books:

1. Wayne C. Turner, *Energy management handbook*, John Wiley and Sons, 6th Edition, 2007.
2. Cape Hart, Turner and Kennedy, *Guide to Energy Management*, 8th Edition, 2016
3. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

PES-6407 Thermal Design for Heat Sinks, Thermoelectrics and EMI/EMC

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - 2 Hrs per week

Introduction: Thermodynamics - Energy, Heat and work, the first law of Thermodynamics, Heat Engines, Refrigerators, and Heat pumps, The second Law of Thermodynamics, Carnot Cycle. Theory of Heat Transfer (Conduction, Convection and Radiation).

Heat Sinks: Longitudinal Fin of Rectangular Profile, Heat Transfer from Fin, Fin Effectiveness, Fin Efficiency, Corrected Profile Length, Optimizations- Constant profile Area, Constant Heat Transfer from a Fin, Constant Fin Volume or Mass, Multiple Fin Array I- Free (Natural) Convection Cooling- Small Spacing Channel, Large Spacing Channel, Optimum Fin Spacing, Force Convection Cooling- Small Spacing Channel, Large Spacing Channel, Multiple Fin Array for Natural (Free) Convection Cooling, Thermal Resistance and Overall Surface efficiency, Fin Design With Thermal Radiation.

Thermoelectrics: Thermoelectric Effect, Thomson Relationships, Thermoelement Couple, The Figure of merit, Similar and Dissimilar Materials, **Thermoelectric Generator (TEG)-** Similar and dissimilar Materials, Theory of Conversion Efficiency and Current, , Maximum Power Efficiency, Maximum Performance Parameters, Multicouple Modules, **Thermoelectric Coolers (TEC)-**Coefficient of Performance, optimum Current For the Maximum Cooling Rate and maximum COP, Maximum Performance Parameters, Generalized Charts, Optimum Geometry for the Maximum Cooling in Similar Materials, Thermoelectric Modules/Design, Commercial TEC, Multistage Modules, Applications and Design - Thermoelectric Generators, Thermoelectric Coolers, Design Example- Design of Internal and External Heat Sinks, Performance Curves for Thermoelectric Air Cooler, Thermoelectric Module Design- Thermal and Electrical Contact Resistances for TEG and TEC.

Compact Heat Exchanger: Fundamentals of Heat Exchangers-Over Heat Transfer Coefficient, Log Mean Temperature Difference (LMTD), Flow Properties, Nusselt Numbers, Effectiveness-NTU (e-NTU) Method- Parallel Flow, Counterflow, Crossflow, Heat Exchange Pressure Drop, Fouling Resistances (Fouling Factor), Overall Surface (Fin) Efficiency, Reasonable Velocities of Various Fluid in Pipe Flow, Double Pipe Heat Exchangers, Shell and tube Heat Exchangers, Plate Heat Exchangers (PHE), Pressure Drop in Compact Heat Exchangers, Contraction and Expansion Loss Coefficient, Types of tube cores, Finned-Tube Heat Exchangers, Correlation for Circular Finned-Tube Geometry, Pressure Drop, Correlation For Louvered Plate-Fin Flat-tube Geometry, Plate Fin Heat Exchangers, Louver-Fin-Type Flat-Tube Plate-Fin Heat Exchangers.

Text Books/Reference Books:

1. Halid Hrasnica, Abdel fatteh Haidine and Ralf Lehnert, *Broadband Powerline Communications Networks: Network Design*, John Wiley & Sons Ltd, 2004.
2. Ho Sung Lee, *Thermal Design: Heat Sinks, Thermoelectrics, Heat Pipes, Compact Heat Exchangers, and Solar Cells*, John Wiley & Sons Inc, 2010.
3. Allan D. Kraus,*Design and Analysis of Heat Sinks*, John Wiley & Sons Inc, 1995.
4. Younes Shabany, *Heat Transfer: Thermal Management of Electronics*, CRC Press, 2009.
5. Gordon Ellison, *Thermal Computations for Electronics: Conductive, Radiative, and Convective Air Cooling*, CRC Press 2010.

PES-6301 SCADA & Energy Management System

Lectures: - 3 Hrs per week
Practicals: - Nil

<div align="right">Pre-requisites: Nil</div>

General Theory: Purpose and necessity, general structure, data acquisition, transmission & monitoring. General power system and hierarchical Structure; Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fiber optical channels and satellites.

