



विश्वजीवनामृतं ज्ञानम्

Courses of Study

**Atal Bihari Vajpayee
Indian Institute of Information Technology &
Management , Gwalior**

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About the Institute

Atal Bihari Vajpayee Indian Institute of Information Technology and Management, Gwalior (ABV-IITM Gwalior), is an apex Information Technology (IT) and Management Institute, established by the Government of India. The Institute strives to become a world-class Institution which endeavors to carve young minds through teaching and research and develop them as tomorrow's leaders. The Institute's mandate is to create Information Technology enabled Management solutions for nation building.

The Institute offers various programmes at Masters and Doctoral level. Sprawling across 160 lush green acres on the foothills of Gwalior Fort, the Institute is self-contained with basic amenities for all round development of students. The Institute's activities are aimed at developing amongst students an inquisitive mind and a culture of camaraderie and research.

The Institute has established research collaborations with various Universities in USA, France, and Japan. The Institute has also developed industrial linkages with various research labs and industries.

Academic Programmes

The institute runs the following academic programmes.

- **Integrated Post Graduate (IPG) Programme**

The Institute offers a five - year dual degree Integrated Post Graduate (IPG) programme leading to dual degree of Bachelor of Technology in Information Technology and Master of Technology/ Master of Business Administration.

- **Master of Technology Programme**

The Institute offers a four-semester Master of Technology programme (M.Tech) in Computer Science and Engineering. The programme offers specializations in the areas of Advanced Network, Digital Communication, Information Security, and VLSI.

- **Master of Business Administration Programme**

The Institute also offers a four-semester programme Master of Business Administration, MBA (ITeS), MBA (PSM & E-Gov). The focus of the programme is to integrate IT with business processes. The MBA programme offers various courses falling under the specialization areas of Marketing, Human Resource Management, IT & Systems, Operations and Finance.

The MBA / MBA (ITeS)/MBA (PSM & E-Gov) programme is intended to serve the following objectives:

- To create a generation of 'knowledge leaders' who will contribute to new vistas of development of the 'business' and thereby to the society at large, impart knowledge and training of mind to a new genre to business managers capable of providing a right mix of innovation and operational nuances and continuously refine the business value chain, integrate technology (such as ERP, SCM CRM, etc.) into business processes through innovations and process of continuous learning and research, for creating widespread value both to business and encapsulates those into all segments of the society, create a level of sensitization towards strategic business intent and put in place a sense of social

responsibility behind every move they make, sensitize students about new models of business and prepare them for careers in industry.

- **Ph.D Programme**

The Institute offers offers postgraduate programmes leading to the award of Ph.D. degree through its Department / Centre. The award of Ph.D. degree is in recognition of high academic achievements, independent research and application of knowledge to the solution of technical and scientific problems in Information Technology and Management; creative and productive inquiry is the basic concept underlying the research work. The academic programme leading to the Ph.D. degree is broad – based and involves a minimum course credit requirement and a research thesis. The institute also encourages interdisciplinary areas through a system of Co-supervision and provides excellent opportunities for such programs. The institute undertakes sponsored research and development projects from industrial and other organizations in the public as well as private sector. The degree of Doctor of Philosophy is abbreviated as Ph.D. The degree of Doctor of Philosophy is granted for research work in areas recognized by the academic Department / Centre of the institute subject to the conditions and regulations mentioned in **“ORDINANCES & REGULATIONS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY”**.

The research work shall be an original work characterized either by the discovery of facts, or by a fresh approach towards the interpretation and application of facts, or development of equipment making a distinct advancement in instrument technology. It shall evince the candidate’s capacity for critical examination and sound judgment and shall represent original contribution to the existing knowledge.

The degree of Doctor of Philosophy (Ph.D.) of the Institute shall be conferred on a candidate who fulfills all the requirements specified in these Ordinances and Regulations.

Programme Administration

Medium of Instruction

English shall be the medium of instruction and examination.

Credit System

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

A student is allowed to attend classes in a course and earn credit for it, only if he/she has registered for that course.

A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grade obtained by the student, grade point average is calculated.

All programmes are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

Details are given in Course Contents.

(a) Course credits assignment

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials : One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory : Two laboratory hours per week is assigned one credit.

(b) Earning credits

At the end of every course for which a student has registered, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average. A student has the option of auditing some courses. Grades obtained in these audit courses are not counted for computation of grade point average. However, a pass grade is essential for earning credits from an audit course; this does not apply to postgraduate programmes.

Academic year:

The period of formal academic instruction, usually extending from August through May. It is divided into fall and spring semesters. Students may also be able to take classes during summer sessions.

Audit:

Enrolling in a class on an audit basis means the class would not count for credit or grade point average. In some cases. Registration for audit may require the permission of the course coordinator.

Colloquium:

A gathering of students to discuss a given topic over a period of a few hours to a few days.

Comprehension:

Comprehension will be a comprehensive viva which will test the knowledge and skills gained by students over three semesters. It will also help them to appreciate the importance of integration. The viva will be conducted by a panel comprising faculty members and industry executives. This will offer an opportunity to expose our students to outside experts who can also give feedback about communication skills of students, curriculum and the pace with which this curriculum is delivered.

Credit course:

A class with specified learning goals which the student is required to meet in order to pass the course and that may be applied toward the fulfillment of degree requirements at the Institute.

Electives :

Electives are the academic courses chosen by the student from a set of options, as opposed to a required course. While required courses (sometimes called core courses) are deemed essential for an academic degree, elective courses tend to be more specialized. Elective courses usually have fewer students than the required core courses.

Grades:

Evaluative scores provided for each course, and often for individual examinations or papers written for that course. There are letter grades (usually A, A(-), B, B(-), C, C(-), D, F, I) .

Lecture:

A lecture is an oral presentation intended to present information or teach students about a particular subject.

Major Examination:

Usually a major examination is given at the end of the semester.

Minor Examination:

Usually two minor examination are given in the semester.

Open Elective:

Open Elective courses allow a student to explore additional areas of interest, work toward a focused area.

Practical:

A practical is a learning opportunity that involves a brief presentation by the lecturer or tutor, followed by students participating in various exercises or experiments. Practicals provide opportunities to study and gain hands on experience on the practical applications of the concepts taught in the Lectures for a particular subject.

Semester:

A period of study of approximately 13-14 weeks, usually half of the academic year.

Seminar:

Most commonly offered as upper-level and postgraduate courses, these are small classes of approximately 15 students each, designed to facilitate intensive study of specific subject areas.

Summer Internship:

In Summer internships to students undertake summer internship in leading organization engaged in services (like banking, insurance etc.), IT/manufacturing, government or NGOs. This internship will expose the students to real life environment and will also sensitize them about contemporary models of business. It is also expected students will sharpen their soft skills and also prepare them

for careers in business. The projects at various other Institutes / Industries /Organizations like Bank, insurance/ Research Organizations, that not only give them an opportunity to learn but also to contribute to theseInstitutes / Industries /Organizations like Bank, insurance/ Research Organizations. They work on cross functional operational projects that expose them to all the verticals of the company. This internship will expose the students to real life environment and will also sensitize them about contemporary models of business. It is also expected students will sharpen their soft skills and also prepare them for careers in Technology Sector and business.After the Summer Internship, the assessment is done by in the Colloquium.

Project/Thesis

The project work is divided into 2 parts (Part I and Part II) and will be spread over two semesters. Students are expected to work on real life problems, preferably extending the scope of their summer internship/innovative research problem. It is envisaged that students will diagnose the problem and come out with innovative solutions and/or suggest an alternative models of doing business in chosen organization. The project work is a capstone assignment integrating a variety of skills gained, variety of tools/techniques and an opportunity to display maturity in understanding and implementing business solutions in a holistic manner. This will also provide an opportunity to exhibit their “project management” skills.

Tutorial:

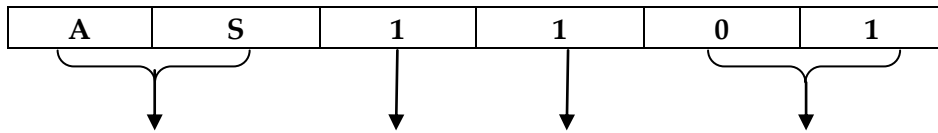
A method of providing help to students by instruction outside of class. A tutorial is a method of transferring knowledge and may be used as a part of learning. More interactive and specific than a book or a lecture; a tutorial seeks to teach by example and supply the information to complete a certain task. Teaching course that is generally offered in conjunction with a lecture in which the material is dealt with actively in more depth. A tutorial system is basically a form of one on one teaching.

Course Contents / Syllabus:

This is an indicative description about the course.

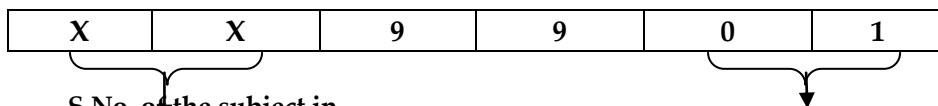
Subject Coding Scheme for IPG/M.Tech/MBA Programme

Coding Scheme for IPG Programme (Core Subjects):



Subject Stream Year of Programme Semester S.No. of the subject in the respective discipline

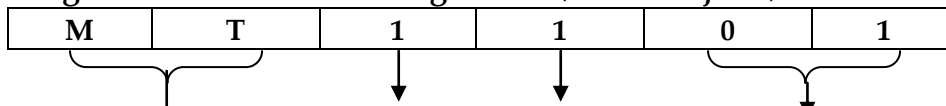
Coding Scheme for IPG Programme (Elective Subjects):



S.No. of the subject in the respective discipline

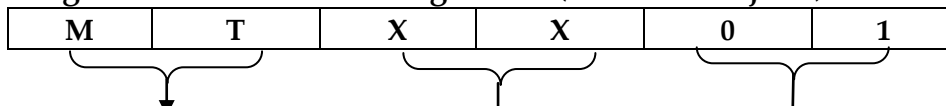
IT : Elective subject in IPG M.Tech(IT)MG :
 Elective subject in IPG MBA

Coding Scheme for M.Tech Programme (Core Subjects):



Subject Stream Year of Programme Semester S.No. of the subject
 0X : Core Subject

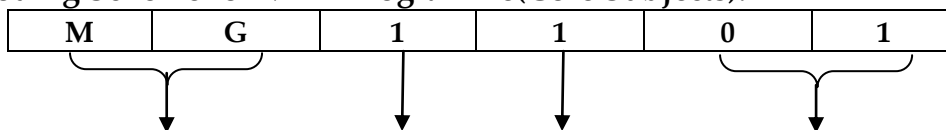
Coding Scheme for M.Tech Programme (Elective Subjects):



Subject Stream S.No. of the subject in specialization

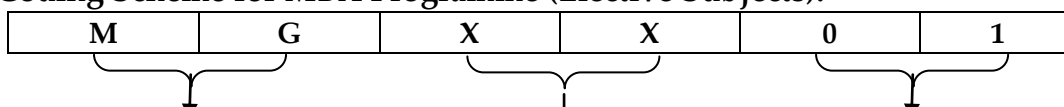
33 : Elective subject in AN
 44 : Elective subject in DC
 55 : Elective subject in IS
 66 : Elective subject in VIP
 77 : Elective subject in VLSI
 99 : Open elective

Coding Scheme for MBA Programme(Core Subjects):



Subject Stream Year of Programme Semester S.No. of the subject
 0X : Core Subject

Coding Scheme for MBA Programme (Elective Subjects):



Subject Stream S.No. of the subject in the Focus

33 : Elective subject in Marketing Management
 44 : Elective subject in Technology and Operations Management
 55 : Elective subject in IT and Systems
 66 : Elective subject in Finance
 77 : Elective subject in Human Resource Management
 88 : Elective subject in Management of Social Sector

Stream Coding Scheme for IPG Programme:

S.No.	Stream	Code
1	Applied Sciences	AS
2	Humanities	HS
3	Information Technology	IT
4	Management	MG

Stream Coding Scheme for Two Years M.Tech Programme:

S.No.	Stream	Code
1	Computer Science	MT

Stream Coding Scheme for Two Years MBA Programme:

S.No.	Stream	Code
1	Management	MG

Programme Structure of IPG/M.Tech/MBA

The institute conducts the following academic programmes.