Supervisory and Control Functions: Data acquisitions, status indications, majored values, energy values, monitoring alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc. Regulatory functions: Set points and feedback loops, time tagged data, disturbance data collection and analysis. Calculation and report preparation.

MAN- Machine Communication: Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printing facilities.

Data Basis - SCADA, EMS and network data basis. SCADA system structure - local system, communication system and central system. Configuration- NON-redundant- single processor, redundant dual processor, multicontrol centers, system configuration. Performance considerations: real time operation system requirements, modularization of software programming languages.

Energy Management Center: Functions performed at a centralized management center, production control and load management economic dispatch, distributed centers and power pool management.

Text Books/Reference Books:

1. Torsten Cergrell, *Power System Control Technology*, Prentice Hall International, 1986.
2. George L Kusic, *Computer Aided Power System Analysis*, Prentice Hall of India, 2nd Edition, 2009.
3. A. J. Wood and B. Woolenberg, *Power Generation Operation and Control*, John Wiley & Sons, 2nd Edition, 1996.
4. Sunil S Rao, *Switchgear Protection & Power System*, Khanna Publishers, 11th Edition, 2008.

PES-6303 Energy, Environmental Economics and Energy Policy

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Overview of Energy Markets: Introduction to energy fundamentals, Pricing of exhaustible resources, Discussion of energy prices and markets, Economic regulation of energy markets, Electricity regulation and restructuring.

Environmental Implications of Energy: Externalities of conventional fuels, Discussion of externalities, Economics of pollution control, Discussion of pollution control policies, Economics of climate change, Introduction to climate change policies.

Investment in Renewable Energy Sources: Overview of renewable technology, Discussion of investing in energy projects, Introduction to Policies for Renewables, Discussion of Policies for Renewables.

Issues in Energy Economics: Energy efficiency and conservation, Introduction to transportation economics, "Mobile-Source Air Pollution" CAFE and transportation policies, other transportation policies.

Text Book/Reference Book:

1. Thomas Tietenberg., *Environmental and Natural Resource Economics*, 7th edition, (Boston, MA: Addison Wesley, 2006).

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PES-6307 Optimization Techniques

Lectures: - 3 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

Introduction to optimization

Unconstrained One Dimensional Optimization Techniques: Necessary and sufficient conditions, unrestricted search methods, Fibonacci and golden section methods, quadratic and cubic interpolation methods.

Unconstrained multi-dimensional Optimization Techniques: Direct search methods, Random search methods, univariate methods, pattern Search methods, steepest descent methods

Constrained optimization Techniques: Kuhn Tucker conditions, penalty function methods, gradient projection methods, cutting plane methods.

Artificial Intelligent Optimization Techniques: Particle swarm optimization, Genetic algorithms, Ant-colony optimization, neural and fuzzy optimization techniques.

Text Books/Reference Books:

1. Singiresu S. Rao *Engineering Optimization: Theory and Practice* Wiley India Pvt Ltd; Fourth edition (29 January 2013)
2. Deb K *Optimization for Engineering Design: Algorithms and Examples* Prentice Hall India Learning Private Limited; Second edition (2012).
3. D.P. Kothari, J.S.Dhillon *Power System Optimization* Prentice Hall India Learning Private Limited; 2 edition (2010)

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PES-6305 Power Line Communication and Control Applications

Lectures: - 3 Hrs per week
Practicals: - Nil

Pre-requisites: Nil

Introduction- Power line Communications Systems, Historical Overview, Power Supply Networks, Standards, Narrowband PLC, Broadband PLC. PLC Access Networks, Structure of PLC Access Networks, PLC Network Elements Connection to the Core Network, Medium-voltage PLC. Specific PLC Performance Problems, Features of PLC Transmission Channel, Electromagnetic Compatibility, Impact of Disturbances and Data Rate Limitation, Realization of Broadband PLC Transmission Systems, Performance Improvement by Efficient MAC Layer. Summary

Network Characteristics- Network Topology, Topology of the Low-voltage Supply Networks, Organization of PLC Access Networks, Structure of In-home PLC Networks, Complex PLC Access Networks, Features of PLC Transmission Channel, Channel Characterization, Characteristics of PLC Transmission Cable, Modeling of the PLC Channel, Electromagnetic Compatibility of PLC Systems, Different Aspects of the EMC, PLC EM Disturbances Modeling, EMC Standards for PLC Systems. Disturbance Characterization, Noise Description, Generalized Background Noise, Impulsive Noise, Disturbance Modeling.