Integrated Postgraduate Programme B.Tech + M.Tech (IT)

Integrated Postgraduate Programme B.Tech + M.B.A

M.Tech (CSE) Programme with Specialization in

- **Advanced Networks**
- **Digital Communication**
- **Information Security**
- **VLSI**

MBA Programme

MBA (ITeS) Programme

MBA (PSM& E-Gov) Programme

Ph D Programme (IT, Management & Applied Sciences Stream)

FIVE YEAR IPG COURSE CURRICULUM

Broadly the structure of IPG (B.Tech + M.Tech(IT) & IPG(B.Tech + MBA) programme is as follows:

First Year			Second Year		
First Semester	Second Semester		Third Semester	Fourth Semester	
Focus on Introductory and Foundation Courses of Engineering and communication skills <i>Credits: 21</i>	Focus on basic Technology subjects <i>Credits: 21</i>		Focus on Introductory foundation Information Technology subjects <i>Credits: 21</i>	Focus on core Information Technology subjects <i>Credits: 21</i>	
Third Year			Summer Semester Project		
Fifth Semester	Sixth Semester		Two months Summer Semester Project Based on Research Problems in the areas of Information Technology / Management <i>Credits: 5</i>		
Focus on core and advanced subjects of Information Technology <i>Credits: 23</i>	Focus on elective subjects based on application areas of Information <i>Credits: 21</i>				
Fourth Year		Summer Internship of Eight Weeks in IT /Management Industry	Fifth Year		
Seventh Semester	Eighth Semester		Ninth Semester	Tenth Semester	
Focus on Electives as per latest Industry Trends Information Technology(for M.Tech/ Management for MBA <i>Credits: 20-24</i>	Focus on Electives as per latest Industry Trends Information Technology(for M.Tech/ Management for MBA <i>Credits: 20-23</i>		Focus on Colloquim/ Seminar/ Electives Functional Areas of Information Technology for M.Tech / Management for MBA Major Project-I / Thesis-I based on Research Problem (IT/Management) <i>Credits: 21-23</i>	Focus on Seminar/ Electives Functional Areas of Information Technology for M.Tech / Management for MBA Major Project-II / Thesis –II based on Research Problem (IT/Managent) <i>Credits: 23</i>	

FIVE YEARS INTEGRATED PROGRAMME COURSE CURRICULUM

I Semester

S.No.	Subject Code	Subject	L	T	P	Credits
1	AS1101	Engineering Mathematics – I	3	1	0	4
2	AS1102	Physics-I	3	0	2	4
3	HS1101	Language & Communication Skills	2	0	2	3
4	IT1101	Basic Electrical Engineering	3	0	2	4
5	IT1102	Computer Programming	2	0	4	4
6	HS1102	Sports and Physical Education	1	0	2	2
Total Credits						21

II Semester

S.No.	Subject Code	Subject	L	T	P	Credits
1	AS1201	Engineering Mathematics – II	3	1	0	4
2	AS1202	Physics-II	3	0	2	4
3	AS1203	Probability & Statistics	3	1	0	4
4	IT1201	Basic Electronics	3	0	2	4
5	IT1202	Bio-Systems Engineering	3	0	0	3
6	MG1201	Philosophy & Human Values	2	0	0	2
Total Credits						21

III Semester

S.No.	Subject Code	Subject	L	T	P	Credits
1	IT2101	Data Structures	3	0	2	4
2	IT2102	Object Oriented Programming	2	0	4	4
3	IT2103	Data Communication	3	0	2	4
4	IT2104	Digital Logic Design	3	0	2	4
5	IT2105	ICT Workshop	0	0	4	2
6	MG2101	Organizational Behavior	2	0	2	3
		Total Credits				21

IV Semester

S.No.	Subject Code	Subject	L	T	P	Credits
1	IT2201	Computer Organization & Architecture	3	0	2	4
2	IT2202	System Analysis and Design	3	0	0	3
3	IT2203	Database Management System	3	0	2	4
4	IT2204	Computer Networks	3	0	2	4
5	IT2205	Control Systems	3	0	0	3
6	MG2201	Industrial Economics	3	0	0	3
		Total Credits				21

V Semester

S.No.	Subject Code	Subject	L	T	P	Credits
1	IT3101	Microprocessor Based System Design	2	0	2	3
2	IT3102	Computer Graphics	3	0	2	4
3	IT3103	Operating Systems	3	0	2	4
4	IT3104	Software Engineering	3	0	2	4
5	IT3105	Design & Analysis of Algorithms	3	1	0	4
6	IT3106	Internet Technologies	3	0	2	4
		Total Credits				23

VI Semester

S.No.	Subject Code	Subject	L	T	P	Credits
1	AS3201	Modeling & Simulation	3	0	2	4
	HS3201	Ecosystem & Sustainable Development	3	0	0	3
3	HS3202	Foreign Language (French / Japanese / German)	2	0	0	2
4	IT3201	Wireless Communication Technologies	3	0	2	4
5	IT3202	Artificial Intelligence	3	0	2	4
6	IT3203	Information Systems Security	3	0	2	4
		Total Credits				21

S.No.	Subject Code	Name	Credits
1	IT3299	Summer Semester Project	6
		Total Credits	6

M. TECH. / MBA CURRICULA**VII Semester (IPG M.Tech.)**

S.No.	Subject Code	Subject	L	T	P	Credits
1	AS4101	Research Methodology	2	0	2	3
2	IT4101	Data Mining & Data Warehousing	3	0	0	3
3	IT4102	Mobile Computing	3	0	2	4
4	IT4103	Modern Cryptography	3	0	2	4
5	IT4104	Cloud Computing	2	0	2	3
6		Elective (To be selected from indicative list of Elective-A)	3/2	0	2	4/3
Total Credits						20/21

VIII Semester (IPG M.Tech.)

S.No.	Subject Code	Subject	L	T	P	Credits
1	HS4201	Foreign Language	2	0	0	2
2	IT4201	Digital Signal Processing	3	0	2	4
3	IT4202	Embedded Systems	3	1	0	4
4	IT4203	Computer Vision	3	0	2	4
5	IT4204	Natural Language Processing	3	0	0	3
6		Elective (To be selected from indicative list of Elective-A)	3	0	0	3
Total Credits						20

Summer Internship: This will consist of internship of 8 weeks during May to June-July.

IX Semester (IPG M.Tech.)

S.No.	Subject Code	Subject	L	T	P	Credits
1	IT5190	Colloquium (Based On Summer Internship)				4
2	IT5199	Major Project Part-I				8
3	MG5101	Knowledge Management	3	0	0	3
4		Elective 1 (To be selected from indicative List of Elective-B)	3	0	0	3
5		Elective 2 (To be selected from indicative List of Elective-C)	3	0	0	3/4
Total Credits						21/22

X Semester (IPG M.Tech.)

S.No.	Subject Code	Subject	Credits
1	IT5299	Major Project Part-II	20
Total Credits			20

Indicative List of Electives-A [IPG(M.Tech (IT))

S.No.	Subject Code	Subject	L	T	P	Credits
1	IT9901	Compiler Design	3	0	0	3
2	IT9902	System Level Design and Modeling	3	0	0	3
3	IT9903	Advanced Topics in Software Engineering	3	0	0	3
4	IT9904	Microelectronics	3	0	0	3
5	IT9905	Advanced Network Technologies	3	0	0	3

Indicative List of Electives-B [IPG(M.Tech (IT))]

S.No.	Subject Code	Subject	L	T	P	Credits
1	IT9906	Distributed Computing	3	0	0	3
2	IT9907	Grid Computing	3	0	0	3
3	IT9908	Distributed Algorithms	3	0	0	3
4	IT9909	Advanced VLSI Architecture	3	0	0	3
5	IT9910	Distributed OS	3	0	0	3

Indicative List of Electives- C [IPG(M.Tech (IT))]

S.No	Subject Code	Subject	L	T	P	Credits
1	IT9911	Reconfigurable Computing	3	0	0	3
2	IT9912	Computational Geometry	3	0	2	4
3	IT9913	Complexity Theory	3	0	0	3
4	IT9914	Advanced topics in VLSI Design	3	0	0	3
5	IT9915	Software Quality Management	3	0	0	3

M.TECH. / MBA CURRICULA**VII Semester (IPG MBA)**

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1101	Principles and Practices of Management	2	0	2	3
2	MG1102	Business Statistics and Research Methodology	2	0	2	3
3	MG1103	Managerial Economics	2	0	2	3
4	MG1104	Business and Legal Environment	2	0	2	3
5	MG1105	Financial Reporting & Management Control	2	0	2	3
6	MG1106	Organizational Behavior-II	2	0	2	3
7	MG1107	Internet Technologies for Business	2	0	2	3
8	MG1108	Business Communication	2	0	2	3
9	MG1109	Seminar I	0	0	2	1 (Audit)
		Total Credits				24

VIII Semester (IPG MBA)

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1201	Human Resource Management	2	0	2	3
2	MG1202	Operations Management	2	0	2	3
3	MG1203	Marketing Management	2	0	2	3
4	MG1204	Decision Modeling	2	0	2	3
5	MG1205	Financial Management	2	0	2	3
6	MG1206	Management Information System	2	0	2	3
7	MG1207	Database Management	2	0	2	3
8	MG1208	Foreign Language	2	0	2	2
9	MG1209	Seminar II	2	0	2	1(Audit)
		Total Credits				23

Summer Internship: This will consist of internship of 8 weeks during May to June-July.

IX Semester (IPG MBA)

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2101	Strategic Management	2	0	2	3
2	MG2102	Project Management	2	0	2	3
3	MG2103	Business Process Management	2	0	2	3
4	MG2104	Business Ethics	2	0	2	3
5		Elective I	2	0	0	2
6		Elective II	2	0	0	2
7		Elective III	2	0	0	2
8	MG2105	Seminar III	0	0	2	1(Audit)
9	MG2106	Colloquium based on Summer internship	0	0	2	1(Audit)
10	MG2107	Comprehension	0	0	6	3(Audit)
11	MG2199	Major Project Part-I	0	0	1 0	5
		Total Credits				23

X Semester (IPG MBA)

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2201	Entrepreneurship and Innovation	2	0	2	3
2	MG2202	International Business	2	0	2	3
3	MG2203	Business Analytics	2	0	2	3
4	MG2204	E-Governance	2	0	2	3
5		Elective IV	2	0	0	2
6		Elective V	2	0	0	2
7		Elective VI	2	0	0	2
8	MG2205	Seminar IV	0	0	2	1(Audit)
9	MG2299	Major Project Part-II	0	0	1 0	5
		Total Credits				23

Indicative List of Electives - D[IPG(MBA)]

S.No.	Subject Code	Subject	L	T	P	Credits
1	MG9901	Internet Business Models & Strategies	3	0	0	3
2	MG9902	IT Enabled Services Management	3	0	0	3
3	MG9903	Public Private Partnership	3	0	0	3
4	MG9904	Service Marketing	2	0	0	2
5	MG9905	Software Project Management	2	0	0	2

Indicative List of Electives-E [IPG(MBA)]

S.No.	Subject Code	Subject	L	T	P	Credits
1	MG9906	Supply Chain Management	2	0	0	2
2	MG9907	Security Analysis and Portfolio Management	2	0	0	2
3	MG9908	Financial Risk management	2	0	0	2
4	MG9909	Change Management	2	0	0	2
5	MG9910	Leadership and Talent Management	2	0	0	2

Indicative List of Electives-F [IPG(MBA)]

S.No.	Subject Code	Subject	L	T	P	Credits
1	MG9911	Service Operations Management	2	0	0	2
2	MG9912	Business Systems Simulation	2	0	0	2
3	MG9913	Total Quality Management	2	0	0	2
4	MG9914	Product and Brand Management	2	0	0	2
5	MG9915	Software Quality Management	2	0	0	2

M.TECH COURSE CURRICULUM

Broadly the structure of M.Tech (CSE) programme with specialization in Advanced Networks/Digital Communication/Information Security/VLSI is as follows:

First Year			Second Year	
First Semester	Second Semester		Third Semester	Fourth Semester
Focus on Introductory and Foundation Courses Advanced Networks/Digital Communication/Information Security/VLSI Credits: 19-21	Focus on Core Functional Areas of Advanced Networks/Digital Communication/Information Security/VLSI Credits: 18-21	Summer Internship of Eight Weeks	Focus on Major Project-I/Thesis-I based on Research Problem In the areas of Advanced Networks/Digital Communication/Information Security/VLSI Credits: 9	Focus on Major Project-II/Thesis-II Research Problem In the areas of Advanced Networks/Digital Communication/Information Security/VLSI Credits: 12

TWO YEARS POSTGRADUATE M.TECH PROGRAMME

Semester I

S.No	Subject Code	Course Title	L	T	P	Credits
1	MT1101/ MT1102	Modeling & Simulation / Advanced Database Management System	3	0	2	4
2	MT1103	Advanced Computer Architecture	3	0	0	3
3	MT1104	Advanced Data Structures & Algorithms	3	0	2	4
4		Specialization Core/Elective				4/3
5		Specialization Core/Elective /Open Elective				4/3
6	MT1105	Communication skills				2
		Total Credits				19/21

Semester II

S.No	Subject Code	Course Title	L	T	P	Credits
1	MT1201/ MT1202	*Advanced Operating Systems/ Digital Signal Processing	3	0	0	3
2	MT1203	Advanced Computer Networks	3	0	0	3
3		Specialization Core/Elective (To be selected from indicative list)				4/3
4		Specialization Core/Elective (To be selected from indicative list)				4/3
5		Open /Specialization Elective (To be selected from indicative list)				4/3
6	MT1204	Research Methodology	2	0	2	3
		Total Credits				18/21

Semester III

S.No.	Subject Code	Course Title	Credits
1	MT2197	Seminar	3
2	MT2199	Major Project Part I	6
		Total Credits	9

Semester IV

S.No.	Subject Code	Course Title	Credits
1	MT2299	Major Project Part II	12
		Total Credits	12

Specialization : Advanced Networks

S.No	Subject Code	Course Title	L	T	P	Credits
1.	MT3301	Cellular and Mobile Communication Systems	3	0	0	3
2.	MT3302	Network Management and Security	3	0	2	4
3.	MT3303	Mobile Computing	3	0	2	4
4.	MT3304	Distributed Computing	3	0	0	3
5.	MT3305	Grid and Peer-to-peer computing	3	0	0	3
6.	MT3306	Queuing Theory and Data Networks	3	1	0	4
7.	MT3307	Quantum Computing	2	0	2	3
8.	MT3308	Special Topics in Networks	3	0	0	3

Specialization: Digital Communications

S.No	Subject Code	Course Title	L	T	P	Credits
1.	MT4401	Communication Systems	3	1	0	4
2.	MT4402	Cellular and Mobile Communication Systems	3	1	0	4
3.	MT4403	Digital Signal Processing	3	0	2	4
4.	MT4404	Advanced Communication Engineering	3	1	0	4
5.	MT4405	Optical Communication	3	1	0	4
6.	MT4406	Adaptive Signal Processing	3	1	0	4
7.	MT4407	Detection and Estimation Theory	3	1	0	4
8.	MT4408	Signal Theory	3	1	0	4
9.	MT4409	Special Topics in Communications	3	0	0	3
10.	MT4410	Mobile Computing	3	0	2	4

Specialization : Information Security

S.No	Subject Code	Course Title	L	T	P	Credits
1	MT5501	Information Privacy and Computer Security	3	0	0	3
2	MT5502	Modern Cryptography	3	0	2	4
3	MT5503	Network Management and Security	3	0	2	4
4	MT5504	Lightweight Security	3	0	0	3
5	MT5505	Verification of Security Protocols	3	0	0	3
6	MT5506	Access Control System and Methodology	3	0	0	3
7	MT5507	Telecommunications, Network and Internet security	3	0	0	3
8	MT5508	Digital Rights Management	3	0	0	3
9	MT5509	Special Topics in Information Security	3	0	0	3
10	MT5510	Cyber Laws and information Crime	3	0	0	3

Specialization: VLSI

S.No	Subject Code	Course Title	L	T	P	Credits
1.	MT7701	MOS-VLSI Circuit Design	3	0	2	4
2.	MT7702	CAD for VLSI	3	0	2	4
3.	MT7703	Mixed Analog-Digital Design	3	0	2	4
4.	MT7704	VLSI Testing & Testability	3	0	2	4
5.	MT7705	VLSI System Design	2	0	2	3
6.	MT7706	Embedded System Design	3	0	0	3
7.	MT7707	Low Power Circuits and Systems	2	0	2	3
8.	MT7708	Digital Signal Processing	3	0	2	4
9.	MT7709	Special Topics in VLSI Design	3	0	0	3

Open Electives

S.No	Subject Code	Course Title	L	T	P	Credits
1	MT9901	Soft Computing	3	0	2	4
2	MT9902	Data Mining and Data Warehousing	3	0	0	3
3	MT9903	Software Engineering	3	0	2	4
4	MT9904	Information Theory and Coding	3	0	0	3
5	MT9905	Advanced Graph Theory	3	0	0	3
6	MT9906	Multiobjective Optimization Methods	3	1	0	4

MBA COURSE CURRICULUM

Broadly the structure of MBA / MBA(ITeS) / MBA(PSM & E-Gov) programme is as follows:

First Year		Summer Internship of Eight Weeks	Second Year	
First Semester	Second Semester		Third Semester	Fourth Semester
Focus on Introductory and Foundation Courses <i>Credits: 24</i>	Focus on Core Functional Areas of Management <i>Credits: 23</i>		Focus on Electives, Project/Thesis <i>Credits: 23</i>	Focus on Electives, Project/Thesis <i>Credits: 18</i>
		Options Available: <ul style="list-style-type: none"> Choose at least three Electives in the focus area of MBA/MBA(ITeS)/MBA PSM & E-Gov. Thesis must be in the area of MBA/MBA(ITeS)/MBA(PSM & E-Gov) 		

TWO YEARS POSTGRADUATE MBA PROGRAMME

Semester I

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1101	Principles and Practices of Management	2	0	2	3
2	MG1102	Business Statistics and Research Methodology	2	0	2	3
3	MG1103	Managerial Economics	2	0	2	3
4	MG1104	Business and Legal Environment	2	0	2	3
5	MG1105	Financial Reporting & Management Control	2	0	2	3
6	MG1106	Organizational Behavior	2	0	2	3
7	MG1107	Internet Technologies for Business	2	0	2	3
8	MG1108	Business Communication	2	0	2	3
9	MG1109	Seminar I	0	0	2	1 (Audit)
Total Credits						24

Semester II

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1201	Human Resource Management	2	0	2	3
2	MG1202	Operations Management	2	0	2	3
3	MG1203	Marketing Management	2	0	2	3
4	MG1204	Decision Modeling	2	0	2	3
5	MG1205	Financial Management	2	0	2	3
6	MG1206	Management Information System	2	0	2	3
7	MG1207	Database Management	2	0	2	3
8	MG1208	Foreign Language	2	0	2	2
9	MG1209	Seminar II	2	0	2	1(Audit)
Total Credits						23

Summer Internship : This will consist of internship of 8 weeks (Three credit component) during May to June-July.

Semester III

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2101	Strategic Management	2	0	2	3
2	MG2102	Project Management	2	0	2	3
3	MG2103	Business Process Management	2	0	2	3
4	MG2104	Business Ethics	2	0	2	3
5		Elective I	2	0	0	2
6		Elective II	2	0	0	2
7		Elective III	2	0	0	2
8	MG2105	Seminar III	0	0	2	1(Audit)
9	MG2106	Colloquium based on Summer internship	0	0	2	1(Audit)
10	MG2107	Comprehension	0	0	6	3(Audit)
11	MG2199	Major Project Part-I	0	0	1 0	5
		Total Credits				23

Semester IV

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2201	Entrepreneurship and Innovation	2	0	2	3
2	MG2202	International Business	2	0	2	3
3	MG2203	Business Analytics	2	0	2	3
4	MG2204	E-Governance	2	0	2	3
5		Elective IV	2	0	0	2
6		Elective V	2	0	0	2
7		Elective VI	2	0	0	2
8	MG2205	Seminar IV	0	0	2	1(Audit)
9	MG2299	Major Project Part-II	0	0	1 0	5
		Total Credits				23

Focus Area wise List of Electives**Marketing Management**

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG3301	Product and Brand Management	2	0	0	2
2	MG3302	E-marketing	2	0	0	2
3	MG3303	Service Marketing	2	0	0	2
4	MG3304	Advertising and Sales Promotion Management	2	0	0	2
5	MG3305	Sales and Distribution	2	0	0	2
6	MG3306	Strategic Marketing	2	0	0	2
7	MG3307	Marketing Research	2	0	0	2
8	MG3308	Social Marketing	2	0	0	2
9	MG3309	Customer Relationship Management	2	0	0	2
10	MG3310	International Marketing	2	0	0	2
11	MG3311	Emerging Areas in Marketing	2	0	0	2

Technology and Operations Management

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG4401	Supply Chain Management	2	0	0	2
2	MG4402	Service Operations Management	2	0	0	2
3	MG4403	New Product and Service Development	2	0	0	2
4	MG4404	Business Systems Simulation	2	0	0	2
5	MG4405	Retail Management	2	0	0	2
6	MG4406	Total Quality Management	2	0	0	2

7	MG4407	Technology Management	2	0	0	2
8	MG4408	Advanced Operations Management	2	0	0	2
9	MG4409	Technology and Operations Strategy	2	0	0	2
10	MG4410	Emerging Areas in Technology and Operations Management	2	0	0	2

IT and Systems

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG5501	Software Project Management	2	0	0	2
2	MG5502	IT and Strategy	2	0	0	2
3	MG5503	Knowledge Management	2	0	0	2
4	MG5504	Software Engineering	2	0	0	2
5	MG5505	Decision Support System	2	0	0	2
6	MG5506	Software Quality Management	2	0	0	2
7	MG5507	Telecommunications Systems Management	2	0	0	2
8	MG5508	Strategic Planning of Information Systems	2	0	0	2
9	MG5509	Emerging Areas in IT and Systems	2	0	0	2

Finance

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG6601	Security Analysis and Portfolio Management	2	0	0	2
2	MG6602	Financial Risk management	2	0	0	2
3	MG6603	Corporate Tax Planning	2	0	0	2
4	MG6604	International Finance	2	0	0	2
5	MG6605	Personal Wealth Management	2	0	0	2
6	MG6606	Project Appraisal and Finance	2	0	0	2
7	MG6607	Corporate Restructuring	2	0	0	2
8	MG6608	Management of Financial Services	2	0	0	2
9	MG6609	Economic and Financial Modeling	2	0	0	2
10	MG6610	Emerging Areas in Finance	2	0	0	2

Human Resource Management

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG7701	Change Management	2	0	0	2
2	MG7702	Organization Theory	2	0	0	2
3	MG7703	Corporate Social Responsibility	2	0	0	2
4	MG7704	Leadership and Talent Management	2	0	0	2
5	MG7705	Competency Management	2	0	0	2
6	MG7706	Training and Development	2	0	0	2
7	MG7707	Management of Employee Relation	2	0	0	2
8	MG7708	Organization Development	2	0	0	2
9	MG7709	Emerging Areas in Human Resource Management	2	0	0	2

Management of Social Sector

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG8801	Infrastructure Management	2	0	0	2
2	MG8802	Public Private Partnerships	2	0	0	2
3	MG8803	Public Policy and Processes	2	0	0	2
4	MG8804	Management of Rural and Social Sector	2	0	0	2
5	MG8805	Sustainable Development	2	0	0	2
6	MG8806	Management of Non Formal	2	0	0	2

		Organization				
7	MG8807	Information Technology Enabled Services	2	0	0	2
8	MG8808	Healthcare System Management	2	0	0	2
9	MG8809	Emerging Areas in Management of Social Sector	2	0	0	2

TWO YEARS POSTGRADUATE MBA(ITeS) PROGRAMME

Semester I

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1101	Principles and Practices of Management	2	0	2	3
2	MG1102	Business Statistics and Research Methodology	2	0	2	3
3	MG1103	Managerial Economics	2	0	2	3
4	MG1104	Business and Legal Environment	2	0	2	3
5	MG1105	Financial Reporting & Management Control	2	0	2	3
6	MG1106	Organizational Behavior	2	0	2	3
7	MG1107	Internet Technologies for Business	2	0	2	3
8	MG1108	Business Communication	2	0	2	3
9	MG1109	Seminar I	0	0	2	1 (Audit)
		Total Credits				24

Semester II

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1201	Human Resource Management	2	0	2	3
2	MG1202	Operations Management	2	0	2	3
3	MG1203	Marketing Management	2	0	2	3
4	MG1204	Decision Modeling	2	0	2	3
5	MG1205	Financial Management	2	0	2	3
6	MG1206	Management Information System	2	0	2	3
7	MG1207	Database Management	2	0	2	3
8	MG1208	Foreign Language	2	0	2	2
9	MG1209	Seminar II	2	0	2	1(Audit)
		Total Credits				23

Summer Internship : This will consist of internship of 8 weeks (Three credit component) during May to June-July.

Semester III

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2101	Strategic Management	2	0	2	3
2	MG2102	Project Management	2	0	2	3
3	MG2103	Business Process Management	2	0	2	3
4	MG2104	Business Ethics	2	0	2	3
5		Elective I	2	0	0	2
6		Elective II	2	0	0	2
7		Elective III	2	0	0	2
8	MG2105	Seminar III	0	0	2	1(Audit)
9	MG2106	Colloquium based on Summer internship	0	0	2	1(Audit)
10	MG2107	Comprehension	0	0	6	3(Audit)
11	MG2199	Major Project Part-I	0	0	1 0	5
		Total Credits				23

Semester IV

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2201	Entrepreneurship and Innovation	2	0	2	3
2	MG2202	International Business	2	0	2	3
3	MG2203	Business Analytics	2	0	2	3
4	MG2204	E-Governance &&	2	0	2	3
5		Elective IV	2	0	0	2
6		Elective V	2	0	0	2
7		Elective VI	2	0	0	2
8	MG2205	Seminar IV	0	0	2	1(Audit)
9	MG2299	Major Project Part-II	0	0	10	5
		Total Credits				23

List of Electives**IT Enabled Services**

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG5501	Software Project Management	2	0	0	2
2	MG5502	IT and Strategy	2	0	0	2
3	MG5503	Knowledge Management	2	0	0	2
4	MG5504	Software Engineering	2	0	0	2
5	MG5505	Decision Support System	2	0	0	2
6	MG5506	Software Quality Management	2	0	0	2
7	MG5507	Telecommunications Systems Management	2	0	0	2
8	MG5508	Strategic Planning of Information Systems	2	0	0	2
9	MG5509	Emerging Areas in IT and Systems	2	0	0	2

TWO YEARS POSTGRADUATE MBA(PSM & E-Gov) PROGRAMME**Semester I**

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1101	Principles and Practices of Management	2	0	2	3
2	MG1102	Business Statistics and Research Methodology	2	0	2	3
3	MG1103	Managerial Economics	2	0	2	3
4	MG1104	Business and Legal Environment	2	0	2	3
5	MG1105	Financial Reporting & Management Control	2	0	2	3
6	MG1106	Organizational Behavior	2	0	2	3
7	MG1107	Internet Technologies for Business	2	0	2	3
8	MG1108	Business Communication	2	0	2	3
9	MG1109	Seminar I	0	0	2	1 (Audit)
		Total Credits				24

Semester II

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG1201	Human Resource Management	2	0	2	3
2	MG1202	Operations Management	2	0	2	3
3	MG1203	Marketing Management	2	0	2	3
4	MG1204	Decision Modeling	2	0	2	3
5	MG1205	Financial Management	2	0	2	3
6	MG1206	Management Information System	2	0	2	3
7	MG1207	Database Management	2	0	2	3
8	MG1208	Foreign Language	2	0	2	2
9	MG1209	Seminar II	2	0	2	1(Audit)
		Total Credits				23

Summer Internship : This will consist of internship of 8 weeks (Three credit component) during May to June-July.