Realization of PLC Access Systems- Architecture of the PLC Systems, Modulation Techniques for PLC Systems, Choice of Modulation Scheme for PLC Systems. Error Handling, Overview, Forward Error Correction, Interleaving, ARQ Mechanisms. PLC Services, PLC Bearer Service, Telecommunications Services in PLC Access Networks, Service Classification.

PLC MAC Layer - Structure of the MAC Layer, MAC Layer Components, Characteristics of PLC MAC Layer, Requirements on the PLC MAC Layer. Multiple Access Scheme, TDMA ,FDMA, CDMA, Logical Channel Model. Resource-sharing Strategies, Classification of MAC Protocols, Contention Protocols, Arbitration Protocols, IEEE 802.11 MAC Protocol. Traffic Control, Duplex Mode, Traffic Scheduling, CAC Mechanism.

Performance Evaluation of Reservation MAC Protocols- Reservation MAC Protocols for PLC, Reservation Domain, Signaling Procedure, Access Control, Signaling MAC Protocols. Modeling PLC MAC Layer, Analysis Method, Simulation Model for PLC MAC Layer, Traffic Modeling, Simulation Technique. Investigation of Signaling MAC Protocols, Basic Protocols Protocol Extensions, Advanced Polling-based Reservation Protocols. Error Handling in Reservation MAC Protocols, Protection of the Signaling Procedure, Integration of ARQ in Reservation MAC Protocols, ARQ for Per-packet Reservation Protocols. Protocol Comparison, Specification of Required Slot Structure Specification of Traffic Mix, Simulation Results, Provision of QoS in Two-step Reservation Protocol.

Text Books/Reference Books:

1. Halid Hrasnica, Abdel fatteh Haidine and Ralf Lehnert, *Broadband Powerline Communications Networks: Network Design*, John Wiley & Sons Ltd, 2004.
2. Gilbert Held, *Understanding Broadband over Power Line*, Auerbach Publications, 2006.
3. Michael M. A. Mirabito and Barbara L. Morgenstern, *The New Communications Technologies*, Elsevier Inc., 2004.

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PES-6201 Condition Monitoring, System Modeling & Forecasting

Lectures: - 2 Hrs per week   Pre-requisites: Nil
Practicals: - Nil

General concept of condition monitoring, general issues of condition monitoring, Main components in a condition monitoring system, condition monitoring techniques, Power Transformer Condition Monitoring-Transformer faults and monitoring techniques, monitoring for on-load top changer, insulation monitoring, sweep frequency response test for condition monitoring, recent trend/research on power transformer condition monitoring.

Power-generation faults and monitoring methods, stator winding faults, rotor body faults, rotor winding faults, stator-core faults, condition monitoring for generator stator windings, Induction motor faults and monitoring methods, faults such as stator faults, rotor faults, bearing faults, air gap eccentricities. Popular Monitoring Techniques such as Vibration monitoring, current monitoring.

Modelling philosophies, Rationales for mathematical modeling, Dynamic versus steady state models, General modelling principles, Degrees of freedom in modeling, Transfer function models, Procedure for developing transfer function models, Performance modeling; Modelling of automated manufacturing systems; Role of performance modeling, Performance measure, Petrinet models, Introduction to Petrinet, Basic definitions and analytical techniques, S-Net models; Preliminary definitions and analytical techniques.

Modelling with active graph theory, General concepts, Events and conditions, Synchronisation, Mutual exclusion problems, Standard Problems - Dining philosophers' problems, Readers/ writers problems, Analysis problems of active graph, Petrinets, S-Nets. Their popular extensions, Different case studies of Petrinet and S-Net models related to super computer pipe line, Flexible manufacturing systems. Computer communication system, Computer controlled data acquisition system- computer communication network, Process control systems.

Need of forecasting, philosophy of forecasting, requirement of good forecasting, types of forecasting: day to day forecasting, short term forecasting, long term forecasting, factor affecting forecasting.