Semester III

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2101	Strategic Management	2	0	2	3
2	MG2102	Project Management	2	0	2	3
3	MG2103	Business Process Management	2	0	2	3
4	MG2104	Business Ethics	2	0	2	3
5		Elective I	2	0	0	2
6		Elective II	2	0	0	2
7		Elective III	2	0	0	2
8	MG2105	Seminar III	0	0	2	1(Audit)
9	MG2106	Colloquium based on Summer internship	0	0	2	1(Audit)
10	MG2107	Comprehension	0	0	6	3(Audit)
11	MG2199	Major Project Part-I	0	0	1 0	5
		Total Credits				23

Semester IV

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG2201	Entrepreneurship and Innovation	2	0	2	3
2	MG2202	International Business	2	0	2	3
3	MG2203	Business Analytics	2	0	2	3
4	MG2204	E-Governance	2	0	2	3
5		Elective IV	2	0	0	2
6		Elective V	2	0	0	2
7		Elective VI	2	0	0	2
8	MG2205	Seminar IV	0	0	2	1(Audit)
9	MG2299	Major Project Part-II	0	0	10	5
		Total Credits				23

List of Electives**Public System Management and e-Governance**

S.No	Subject Code	Course Name	L	T	P	Credits
1	MG8801	Infrastructure Management	2	0	0	2
2	MG8802	Public Private Partnerships	2	0	0	2
3	MG8803	Public Policy and Processes	2	0	0	2
4	MG8804	Management of Rural and Social Sector	2	0	0	2
5	MG8805	Sustainable Development	2	0	0	2
6	MG8806	Management of Non Formal Organization	2	0	0	2
8	MG8807	Healthcare System Management	2	0	0	2
9	MG8808	Emerging Areas in Management of Social Sector	2	0	0	2

Ph.D Programme

Broadly the structure of Ph.D programme is as follows:

Programme Duration Five Years (General)		
Stage - I	Course Work	Course Work as a foundation for the proposed Research area <i>Credits: 12-20 (as suggested by Student Research Committee)</i> Currently, the candidate has to take courses available from M Tech/MBA and IPG streams.
Stage - II	Comprehensive Examination (with in 18 months of joining the programme)	Written /Oral examination as comprehension of his broad field of research and academic preparation and potential to carry out the proposed research plan
Stage - III	Pre-synopsis Seminar	Assessment of the research work through the pre-synopsis seminar, as a qualifier for submission as a Ph.D thesis
Stage - IV	Thesis Submission	The thesis shall contain critical account of the candidate's research, characterized by discovery of facts or fresh approach towards interpretation of facts and theories or significant contribution to knowledge It should bear evidence of the candidate's capacity for analysis and judgment as well as his ability to carry out independent investigation, design or development.
Stage - V	Thesis Evaluation	Thesis is evaluated by One Indian Examiner and One Foreign examiner and the Supervisor(s)
Stage - VI	Ph.D. Defense/Viva	Oral Defense Viva is conducted on the recommendation of the thesis for the award of Ph.D degree by the Examiners by a Oral Defense Committee

Course Contents

Note: The course contents are indicative only.

AS1101: Engineering Mathematics – I 4 credits (3-1-0)

Matrices: Introduction and Rank of a matrix, Elementary transformation of a matrix, Gauss-Jordan method of finding the inverse, Linear dependence, Consistency of linear system of equations, Partition method of finding the inverse, Linear transformation and Orthogonal transformation, Eigen value and eigen vectors, Properties of eigen values, Cayley Hamilton theorem, Reduction to diagonal form, Complex matrices. Partial Derivatives: Partial Derivatives, Homogeneous Equations, Euler's theorem and Applications, Total Derivatives, Change of variables, Chain rules and problems, Taylor's theorem for function of two variables and applications, Errors and approximations of functions of multi-variables, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers. Differential Equations: Formation of DE and first order DE, Linear differential equations, Exact differential equations, Reducible to exact differential equations and problems, Higher order linear differential equations, Method of Variation and Undetermined coefficients for finding P.I., Reducible to linear differential equations, Application of DE (orthogonal trajectories, Physical applications, L-R electrical series circuit, Oscillatory electrical circuit). Solid Geometry: Equation of Sphere, section of a sphere by a plane, tangent plane, orthogonal spheres, Equation of cone, Right circular cone, Equation of cylinder, Right cylinder cone, Ellipsoid, Hyperboloid of one and two sheet, Few standard Surface of revolutions. Vector Calculus: Introduction and Differentiation of vectors, Curves in space, Scalar and vector point functions, Gradient, Directional derivatives and problems, Physical interpretation of Divergence, Curl and applications, Del applied twice to a point functions, Integration of vectors, line integrals, Surface and Green's theorem, Stoke's theorem, Multiple integral

concepts and Volume integrals, Gauss Divergence theorem, Irrotational and Solenoidal fields.

AS1102: Physics-I 4 credits (3-0-2)

Quantum Mechanics-I: Dual nature of matter, de-Broglie Hypothesis, phase velocity and group velocity, their relations, wave function & its physical significance, probability density, Schrodinger's wave equation, eigen values & eigen functions, applications. Electronic conduction in solids: Drude-Lorentz Theory, Drift velocity, relaxation time, mean collision time, mean free path, Electrical conductivity, Quantum free electron theory, density of energy states, Fermi energy, thermionic emission. Lasers: Interaction of radiation with matter, Einstein Coefficients, Types of Lasers, Solid state lasers, Ruby lasers, He-Neon Laser, Applications of Lasers, Holography & its applications. Optical Fibers : Optical fibers, propagation of light through a cladded fiber, total internal reflection, acceptance angle and acceptance cone, numerical aperture, types of optical fibers, modes of propagation, applications of fiber optics in information technology (IT). Current trends in Engineering. applications : Quantum information & quantum computing, evolution of quantum theory, quantum computer, nanoscale systems and nanotechnology, nanoscience and technology, composite materials, smart materials and structures, nano and micromechanical systems (NEMS and MEMS).

AS1201: Engineering Mathematics – II 4 credits (3-1-0)

Double integration, Cartesian and Polar Co-ordinates, Change of order of integration, Area as a double integral, Change of variables between Cartesian and Polar Co-ordinates, Triple integration, Volume as a triple integral. Gradient, Divergence and Curl , Directional derivative, Irrotational and Solenoidal vector fields, Vector

integration, Problem solving using Green's theorem, Gauss divergence theorem and Stoke's theorem. Analytic Functions, Cauchy-Riemann equations, Properties of analytic functions, Harmonic conjugate, Construction of Analytic, Conformal mapping, bilinear transformation. Complex Integration, Problems solving using Cauchy's integral theorem and integral formula Taylor's and Laurent's expansions, Residues, Cauchy's residue theorem, Contour integration over unit circle, Semicircular contours with no pole on real axis. Laplace transforms, Transforms of elementary functions, Basic properties, Transforms of derivatives and integrals, Initial and final value theorems, Inverse Laplace transforms, Convolution theorem, Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms, Transform of periodic functions, Solution of integral equations.

AS1202: Physics-II

4 credits (3-0-2)

Pre-requisites: AS1101

Structure of materials, Properties of materials, Transforming materials, Structure and transformation of materials, Electronic properties of materials, Mechanical properties, Engineering applications of materials.

AS1203: Probability & Statistics

4 credits (3-1-0)

Introduction, Measures of Central Tendency and Dispersion in Frequency Distributions, Arithmetic Mean, Weighted Mean, Geometric Mean, Median, Mode, Dispersion, Ranges, Coefficient of Variation. Probability, Basic terminology, Types of Probability, Probability rules, Probability distribution, Binomial distribution, Poisson distribution, Normal distribution. Sampling and Sampling Distribution, Random sampling, Design of Experiments, Sampling distribution, Relationship between sample size and standard error. Testing Hypotheses: One Sample Test, Basics to hypotheses – testing procedure, Testing hypotheses, Hypotheses testing of means, measuring the power of hypotheses test. Testing Hypotheses: Two Sample Test, Testing for differences between means and proportions, Testing differences between means with dependent samples, Probability values. Chi – Square and Analysis of Variance, Shi – Square as a test of independence, Testing the appropriateness of a

distribution, Analysis of variance, Inference about a population variance.

Simple Regression and Correlation: Estimation using the regression line, Correlation analysis, making inferences about population parameters.

Multiple Regression: Multiple regression and correlation analysis, Finding multiple regression equation, Inferences about population parameters.

Time Series and Forecasting, Variation in time series, Trend Analysis, Cycle Variation, Seasonal Variation, Irregular Variation, Time series analysis in forecasting. Activities: Software development in C++ to generate Normal Distribution Curves, Paper Submission on advanced topics related to the application of statistics.

AS3201: Modeling & Simulation

4 credits (3-0-2)

Pre-requisites:AS1203

Introduction and basic simulation procedures. Model classification : Monte Carlo simulation, discrete-event simulation, continuous system simulation, mixed continuous/discrete-event simulation. Quantitative modelling paradigms: queueing networks, stochastic process; algebras and stochastic Petri nets Input and output analysis: random numbers, generating and analysing random numbers, sample generation, trace- and execution-driven simulation, point and interval estimation. Variance reduction techniques, Process-oriented and parallel and component simulation and modelling.

AS4101: Research Methodology

3 credits (2-0-2)

Research methodology: introduction and motivation, types of research, research approaches, Significance of research, research methods versus methodology, Defining the research problem, selecting the problem, techniques involved in defining a problem, Measurement in research, measurement scales, sources of error in measurement; technique of developing measurement tools, scaling, Methods of data collection ,Case study method, meaning, advantages, limitations, Meaning of interpretation, significance of report writing, different steps in writing report

HS1101: Language & Communication Skills

3 credits (2-0-2)

Importance of Effective Communication; Reading, writing and oral communication skills; Methods/Modes of communication, choice of

media; Barriers to communication. Basics of Technical report Writing, Referencing methods, Visual communication and its impact, Hands-on-experiences and Case studies

HS3201: Ecosystem & Sustainable Development
3 credits (3-0-0)

Ecology of Tropical Eco-systems, Eco-systems and the context of Economic Development in India, Agriculture and Resource Use, Grasslands, Forests in India, Biodiversity and Wildlife Management in India. Water, Traditional Water Management, Modern Water Management in India, Alternative Water Management, Watershed Development, Marine Eco-system. Approaches to Restoration, Landscape Ecology and Restoration, Restoration of Land, Civil Engineering Works and Care for Nature, Restoration of Rivers, Streams, Lakes and Reservoirs, Integrated Aquatic Ecosystem Management, Restoration in the context of Sustainability, Globalization and Sustainability, Environmental Law.

HS3202: Foreign Language (French / Japanese / German)

2 credits (2-0-0)

Pre-requisites: HS1101

Language such as French, Japanese, German will be covered. Basics of communication and syntax and semantics related to foreign language, Verbal and written communication, simple constructs and case studies, Video/audio based Exercises

HS4201: Foreign Language

2 credits (2-0-0)

Pre-requisites: HS1101

Language such as French, Japanese, German will be covered. Basics of communication and syntax and semantics related to foreign language, Verbal and written communication, simple constructs and case studies, Video/audio based Exercises

IT1101: Basic Electrical Engineering

4 credits (3-0-2)

Basic Concepts: System of units, Energy. Electric Charge, current, electromotive force and potential difference. Ohm's Law, Faraday's law of electromagnetic induction, Kirchhoff's laws, Ampere's law, Electrical and Electronic materials and devices. Circuit Elements: Resistors, conductors and inductors, Active and passive

circuit elements, Dependent and independent current and voltage sources, Reference directions and symbols, Power and energy, Resistance parameter, Inductance parameter, Capacitance parameter, Operational Amplifier and its role as circuit element and as controlled source. Elementary Network Theory: Series and parallel combination of resistances, capacitances and inductances, Network analysis by Kirchhoff's laws. Superposition theorem. Thevenin's theorem. Norton's theorem. Delta-Star transformation. Maximum power transfer. Inductance in a DC Circuit: Inductive and non-inductive circuit. Inductance of air-cored and iron-cored coil. Growth and decay of current in LR circuit. Energy storage. Mutual inductance and coupling coefficient. AC Fundamentals: Generation of single phase and three phase alternating e.m.f. Relationship between frequency, speed and number poles. RMS, average, instantaneous and Peak Values of sinusoidal waveform. Voltages and currents in star and delta circuits. Inductive reactance and impedance of RL load. Phasor representation of alternating quantity. Active, reactive and apparent powers, power factor and power triangle. Working principle of transformer.

IT1102: Computer Programming

4 credits (2-0-4)

Introduction to Computers, Introduction to Linux, Introduction to C, Simple Computer Programs, Numeric Constants and Variables, Arithmetic Expressions, Input and Output, Conditional Statements, Looping, Arrays, Logical expressions, More control Structures, Functions, Recursive Functions, Character Strings, Structures, Pointers, Linked Lists.

IT1201: Basic Electronics

4 credits (3-0-2)

Pre-requisites: AS1102, IT1101

Introductions to Electronics and its Applications: Transducers, Processing, Electronics Devices, Circuits and Systems, Analog and Digital Systems Applications of Electronics.

Modeling: Ideal Voltage source, Resistance, battery and its Model, Capacitor and its Model, Inductance and its model, Voltage Source and Current Source, Power and Energy, transformer.

Circuit Analysis: Circuit elements R, L and C, Network theorem: Kickoff's Current law (KCL), Kickoff's Voltage law (KVL), Application of Kickoff's Laws, Loop and node method of circuit analysis, Superposition, Thevenin's and Norton's

theorems, Maximum Power Transfer theorem and Application. AC Fundamental: Single phase a.c. circuits, Phasor for a.c. analysis, real and reactive power, n.m.s. value, series AC circuit: AC through Resistance and Inductance, Power factor, Active and reactive components of circuit current, Q factor of a coil. AC through Resistance and Capacitance. Resonance in R-L-C circuit, Graphic representation of Resonance curve. Terminal characteristics of transformer. Semiconductor devices and application: Diode and transistor circuits: Application of Diode, Rectifiers, filters clipping and clamping circuits. Voltage regulation using Zener Diode. Bipolar and field effect transistors, characteristics, biasing and small signal equivalent circuits, basic amplifier circuits, differential amplifier circuits. Principal of feedback. Operational amplifiers, applications of operational amplifiers including analogue computation.

IT1202:Bio-Systems Engineering
3 credits (3-0-0)

Principles of Biology, Mechanical Power for Bio-systems, Natural Resource Conservation Engineering, Hydraulic Transport in Bio-systems, Intro to Geospatial Technologies for Bio-systems, Instrumentation & Controls in Bio-systems, Process Engineering in Bio-systems, Waste Management & Utilization Engineering, Irrigation Systems Design, Engineering Design for Bio-systems.

IT2101:Data Structures
4 credits (3-0-2)

Pre-requisites: IT1102

Order Notation, complexity of Algorithms, Stacks, Queues, Skip Lists, Sorting and Searching, Selection, Heap Sort, Merge Sort, Bucket Sort, Radix Sort, Range Reduction Technique for Integer Sorting. Trees, Search Trees, Dictionary, Mergable Heaps, Concatenable Queues, Height Balanced Trees, k-heaps, Disjoint Set Union, Traversal of trees, Analysis of Disjoint Set Union. Graphs, Depth First Search, Breadth First Search, Shortest Path, Minimum Spanning Trees.

IT2102: Object Oriented Programming
4 credits (2-0-4)

Pre-requisites:IT1102, IT2101

Language Design Issues: Why study Programming Languages, a short history of programming languages, development of early languages, evolution of software architecture, application domains, Role of Programming Languages: What makes a good language, language Paradigms,

language standardization, Internationalization, Programming. Environments: Effects On Language Design, Environment Frameworks, job control and process languages, C overview, suggestions for further reading. Impact of Machine architectures: The Operation of a computer, computer Hardware, Firmware computer, translators and virtual architecture, Virtual Computers and Binding Times: Virtual Computers and Languages Implementations, Hierarchies of Virtual machines, binding and binding time, java overview.Language Translation Issues: Programming language syntax, general syntactic criteria, syntactic elements of a language, overall program subprogram structure stages in transition, analysis of the source program, synthesis of the object program, formal translation models: BNF grammars, finite state automats, pearl overview, pushdown automata, general parsing algorithms, recursive descent parsing, Pascal overview, suggestions for further reading. Modeling language properties: Formal properties of language cloudily hierarchy, undividable complexity language semantics: Attribute grammars, denotation semantics, ML overview, program verification, algebraic data types, suggestions for further reading.Elementary data types: Properties of types and objects, Data objects variables and constants, data types, declarations, type conversion,. Assignment and initialization, scalar data types: Numeric data types, enumerations, Booleans, character, composite data types: character strings, pointers and programmer constructed data objects, files and input output, Fortran overview, suggestions for further reading. Encapsulation: structured Data types, structured data objects and data types, specification of data structure types, implementation of data structure types, declarations and type checking for data structures, vectors and arrays, records, lists, sets, executable data objects, abstract data types, evolution of the data type concept, information hiding, encapsulation by subprograms, subprograms As abstract operations, subprogram definition and Invocation, subprogram definitions as data objects, type definitions: type equivalence type definitions with parameters, C++ overview, suggestions for further reading. Inheritance: Abstract data types Revisited, Inheritance, derived classes, methods, abstract classes, Smalltalk overview, objects and messages, abstraction concepts, polymorphism, suggestions for further reading.

IT2103:Data Communication**4 credits (3-0-2)**

Data Communication Concepts and Terminology: Data Representation, Data Transmission, Modes of Data Transmission, signal Encoding, Frequency Spectrum, Transmission Channel, Data communication, Directional Capabilities of Data Exchange. Transmission Media :Transmission Line Characteristics, Liner Distortions, Transmission Line Characteristics in Time Domain, Crosstalk, Metallic Transmission Media, Optical Fiber, Base band Transmission of Data Signals, Equalization for Minimizing Inter symbol Interference, Clocked Regenerative Receiver, Eye Pattern, Telephone Network, Long Distance Network, Transmission Media for Long Distance Network, Echo in Transmission Systems, Noise in Transmission Systems, signal Impairments, Networking Options, CCITT Recommendation for Leased Circuits. Modems and Data Multiplexers : Digital Modulation Methods, Multilevel Modulation, Differential PSK Modern, Standard Modems, Limited Distance Modems and Line Drivers, Group Band Error Control Transmission Errors, Coding for Error Detection and Correction, Error Detection Methods, Forward Error Correction Methods, Reverse Error Correction. Reference Model For Open System Interconnection Topology computer Network, Elements of Meaningful Communication, Transport Oriented Functions, Meaningful Communication in a Distributed Computing System, Components of a Computer Network, Architecture of a Computer Network, Network Architecture Models, Layered Architecture of the OSI Reference, OSI Terminology, Role of OSI Reference Model in Standards Development. The Physical Layer :The Physical Layer, Functions Within the Physical Layer, Relaying Function in the Physical Layer, Physical Layer, Physical Medium Interface, Physical Layer Standards, EIA-232-D Digital Interface, EIA-232-D Interface, Specifications, Common Configurations of EIA-232-D Interface, Limitations of EIA-232-D, RS – 449 Interface, CCITT X.21 Recommendations. The Data Link Layer :Need for Data Link Control, The Data Link Layer, Frame Design, Considerations, Flow Control, Data Link Error Control and Data Link Management.

IT2104:Digital Logic Design**4 credits (3-0-2)****Pre-requisites: IT1201**

Designing & Problems using Combinational circuits, Designing & Problems using Sequential circuits, Code Converters, Designing of Combinational circuits using ICs, Designing of Sequential circuits using ICs, Logic Families (RTL, DTL, DCTL, HTL, TTL, ECL, MOS), Designing & Problems using OP-AMP (Operational Amplifiers), Designing & Problems using Timer (555) circuits, Analog to Digital Converters, Digital to Analog Converters, Applications of all the above mentioned topics.

IT2105: ICT Workshop**2 credits (0-0-4)****Pre-requisites: AS1102, IT1201**

Electrical circuits, Electro-mechanical machines, mechanical machines, PC hardware, Accessories; Input/output devices such as disk drives, Printer, mouse etc., Computer networking. , Hands-on experiments on microprocessor circuits etc.

IT2201:Computer Organization & Architecture**4 credits (3-0-2)****Pre-requisites: IT2104**

Introduction to computers – Evolution, programming and Architecture, Evolution of Computers, Hardware and Firmware, Computer Software: Introduction to computer Programming, Operating System, Types of computer, Basic Computer Architecture (8086 architecture), Future Trends, Review, Digital Logic Flip – Flops etc Data Representation, Integer representation number systems (Binary, Octal, decimal, hexadecimal), compliments (r's compliment, r-1's compliments) Binary coded decimals, Character Representation – ASCII, Floating Point Numbers – IEEE standards, normalization. Computer Arithmetic, Half Adder, Full Adder, Ripple Carry and Carry Look – ahead adders, Multipliers – Booth's Algorithms, Floating Point Arithmetic, underflow, overflow, Precision consideration – guard bits, rounding, truncation. Processor: Processor organization, Registers – special purpose (Program Counter) and general purpose, Instruction cycle, ALU design. Instruction set of a processor, Types of operands, Types of operations, addressing modes and Instruction formats. Memory: RAM, ROM, DRAM vs SRAM, Organization of memory cells inside a memory chip, Interfacing of Memory with Processor, Cache Memory – Mapping Function, replacement algorithm, write policy, block size, number of caches (levels) Input / Output Organization,

Program controlled, Interrupt driven (priority interrupts, daisy chaining). Direct Memory access, I/O interfaces – serial vs parallel communication, Bus interconnection. Control Unit: Micro – operations – hardwired implementations, micro – programming (micro – instruction sequencing and execution, application). Computer peripherals: Key Board, Monitor, Introduction to graphic adapters, hard disk, floppy disk drive, tape drive, CD – ROMs, Printers – dot matrix, inkjet and laser jet. Advanced Topics: Pipelining, Virtual Memory, RISC, Parallel Architecture.

IT2202: System Analysis and Design

3 credits (3-0-0)

Principles of system analysis, systems analysis methods, and tools, systems analysis standards and measures, Process-oriented life cycle, Project management principles and tools, Analyzing an existing information system, Planning and organizing an information systems development project, Analysis of business processes, Development of process models, data models and use case models for an information system, Defining object, data and process models, CASE tools, Making of a business case for a technological solution, Feasibility study/cost benefit analysis, System stakeholders, Solving problems from various perspectives, Observation, Questionnaires and interview schedules to discover system, Observation and communication skills, Alternative solutions to an information systems problem and choosing among them, Process and data representations, Documenting information system requirements, Prototype a user interface for a new information system.

IT2203: Database Management System

4 credits (3-0-2)

Introduction: Database Systems Application, Database systems File Systems, View of data, Data Models, Database Language, Database Users and Administrators, Transaction Management, Database system structure, Application Architectures, History of Database systems. Diagram, Week entry sets, Extended E-R features, design of an E-R database Schema, Reduction of an E-R Schema to Tables. Relational Model: Structure of Relational database, the relational Algebra, Extended Relational – Algebra Operations, Modification of the Database, View. SQL: Background, Basic Structure, SET Operations, Aggregate Functions, Null Values, Nested sub queries, Views, Complex Queries, Modification of

the Database, Joined Relations, DDL, Other SQL features. Integrity and Security: Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authorization. Relational Database Design: First Normal Form, Pitfalls in Relational database Design, Functional Dependencies, Decomposition, Desirable Properties of Decomposition, Boyce – Codd Normal Form, Third Normal Form, Fourth Normal Form, Fifth Normal Forms, Overall Database Design Process. Storage and File Structure: Overview of Physical Storage Media, magnetic Disks, RAID, Tertiary Storage, Storage Access File Organization, Organization of Records of Files, Data – Dictionary Storage. Indexing and Hashing: Basic Concepts, Ordered Indices, B tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Index Definition in SQL, Multiple Key Access. Query Processing: Overview, Measures of Query cost, Selection Operation, sorting, Join Operation, Other Operations, Evolution Plans, Materialized View. Transaction: Transaction Concepts, Transaction state, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Transaction Definition in SQL, Testing for Serializability. Concurrency Control: Lock Based Protocols, Timestamp based Protocols. Validation based Protocols, Multiple Granularity, Multi Version Schemes, Deadlock Handling, Insert and Delete Operations. Recovery Systems: Failure Classification, Storage Structure, Recovery and Atomicity, log Based recovery, Shadow Paging, recovery with Concurrent Translation, Buffer Management, Failure with Loss of Nonvolatile Storage, Advance Recovery Techniques. Database System Architecture: Centralized and Client Server Architecture, server System Architectures, Parallel Systems, Distributed Systems, Network Types.

IT2204: Computer Networks

4 credits (3-0-2)

Pre-requisites: IT2103

Introduction: Overview of computer networks, seven – layer architecture, TCP/IP suite of protocols, etc.

MAC protocols for high – speed LANs. And wireless LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc).

ATM Networks, ATM layer, ATM Adaptation Layers. Congestion control, Signaling, Routing, QoS support, Neighbor – discovery, Auto – configuration, Changes to other protocols, Application, Programming Interface for IPv6. 6bone. Mobility in networks. Mobile IP. Security related issues. IP Multicasting. Multicast routing protocols, transaction – oriented applications. Other new options in TCP. Network security at various layers. Secure – HTTP, SSL, ESP, Authentication header, key distribution protocols. Digital signatures, digital certificates.

IT2205:Control Systems

3 credits (3-0-0)

System concept, differential equations and transfer functions. Modelling of electric systems, translational and rotational mechanical systems, electro-mechanical systems. Block diagram representation of systems, Block diagram reduction methods- Closed loop transfer function, determination of signal flow graph. Mason's gain formula, Test signals- time response of first order and second order systems, time domain specifications, types and order of systems, generalised error co-efficients, steady state errors- concepts of stability-Routh-Hurwitz stability, root locus. Correlation between time and frequency response, stability analysis using Bode plots, Polar plots, Nichols chart and Nyquist stability criterion, Gain margin, phase margin, Realization of basic compensators, cascade compensation in time domain and frequency domain and feedback compensation, design of lag, lead, lag-lead compensator using Bode plot and Root locus, Introduction to P, PI and PID controllers. Stepper motors, AC servo motor, DC servo motor, Synchros- sensors and encoders, DC tacho generator, AC tacho generator, Hydraulic controller, Pneumatic controller, Typical application of control system in industry.