Text Books/Reference Books:

1. P. J. Tavner and J. Penman, *Condition Monitroing of Electrical Machine*, Letchworth, RS Press, Ltd., 2nd Edition, 2008.
2. Mazen A. S., Ed., *High Voltage Engineering – Theory and Practices*, Marcel Dekker, Inc., 2000.
3. Kuffel E, Zaengl WS and Kuffel L, *High Voltage Engineering Fundamentals*, Butterworth Heimann, 2000.
4. B. K. N. Rao, *Handbook of Condition Monitoring*, Elsevier Science Publisher, 1996.
5. RA Colacott, *Mechanical Faults Diagnostics and Condition Monitoring*, John Wiley & Sons, 1997.
6. Ernest O Doeblin., *Measurement Systems: Application and Design*, McGraw Hill (Int. edition) 1990
7. C.L. Liu, *Elements of Discrete Mathematics*, McGraw Hill Int. Editions, 1985.
8. J.L. Peterson., *Petrinet Theory and Modelling of Systems*, Prentice Hall Inc., Englewood Cliffs, N.J, 1981.
9. John O. Moody, Panos J Antsaklis, *Supervisory Control of Discrete Event System Using Petrinets*, Kluwer academic Publishers Boston/Dordrecht/ London, 1998.
10. N. Viswanathan, Y. Narahari, *Performance Modelling of Automated Manufacturing Systems*, Prentice Hall of India Pvt. Ltd., New Delhi, 1994.

PES-6207 Industrial Safety

Lectures: - 2 Hrs per week

Pre-requisites: Nil

Practicals: - Nil

Concepts and Statutory Requirements: Introduction – electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation(CPR).

Electric Hazards: Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage, clearances and insulation, classes of insulation, voltage classifications excess energy, current surges, Safety in handling of war equipments, over current and short circuit current, heating effects of current, electromagnetic forces, corona effect, static electricity – definition, sources, hazardous conditions, control, electrical causes of fire and explosion ionization, spark and arc-ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance.

Protection Systems: Fuse, circuit breakers and overload relays, protection against over voltage and under voltage, safe limits of amperage, voltage, safe distance from lines, capacity and protection of conductor, joints, and connections, overload and short circuit protection, no load protection, earth fault protection; FRLS insulation, insulation and continuity test, system grounding, equipment grounding earth leakage circuit breaker (ELCB), cable wires, maintenance of ground, ground fault circuit interrupter, use of low voltage, electrical guards, Personal protective equipment, safety in handling hand held electrical appliances tools and medical equipments.

Selection, Installation, Operation and Maintenance: Role of environment in selection, safety aspects in application, protection and interlock self diagnostic features and fail safe concepts, lock out and work permit system, discharge rod and earthing devices, safety in the use of portable tools, cabling and cable joints preventive maintenance.

Hazardous Zones: Classification of hazardous zones, intrinsically safe and explosion proof electrical apparatus (IS, API and OSHA standard), increase safe equipment, their selection for different zones temperature classification, grouping of gases, use of barriers and isolators, equipment certifying agencies.

Text Books/Reference Books:

1. Fordham Cooper, W., *Electrical Safety Engineering*, Butterworth and Company, London, 1986.
2. *Accident prevention manual for industrial operations,* N.S.C., Chicago, 1982.
3. *Indian Electricity Act and Rules*, Government of India.
4. *Power Engineers – Handbook of TNEB*, Chennai, 1989.
5. *Martin Glov Electrostatic Hazards in powder handling*, Research Studies Pvt. LTd., England, 1988.

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FORMAT

बैचलर ऑफ़ टेक्नोलॉजी

विश्वविद्यालय की शैक्षणिक परिषद की अनुशंसा पर

अभिमानशु सिंह

को सिविल इंजीनियरिंग में बैचलर ऑफ़ टेक्नोलॉजी

की उपाधि प्रदान की जाती है, जिन्होंने इस उपाधि को प्रदान किए जाने हेतु विश्वविद्यालय के अध्यादेशों के तहत निर्धारित अपेक्षाओं को वर्ष 2019 में 10 अंकीय मापक्रम पर 7.69 संचयी कोटि अंक माध्य (सी.जी.पी.ए.) के साथ सफलतापूर्वक पूर्ण कर लिया है। इन्हें उक्त उपाधि से षष्टम् दीक्षान्त समारोह में 13 दिसंबर 2019 को विभूषित किया गया।

BACHELOR OF TECHNOLOGY

Upon the recommendation of the Academic Council of the University

Abhimanshu Singh

is awarded the degree of

Bachelor of Technology in Civil Engineering

who has successfully completed the requirements prescribed under the ordinances of the University for the award of this degree with a Cummulative Grade Point Average (CGPA) of 7.69 on a 10 point scale in the year 2019.

He/She is admitted to the said degree at the 6th Convocation held on December 13, 2019.

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December 13, 2019