IT3101: Microprocessor Based System Design

3 credits (2-0-2)

Pre-requisites:IT2104

Intel 8086 architecture, addressing modes, instruction set, format, assembler directives, Assembly language programming, Architectural features of 80286, 80386, 80486, Pentium, Pentium Pro, Celeron, PII, PIII & P4 processors, multimedia extensions- Applications, Microprocessors for Control Applications, Micro controller based

design of a system, Real time control using micro controllers. Interfacing with peripheral devices, Peripheral Controllers, Bus concepts, Bus Standards, Introduction to Co-processors, DSP Processors, Graphic Processors and their applications.

IT3102:Computer Graphics

4 credits (3-0-2)

Introduction, what is Computer Graphics? Elements of Graphics Workstation, Video Display Devices, Raster Scan System, Random Scan Systems, Input Devices, Graphics Algorithms: Line Drawing algorithms, DDA Algorithms, Bresenham's Line Algorithm, Frame Buffers, Circle and Ellipse Generating Algorithms, Midpoint Circle Algorithms, Midpoint Ellipse Algorithms, Polynomials and Spline Curves, Filling – Filled Area Primitives, scan – Line Polygon Fill Algorithm, Inside Outside Tests, Character Generation, Attributes of Lines, Curves, Filling Characters etc. Graphics Primitives, Primitive Operations, The Display File, Interpreter – Normalized Device Coordinates, Display – File, Structure Display File Algorithms, Display Control, Polygons Polygon Representation. Attributes of Output Primitives, Line Attributes – Line Attributes – Line Types, Line Width, Pen and Brush Options, Line Colour, Colour and Grayscale Levels – Colour Tables, Grayscale, Area Fill Attributes – Fill Styles, Pattern Fill, Soft Fill – Character Attributes, Text Attributes. Geometric: Transformation : Matrices, Scaling Transformations, Sin and Cos Rotation, Homogeneous Coordinates and Translation, Coordinate Translations, Rotation about an arbitrary point, Inverse Transformations, Transformation Routines. Two – Dimensional Viewing, The Viewing Pipeline, Viewing Coordinate Reference Frame, Window – to – viewpoint Coordinate, Transformation, Two – Dimensional Viewing Functions, Clipping Operations, Point Clipping, Line Clipping, Cohen Sutherland Line Clipping, Polygon Clipping, Sutherland Hodgeman Polygon Clipping. Three Dimensional Concepts: Three Dimensional Display Methods, Parallel Projection, Perspective Projection, Visible Line and Surface Identification, Surface Rendering, Three Dimensional Object Representation, Bezier Curves and Surfaces, B-

Spline Curves and Surfaces, Visibility, Image and Object Precision, Z-buffer Algorithm, Floating Horizons. Computer Animations, Design of Animation, Sequences, General Computer Animation Functions Raster Animations, Key – Frame Systems, Morphing, Simulating Accelerations, Motion Specifications, Kinematics and Dynamics.

IT3103: Operating Systems

4 credits (3-0-2)

Pre-requisites: IT2101, IT2104

Introduction to Processes; CPU Scheduling: Multiprogramming and time – sharing, scheduling approaches (SJF, FIFO, round robin etc). Input / Output: Device Controllers and Device Drives, Disks, other Devices. ; Memory Management: with and without swapping, Neutral Memory – Paging and segmentation, page Replacement Algorithms, Implementation. File Systems: FS Services, Disk Space Management. Deadlocks: Modeling, Detection and Recovery Prevention and Avoidance, Example Systems, UNIX, MSDOS.

IT3104: Software Engineering

4 credits (3-0-2)

Pre-requisites: IT2202

Concepts and techniques relevant to production of large software systems: Structured programming, Requirements specification and analysis. Top-down design and development, Information hiding, abstraction, modularity, object-oriented techniques. Separate compilation, configuration management, program libraries Design patterns, UML Documentation, validation, Quality assurance, safety, Testing and test case generation, Software metrics, Cost analysis and estimation, manpower and time management. Organization and management of large software design projects.

IT3105: Design & Analysis of Algorithms

4 credits (3-1-0)

Pre-requisites: IT2101

Review and Proof Techniques; Algorithm and Problem Solving: Classic Techniques for Algorithm Design, Problem Solving in the Object Oriented paradigm, and application of algorithm design techniques to a medium sized project with an emphasis on formal methods of testing.

Basic Algorithmic analysis: Asymptotic analysis of upper, average and lower complexity bounds, identifying differences among best average and worst case behavior, big “Oh” notation (O),

standard complexity classes, empirical measurements of performance, time and space tradeoffs in algorithms.

Fundamentals Algorithmic Strategies: Brute – force, greedy, divide and conquer, Backtracking, branch – and – bound, heuristics, pattern matching and string / text algorithms.

Fundamental Computing algorithmic: Hash table, binary search trees, graphs, depth and breadth first traversals, shortest path algorithms (Dijkstra’s and Floyd’s algorithms), transitive closure (Floyd’s algorithms), minimum spanning tree (Prim’s and Kruskal’s algorithms), topological sort.

The Complexity Classes P and NP: Classes of P and NP – Hard problems, Boolean satisfiability and its application to solve real – worlds problems.

IT3106: Internet Technologies

4 credits (3-0-2)

Pre-requisites: IT2204

Basics of Networking, network Programming in JAVA, Remote Method Innovation and RPC, Database Programming in JVA, Web – Based Programming (Servlets and JAVA Server Pages), Development of Web – Based 3 – Tier Architecture, Enterprise Based Programming, Enterprise JAVA Beans, JAVA Messaging Server, XML Programming (Creation and Paging) WEB Services Programming SQAR WSDI.

IT3201: Wireless Communication Technologies

4 credits (3-0-2)

Pre-requisites: IT2103

Evolution of wireless communication, Wireless generations and standards. Fundamentals of cellular systems, Operation of cellular system, Concept of frequency reuse, Channel assignment strategies, Hand off strategies, Co-channel and Adjacent channel interference, Trunking and grade of service. Cell splitting, Sectoring. Mobile Radio signal propagation, path loss and channel models: Large Scale Path Loss, Small Scale Path Loss - Rayleigh and Rician Fading. Modulation techniques for mobile radio. Multiple access techniques , Case studies in applications

IT3202: Artificial Intelligence

4 credits (3-0-2)

Problem solving, search techniques, control strategies, game playing (minimax), reasoning, knowledge representation through predicate logic rule ;based systems, semantics nets, frames, conceptual dependency formalism. Planning, Handling uncertainty: Bayesian Networks,

Dempster-Shater theory, certainty factprs, Fuzzy logic Learning through Neural nets-Back propagation, radial basis functions, Neural computationjal models - Hopfield Nets, Boltzman machines, PROLOG programming Expert Systems.

IT3203: Information Systems Security

4 credits (3-0-2)

Introduction to security and privacy issues associated with information systems. Control of access through technical and physical means. Confidentiality, integrity, Identification and authentication. Management of encryption systems, key protection and distribution. Privacy legislation and technical means of providing privacy. Operating System security, Database security.

IT3299: Summer Semester Project

6 credits (0-0-12)

In Summer Semester Projects the students undertake projects as a requirement for the completion of B.Tech. Programme. They are expected to formulate a problem, study the relevant literature and come out with an algorithm/software/implementation plan related to the problem formulated.

IT4101: Data Mining & Data Warehousing

3 credits (3-0-0)

Pre-requisites:IT2203

Basic data warehouse architecture, data consolidation, warehouse internals: Storage and indexing, materialized views and aggregate pre-computation, online analytical processing (OLAP) systems, data mining; Main operations: Clustering, Classification, regression, neural networks, feature selection, deviation detection, Item set Associations, discoveries along time, similarity of complex objects, system Integration issues in decision support tools, survey of existing mining and OLAP products, success and failure of data mining.

IT4102: Mobile Computing

4 credits (3-0-2)

Pre-requisites:IT2204, IT3201

Wireless communication principles such as wireless transmissions, smart antennas, frequency allocations, error detection and correction, location-based technologies, spread spectrum, and CDMA/TDMA. wireless LANs with emphasis on 802.11, Bluetooth, wireless sensor networks, UWB (Ultra Wideband), cellular networks ranging from 1G to 5G, mobile ad hoc networks (MANETs), wireless local loops, satellites communications.

Mobility Management: Cellular architecture, Co-channel interference, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, hierarchical scheme, predictive location management schemes. Wireless Internet, Mobile IP, wireless gateways, mobile application servers. Ad hoc Network Routing Protocols: Ad hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, location aided routing, zonal routing algorithm. The architectural, security, and management/support issues and their role in building, deploying and managing wireless systems in modern settings. wireless security wireless sensor applications, and mobile agent applications.

IT4103: Modern Cryptography

4 credits (3-0-2)

History and overview of cryptography, identification protocols. Password protocols, salts, PBKDF2; one time passwords (S/Key and SecurID); challenge response authentication, One time pad and stream ciphersperfect secrecy and the one time pad, semantic security and stream ciphers, Block ciphers. Case studies: Feistel networks, DES, 3DES, and DES basic modes of operation: CBC and counter mode. Block cipher abstractions: PRPs and PRFs . Pseudo Random Permutations (PRP); Pseudo Random Functions (PRF);security against chosen plaintext attacks (CPA); nonce-based CBC encryption and nonce-based counter mode. Attacks on block ciphers exhaustive search, time-space tradeoffs, differential & linear cryptanalysis, meet in the middle, side channels. Message integrity: definition and applications CBC-MAC and PMAC. Collision resistant hashing Merkle-Damgard and Davies-Meyer. MACs from collision resistance. Case studies: SHA and HMAC. Authenticated encryption: security against active attacks , intro to session setup using a key distribution center (KDC). Cryptography using arithmetic modulo primes, vanilla key exchange (Diffie-Hellman); the CDH and discrete-log assumptions . Public key encryption semantically secure ElGamal encryption; CCA security. Arithmetic modulo composites. RSA and Rabin functionshow to encrypt with trapdoor permutations. Digital signatures: definitions and applications. How to sign using RSA. More signature schemes Lamport and Merkle schemes.

overview of signatures based on discrete-logcertificates and trust management.

IT4104: Cloud Computing

3 credits (2-0-2)

Pre-requisites:IT2204, IT3103

Introduction To cloud, Virtualization concepts
Types of Virtualization & its benefits, Introduction to Various Virtualization OS, Vmware , cloud infrastructure and software stack, programming models (e.g., MapReduce and Pregel), underlying distributed storage layers (e.g., HDFS and HBase), as well as enabling technologies such as virtualization, Moving VMs, SAN backend concepts, Cloud Fundamentals : Cloud Building Blocks, Understanding Public & Private cloud environments. Cloud as IaaS, Private Cloud Environment, Basics of Private cloud Infrastructure.Public Cloud Environment, Understanding & exploring Amazon Web services. Managing and Creating Amazon EC2, S3 instances. Managing and Creating Amazon EBS volumes. Managing Hybrid Cloud environment, Setting up your own Cloud, How to build private cloud using open source tools, Understanding various cloud plugins, Setting up your own cloud environment, Autoprovisioning, Custom images, Integration of Public and Private cloud. Future directions, Cloud Domain and scope of work. Cloud as PaaS, SaaS:Cloud Computing Programming Introduction. cloud computing and its applicability to commercial application development as well as research computing needs.

IT4201: Digital Signal Processing

4 credits (3-0-2)

Discrete-time signals and systems, Constant coefficient difference equation. Review of Z Transform: properties, R.O.C, stability and Causality criterion. Structures for digital filters. DTFT and DFT: properties, linear and circular convolution.FFT: Decimation in time & Decimation in frequency.Design of IIR Filters: Bilinear transformation, Impulse invariant transformation. Butterworth, Chebychev, Inverse Chebychev and Elliptical filters etc. Design of F.I.R filters by windowing: rectangular, Bartlett, Hann, Hamming, Kaiser window filters, Design method, Relationship of Kaiser to other windows. Application of MATLAB for design of digital filters.Advanced signal processing techniques: Multirate Signal processing – Down sampling/upsampling.

IT4202:Embedded Systems

4 credits (3-1-0)

Pre-requisites:IT2104, IT3101

Overview of Embedded System:- Embedded System, Categories of Embedded System, Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices.

Embedded Hardware & Software Development Environment :- Hardware Architecture, Micro-Controller Architecture, Communication Interface Standards, Embedded System Development Process, Embedded Operating systems, Types of Embedded Operating systems.

8Bit microcontrollers Architecture on chip peripherals instruction set/ programming of Intel M CS51 family (8 bit) microcontroller,Inter facing of 8051 with LCD,ADC,sensors,stepper motor,key board, DAC,memory. Real Time & Database Applications :- Real-Time Embedded Software Development, Sending a Message over a Serial Link, Simulation of a Process Control System, Controlling an Appliance from the RTLinux System, Embedded Database Applications using examples like Salary Survey, Energy Meter Readings.Microchip PIC16 family PIC16F873 processor features architecture memory organization register file map I/ O ports PORTA - PORTB PORTC Data EEPROM and flash program memory Asynchronous serial port SPI mode I2C mode.

IT4203: Computer Vision

4 credits (3-0-2)

Pre-requisites:IT3102

Overview of Applications; Camera; Physics of Image Formation, Projective Model of Camera, Camera Calibration; Multiple-view Geometry and Reconstruction; Edge/feature extraction, correspondence and tracking, 3D structure/motion estimation. Object recognition, Scene and activity interpretation.

Shape from X (defocus, shading, texture); Motion Analysis and Tracking; Object Recognition and Image Understanding.

IT4204:Natural Language Processing

3 credits (3-0-0)

Introduction to NLP; History and state-of-the-art; Lexical semantics and word-sense disambiguation; Part-of-speech tagging; Morphology; Context-sensitive spelling correction; Noisy channel model; Language modeling; Parsing; Discourse processing; Dialogue systems; Generation; Inference and world knowledge; Semantic analysis ;Information extraction Machine Translation.

IT5190: Colloquium based on Summer Internship
4 credits

It is generally based on summer internship, student will be required to prepare a report and make a presentation highlighting the work done during the summer internship. Students are required to acquire skills in planning, time management and communication.

MT5199: Major Project Part-I
8 credits

Students will be required to formulate a problem in his/her area of interest. Literature review, identification of deliverables after formulating a detailed problem statement.

IT5299: Major Project Part-II
20 credits

The student will continue to work on the problem identified in Major Project Part – I as per the work plan. The work is continued until all stated objectives and deliverables are met. Student will prepare a comprehensive report containing introduction to the problem, literature review, methodology, results and discussion and conclusion.

IT9901: Compiler Design
4 credits (3-0-0)

Pre-requisites: IT1102

Compilers and translators; lexical and syntactic analysis, top-down and bottom up parsing techniques, internal form of source programs; semantic analysis, symbol tables, error detection and recovery, codegeneration and optimization. Type checking and static analysis. Algorithms and implementation techniques for type-checking, codegeneration and optimization. Students will design and implement translators, static analysis, typechecking, and optimization.

IT9902: System Level Design and Modeling
3 credits (3-0-0)

Embedded systems and system-level design, models of computation, specification languages,

hardware/software co-design, system partitioning, application specific processors and memory, low powerdesign.

IT9903: Advanced Topics in Software Engineering
3 credits (3-0-0)

This will focus on special topics of contemporary relevance and interest to both industry and research.

IT9904: Microelectronics
3 credits (3-0-0)

Introduction, trends in electronic circuits; Semiconductor devices: MOSFET ;PN Junctions (diodes); BJT, Analog Integrated Circuits :Small-signal circuits ;Single-stage amplifiers ;Multi-stage amplifiers; Frequency response ;Electronic feedback ;Circuit simulation with SPICE. Basic electronic prototyping and measurement equipment

IT9905: Advanced Network Technologies
3 credits (3-0-0)

Introduction to the Internet: The history of the Internet, A look at Internet standards, practical uses of the Internet. Internet-related careers, Components of the Internet, Connection requirements and options, Considerations in selecting an ISP, Internet addressing, Internet Performance and Indexing, Analyzing the local situation, Concepts and deployment of caching technologies, Performance issues for web servers, The Building Blocks, Understanding protocols, Transmission Control Protocol/Internet Protocol, Name resolution protocols, Client-side protocols, Internet client infrastructure, Client Side Troubleshooting and Security Issues, Identifying problems related to legacy clients, Client-side security issues, Components of the Web Page, All about web pages, More components and concepts of the HTML language, The META tag, Using tables, Improvements on standard HTML, Advanced Web Techniques, Using forms, Databases, Advanced programming techniques with scripting tools, Specific scripting languages, Other advanced programming tools, Popular multimedia extensions (plug-ins), Types of multimedia files and formats, Preparing to publish a web site, Core Components, Hardware platforms, Internet server components, Web servers, E-mail servers, FTP servers, Proxy servers,Certificate servers, Directory servers, Mirrored servers, Cache servers, List servers,The Role of E-Commerce within a Business Strategy, E- commerce terms and

concepts global environment, Broadband networks, fast packet networks, What the future holds?

IT9906: Distributed Computing 3 credits (3-0-0)

Models of Distributed Computing; Basic Issues: Causality, Exclusion, Fairness, Independence, Consistency; Specification of Distributed Systems: Transition systems, petri nets, process algebra properties: Safety, Liveness, stability.

IT9907: Grid Computing

3 credits (3-0-0)

Motivation for grid computing, various considerations, Security for Wide Area Environments:-Authentication,-Authorization and access control;-Encryption; Resource Management:-Remote execution,-Scheduling ;;-Resource reservation and quality of service; Information Management:-Registering and locating grid resources;-Performance measurement: choosing the "best" resources; Data Management:-Managing petabytes of data;-Efficient, parallel transfers over wide area networks;-Caching and replication; Applications, Advanced Topics:-Including other grid projects.

IT9908: Distributed Algorithms

3 credits (3-0-0)

Models of synchronous and asynchronous distributed computing systems: synchronous networks, asynchronous shared memory, asynchronous networks etc.; basic algorithms for synchronous and asynchronous networks: leader election, breadth first search, shortest path, minimum spanning tree etc.; advanced synchronous algorithms: distributed consensus with failures, commit protocols; asynchronous shared memory algorithms: mutual exclusion and consensus; relationship between shared memory and network models; asynchronous networks with failures.

IT9909: Advanced VLSI Architecture

3 credits (3-0-0)

Course Description: The impact of VLSI technology on digital systems and architectures. A variety of applications of these architectures explored with emphasis on digital signal processing and other arithmetic-intensive computations. Introduction to hierarchical structural design: IC design for parallel architecture: Use of pipelining and parallelism, self-synchronized designs, VLSI computing structures. Introduction to systolic arrays, mapping algorithms on systolic arrays, design of systolic arrays, system examples and design exercises. Circuits and DSP

architecture design: Fast filtering algorithms, retiming and pipelining, block processing, folding, distributed arithmetic architectures, VLSI performance measures (area, power, and speed), structural modeling in VHDL. DSP module synthesis: Arithmetic unit architectures (adders, multipliers, dividers), bit-parallel, bit-serial, digit-serial, carry-save architectures, redundant number system, modeling for synthesis in VHDL, synthesis via SYNOPSIS, place-and-route via CADENCE.

IT9910: Distributed Operating Systems

3 credits (3-0-0)

Principles of distributed systems in general, and distributed operating systems in particular. Local autonomy, resource sharing, concurrent programming, distributed inter-process communication, distributed process scheduling, virtualization, Wave algorithms, Network Simulation, Traversal algorithms. *Synchronizing physical clocks*: Logical clocks, Global State recording. *Synchronization and Agreement*: Synchronization of processes, naming, Termination detection. *Distributed mutual exclusion*: permission-based algorithms, token-based algorithms. Distributed deadlock detection, Agreement. *Resource Management*: Remote procedure calls, Distributed file systems, File system extensibility, non-disk file systems, and file system caching, DFS examples: NFS, Andrew File System, Distributed Shared memory, Load distribution, Process migration, *Security*: Security system implementations: Kerberos, Secure Shell. Clusters, Scalability, High Availability, Disaster Recovery, *Special Topics*: Fault-Tolerance, Multiprocessor Operating Systems.

IT9911: Reconfigurable Computing

3 credits (3-0-0)

FPGA architectures, CAD for FPGAs: overview, LUT mapping, timing analysis, placement and routing, Reconfigurable devices - from fine grained to coarse-grained devices, Reconfiguration modes and multicontext devices, Dynamic reconfiguration, Compilation from high level languages, System level design for reconfigurable systems: heuristic temporal partitioning and ILP-based temporal partitioning, Behavioral synthesis, Reconfigurable example systems' tool chains.

IT9912: Computational Geometry

4 credits (3-0-0)

Visibility problems and triangulation. Line sweep and angle sweep: segment intersection, area, perimeter, diameter, width. Planar Point location:

Kirkpatrick's hierarchy, Persistent data structure, Multidimensional data structures: Segment trees, range trees, orthogonal range searching, Convex hulls and Voronoi diagrams: 2d, 3d hulls, 2d Voronoi diagrams, dynamic maintenance, Duality between hulls and Voronoi diagrams, Duality between lines and points, higher order Voronoi diagrams Arrangements : Construction and bounds, ksets, Zone theorem Algebraic lower bounds: Linear Decision model Ben-Or's theorem Randomized algorithms: Random sampling, Incremental construction, Backward analysis Optimization : Monge matrices, Fixed dimensional linear programming, Prune and Search Parametric search: kth intersection, k-th nearest neighbour. Recent topics : Instructor's choice.

IT9913 : Complexity Theory
3 credits (3-0-0)

Turing machines and non-determinism, models of computation like RAM and pointer machines, Relations between complexity classes, timespace tradeoffs for some fundamental problems. Reductions and completeness, Randomized complexity classes, Boolean circuit complexity. Cryptography and one-way functions. Polynomial hierarchy, P-space completeness. Interactive proofs and Hardness of approximation, Parallel complexity classes.

IT9914: Advanced Topics in VLSI Design
3 credits (3-0-0)

The objective of the course is to convey knowledge in advanced topics in VLSI design, Advanced topics in low power and high performance VLSI design, Advanced topics in deep submicron and nanotechnology VLSI design.

IT9915: Software Quality Management
4 credits (3-1-0)

Concepts and Overview: Concepts of Software Quality, Quality Attributes, Software Quality Control and Software Quality Assurance, Evolution of SQA, Major SQA activities, Major SQA issues, Zero defect Software. Software Quality Assurance: The Philosophy of Assurance, The Meaning of Quality, The Relationship of Assurance to the Software Life-Cycle, SQA Techniques. Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits. Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations. Configuration Management:

Maintaining Product Integrity, Change Management, Version Control, Metrics, Configuration Management Planning. Error Reporting: Identification of Defect, Analysis of Defect, Correction of Defect, Implementation of Correction, Regression Testing, Categorization of Defect, Relationship of Development Phases. Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency. Corrective Action as to Cause: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the Correcting the corrective Action, Periodic Review of Actions Taken. Traceability, Records, Software Quality Program Planning, Benefit, Communication, Consistency, and Retaliation.

MG1201: Philosophy & Human Values
2 credits (2-0-0)

Classical Indian Philosophy, Classical Western Philosophy, Modern Western Philosophy, Ethics, Values in a pluralistic society, Rights and duties, Values inherent in creation, Global oneness, Truth, Love, Dharma, Peace, Non-violence, Integral relation between man and Nature, The hierarchy of values, Psychology, The mind-body relationship, The chain of thoughts, Habits, Character and behaviour, Holistic personality.

MG2101: Organizational Behavior
3 credits (2-0-2)

Foundation and background of OB, contemporary challenges-workforce diversity, cross – cultural dynamics, changing nature of managerial work, ethical issues at work, emotional intelligence in contemporary business. Perception, Personality, Learning, Motivation – Concepts and applications, individual decision making. Understanding and managing group processes-interpersonal & group dynamics, Group cohesiveness, Group decision making Emotional Intelligence-concept and applications, Understanding work teams, power & politics, Empowerment, Conflict & Negotiation. Organizational processes and structure; Organizational structure & design, Work & job design; organizational learning; organizational culture; Organization change and development.

MG2201: Industrial Economics
3 credits (3-0-0)

Firm and its environment, firm as an organization, Theory of groups, Representation of firm, Teleological concept of industry and alternative divisions, Statistical economic activity divisions,

Socio-economic environment of industry, Supply characteristics, Demand characteristics, Concentration and its measurement, Markets and their theories, Competition forces, Strategies of price, Strategies of growth, Other strategic dimensions, Relation between structures and strategies, Performances of the firm and industry.

MG4101:Principles & Practices of Management
2 credits (2-0-2)

Typical functions of management: Leading, Directing, controlling, staffing. Styles of management, Motivation: Theories and Practices, Group Behavior and group dynamics, various organizational structures and Management Styles, Managerial grid, Quality, Productivity and role of management, Changing role of management in IT environment, Case studies in practice of management: Indian as well as global

MG4102:Project Management
3 credits (2-0-2)

Project Management Principles and Strategies, key concepts and principles in project management to describe the roles and responsibilities of the project manager, Definition of project and project management, project life – cycle Planning the project, project planning process , project charter and project plan, work breakdown structure (WBS) techniques,, project structuring and organization. Estimating Project Costs, organize project activities, resource and time constraints, final project schedule manually or by using automated tools. Activity sequencing, precedence network diagram, critical path method, program evaluation and review techniques, project scheduling, basics of scheduling. Executing the Project, basic needs and requirement of project execution, project tracking and control elements,factor contribute to successful project control.

MG4103:Entrepreneurship & Innovation Mgt.
3 credits (3-0-0)

Entrepreneurial execution/planning,Entrepreneurial strategy, Invention to application, Entrepreneurship planning, marketing, Managerial accounting, Financial statement analysis, Venture capital and private equity, Raising capital: Financial instruments, institutions and strategy, Real estate entrepreneurship, Entrepreneurial finance, Real estate development, Medical device commercialization, Biotechnology: Management of

drug discovery, Intellectual capital and competitive strategy, Social entrepreneurship, Managing innovation in a Global organization, Market intelligence, Marketing of high technology.

MG4204: Marketing Management
3 credits (2-0-2)

Introduction to Marketing Concepts, Marketing System and Marketing Environment, Marketing Mix; Marketing Plan ;Marketing Segmentation, Targeting and Positioning, Consumer Behavior; Marketing Information System ;Marketing Research; Product management-Product Policy, PLC and Product Mix ;New Product Development-Process and Strategies, Price Management-Price Policy Considerations and Strategy; Promotion Mix- Advertising, Public Relation, Personal Setting, direct Marketing ; Channel management: SCM, Channel Selection and Management, Marketing Implementation and Control ; Strategic Marketing, Services Marketing, Brand Management ; Relationship Management.

MG4205: Operations Management
3 credits (2-0-2)

Management of production systems – concepts and practices, strategies for competitive, Manufacturing, economic analysis, facilities location and layout concepts and methods, Assembly line balancing, forecasting, aggregate production planning, production planning and control, scheduling, materials management and inventory control, material requirement planning, application of optimization techniques, total quality management, quality circles, maintenance management, value engineering, work study, job evaluation, payment systems, material handling system, Business process reengineering, benchmarking, advance manufacturing systems, supply chain management, just in time (JIT), factories of the future, enterprise resource planning.

MG4206: Financial Management
3credits (2-0-2)

Introduction to Financial Management Concepts:(Introduction, Scope of Finance, Financial Goal and Firms Objective, Statement of Financial Information, Ratios)Time Value of MoneyConcept of Value and return, Time reference of Money, Present Value, Concept of Annuity, Net present value, IRR, Portfolio Theory and Risk Diversification, Cost of Capital, Systematic and Unsystematic Risk, CAPM)Capital Budgeting and

Risk,(Nature of Risk, Sensitivity Analysis, Capital Expenditure and Planning, Strategic Aspect of Investment, Capital Budgeting, Decision Making)Capital Structure and Leverage, Kind of Capital – Debt, Security and Stocks and their type, Net Income Approach, Net Operating income approach, Optimal capital structure, M-M Hypothesis under corporate Taxes, CAPM and Capital structure, adjusted Net Value, Features of Appropriate capital Structure, operating and Financial leverage Working Capital Management ,Concepts of WC, need of WC, Determinates and issues in WC management, Finance of current asset, credit polity – nature and Goal, credit policy variables, monitoring receivables, objective of inventory management, cash collection and disbursement, investing surplus cash in marketable securities

MG4207:Human Resource Development

3 credits (2-0-2)

Evolution and Emergence, The Industrial Revolution, Scientific Management, Classical Organization Theory, Human Relation Movement, Behavior Science Movement and Systems Approach, The Organization Development Movement, The Process System Views, Corporate Culture analysis, Role of HRM in the Organization, Responsibilities and Objectives of HRM, HRM Programs, HRM Models, Implementation of HRM Status of HRM today and Expectation from Hr Manager, Contemporary Challenges in HRM, Evaluation. Recruitment Screening and Selection, Recruitment needs, objectives, Planning, External Influences, Internal Influences, Employee Requisition, Screening, Selection, Interview, Interview Problems, Training and Development, Distinction between training and Development, Identification of Training Needs, Principles of Training, Choosing Trainer and Trainees, Administration of Training Programs, Evaluation, Development, Coaching and Counseling. Team Work, Definition, Team Vision, Leading the Team,. Size of the Team, Team Building, Membership and Effective Team Working, Techniques of Promoting Creativity, Conflict Resolution, Creative Problem Solving, Team Weakness and Drawbacks. Leadership, Definition, Three Fold commitment, leadership style, what does a leader do? Characteristics of leader. Performance appraisal: definition, objectives and uses of performance appraisal, Requirement of good appraisal system, problems in appraisal.

Case development: a complete case to be developed by every student covering different aspects of HRM which shall be a part of the curriculum.

MG5101:Knowledge Management

2 credits (2-0-0)

The rise of Knowledge Management: Traditional Methods, Factors of Productivity, The Learning Organization, The Role of Information Technology, Implications to Leadership and Competitiveness Concepts of Knowledge, Definitions, Attributes, A Classification Framework - Forms / Types / Organizational Levels / Structure / States / Domains. Knowledge and Organizational Strategy: Elements of Organizational Strategy, Knowledge for Strategy Formulation and Implementation, Knowledge and Organizational Leadership. Knowledge and Organizational Processes: Elements of Organizational Processes, Knowledge for Process Effectiveness and Efficiency, Knowledge Environment and Infrastructure - Structure / Climate and Culture / Technology and Systems. Knowledge Management Processes and Practices : Knowledge Creation and Acquisition. Knowledge Documentation and Retrieval. Knowledge Sharing and Application.

MG5190: Colloquium

4 credits

It is generally based on summer internship, student will be required to prepare a report and make a presentation highlighting the work done during the summer internship. Students are required to acquire skills in planning, time management and communication.

MG5199: Major Project Part -I

8 credits

Students will be required to formulate a problem in his/her area of interest. Literature review, identification of deliverables after formulating a detailed problem statement.

MG5299: Major Project Part-II

20 credits

Pre-requisites: MG5199

The student will continue to work on the problem identified in Major Project Part – I as per the work plan. The work is continued until all stated objectives and deliverables are met. Student will prepare a comprehensive report containing introduction to the problem, literature review, methodology, results and discussion and conclusion.

MG9901: Internet Business Models and Business Strategies

3 credits (3-0-0)

Introduction to E-Commerce and its impact on organization, economy Porter's framework in the new economy Value chain, virtual value chain Extracting value out of the value chain :(Amazon publishing industry case)Economics of information, impact on strategy ;Value proposition, business models and revenue models on the web ;Business models, components, dynamic and appraisal Value configuration and the internet ;Market opportunity analysis, customer interface, market communication Strategy formulation and implementation for online firms, BMG online, ford, dell, eBay, egghead.com, priceline.com, yahoo, MicroAge, wells, Fargo online, Charles schwb, Merryl Lynch etc. Comprehensive overview and case discussion of impact of internet on various industriesBanking, Travel, Insurance, Automobiles, Health care, advertising, telecom, retail etc.

MG9902: IT Enabled Services Management

3 credits (3-0-0)

Service: A Conceptual Framework, Strategic Planning for Services, Services Marketing Mix, Customer Behavior and Services, STP Strategies in Service Marketing, Service Delivery Process, Information Technology and Service Management, IT Enabled Services: Strategic Framework, Overview of IT Enabled Service: Call Centre, Medical Transcription, Data Processing and Back Office Operation, Web Enabled Education, Content Development and Multimedia Animation, GIS Services. Ventures in IT Enabled Services and Business Process Outsourcing, IT Enabled Services: Banking, Insurance. IT Enabled Customer Interaction Services, Call Centre. IT Services: Enterprises Wide Integration, Networking Services, Database Management Services, IT Consulting Services. Measuring Service Quality and Satisfaction, Customer Relationship Management, Web Enabled Services, Health Care Services, Travel and Tourism Services, Hospitality Services, Telecom Services, Transportation Services, Infrastructure Services.

MG9903: Public Private Partnerships

2 credits (2-0-0)

Changing Economic Scenario & Growing Role of Partnership in Public Services: Global Investment Scenario, Reducing Role of Govt. in business, Collaborative Business and introduction to PPP. Public Private Partnerships (PPP) : PPP – The

Concept : PPP and Privatization / Nature of Collaboration. Principles of PPP - Contractual Framework, Selection of Service Provider - Competitive Bidding / Swiss Challenge approach / Competitive Negotiation, Payment Mechanisms, Potential Benefits of PPP, Local Government & PPP.. Types of PPP: BOT/ BTO- Built Operate Transfer/Built Transfer Operate, BOO- Built Own Operate, BBO- Buy Built Operate, DB-Design Built, DBO-Design Built Operate, DBM-Design Built Maintain, Contract Services, Developer Finance, Enhanced Use Leasing, LDO/BDO, Lease/Purchase, Sales/Leaseback, Tax exempt Lease, Turnkey. Issues – PPP: Monitoring and evaluation, Risks and Revenues sharing, Guiding Principals for successful PPP Implementation. Social Sector and PPP: Indian Scenario, Cases in PPP Best Practices

MG9904: Services Marketing

2 credits (2-0-0)

Introduction to services, Consumer behavior in services, Understanding customer expectation through market research, Customer defined service standards, Employee role in service designing, Managing demand and capacity, Role of marketing communication, Physical evidence in services.

MG9905: Software Project Management

2 credits (2-0-0)

Overview of Project Planning, Project Execution Approach, Software requirement study and Analysis, Objectives of activity planning, project scheduling, sequencing and scheduling activities, Network planning models, forward pass, backwardpass, identifying critical path, project crashing, Project progress review, Risk Management, Managing People and Organising Teams.

MG9906: Supply Chain Management

2 credits (2-0-0)

Pre-requisites: MG4401

Supply Chain Management Concepts and Evolution Modeling and Application; Choice of Supply Chain Strategy & Structure; Sourcing Strategy & Vendor Management; Inventory Management in Supply Chains; Dynamics of Supply Chains; Supply Chain Integration and Transformation using Information Technology; Customer Value & Focus; Global Supply Chain Management; Innovations & Best Practices in Supply Chain Management

MG9907: Security Analysis and Portfolio Management

2 credits (2-0-0)

Pre-requisites: MG6601

Investments, Portfolio Theory, Equilibrium in Capital Market, Bond Analysis, Equity Valuation Model, Security Analysis, Derivatives

MG9908: Financial Risk Management

2 credits (2-0-0)

Pre-requisites: MG6602

Risk Management, Employee Benefit Plan and Design and Financing, Business Insurance and Estate Planning, Risk & Crisis Management, Markets for Pure Risk, Risk Management and Treatment, Financial Strategies and Analysis, Financial Derivatives, International Markets, Investment Management, Risk Analysis and Environmental Management

MG9909: Change Management

2 credits (2-0-0)

Pre-requisites: MG7701

Organizational change, Human process interventions, Techno structural interventions, Contemporary issues and applications.

MG9910: Leadership and Talent Management

2 credits (2-0-0)

Pre-requisites: MG7704

Leadership and talent development, Leadership values and behaviors, Leadership assessment and development framework, Talent dimension, Organizational needs, Approach to establish talent requirement, Organizational life stage, High performance team behaviors.

MG9911: Service Operations Management

2 credits (2-0-0)

Global trends in Services Sector; Changing paradigms in Competitiveness of services; Services – Manufacturing Continuum. Recent trends in manufacturing, increased role of services in manufacturing. Developing an overall vision for the service system. Developing a service strategy. Service Positioning & Implications for Service Delivery Design. Service Enhancement using Internet. Performance issues in service systems. Capacity issues in service systems. Queueing Theory Applications in Service Systems. The services supply chain. Services Management in IT/ITES Sectors. Risk & Security issues in Financial Services Sector: Role of technology

MG9912: Business System Simulation:

2 credits (2-0-0)

System Models, System analysis, System Design, System Postulation, System simulation, Techniques of Simulation, Process of Simulation, Simulation vs Analytical methods. Monte Carlo Method, Numerical Computation techniques for Continuous and Discrete models, Distributed Lag models, Cob Web Models, Continuous system simulation, Continuous system simulation languages, CSMP III, Analog simulation, Hybrid simulation, digital-Analog Simulation, real time simulation, feedback system, interactive system, Exponential growth models, Exponential decay models, Modified Exponential growth models, System Dynamics diagrams, Multi segment models, Feedback in Socio- Economical Systems. Comparative features of Discrete Simulation languages.

MG9913: Total Quality Management

2 credits (2-0-0)

Introduction to quality control- quality and cost consideration- statistics and its implication in quality control- sampling inspection in engineering manufacturing- statistical quality control by the use of control charts- methods of inspection and quality appraisal- reliability engineering- value engineering and value analysis. Theory of sampling inspection- standard tolerance- ABC analysis- defect diagnosis and prevention. Recent techniques of quality improvements - zero defect - quality motivation techniques- quality management system and total quality control. Section of ISO model and implementation of ISO 9000. Human resource development and quality circles - Environmental management system and total quality control

MG9914: Product and Brand Management

2 credits (2-0-0)

Concepts of the brands, branding and creating brand equity in the domestic and international markets. Developing a brand and understanding the issues involved in developing brands in different contexts. Role of brands in the marketing strategy and developing competitive advantage. Brand management decision making for establishing relationship with customers and gaining competitive advantage

MG9915: Software Quality Management

2 credits (2-0-0)

Software Quality, Product versus Process Quality management, techniques to help enhance software quality, Software Validation and Verification, Qualityplans, Brief description of SEI-CMM.

MBA / MBA (ITeS)/MBA(PSM & E-Gov) Programme [Two Years]

MG1101 : Principles and Practices of Management 3 credits (2-0-2)

Concept & nature of management; management competencies-communication, team work, planning and administrative, strategic and global competencies; evolution of management thoughts-traditional, behavioural, systems contingency and quality viewpoints. Planning, decision making and organizing: nature & elements of planning, planning types and models, planning in learning organizations; strategic planning-an overview; decision making process, models of decision making, increasing participation in decision-making, decision-making creativity; basic issues in organizing – work specialization, chain of command, delegation, decentralization, span of management, bases for departmentation. Leading: recognition of human factor, motivation models/approaches, leadership styles/behaviours, personal characteristics of effective leaders, leadership development; leadership for learning organization. Management control, managerial ethics and social responsibility: management control – concept and process, overview of control techniques, effective control system; managerial ethics, factors affecting ethical choices; ethical dilemma; social responsibility; evaluating corporate social performance; managing company ethics and social responsibility.

MG1102: Business Statistics and Research Methodology 3 credits (2-0-2)

Construction of frequency distributions and their analysis in the form of measures of central tendency and variations; types of measures, their relative merits, limitations and characteristics; skewness; meaning and co-efficient of skewness. Correlation analysis-meaning & types of correlation, Karl Pearson's coefficient of correlation and Spearman's rank correlation; regression analysis- meaning and two lines of regression; relationship between correlation and regression co-

efficient. Time series analysis- measurement of trend and seasonal variations; time series and forecasting. Probability; basic concept and approaches, addition, multiplication and Bayes', theorem. Probability distribution-meaning, types and applications, Binomial, Poisson and Normal. Tests of significance; Hypothesis testing; Large samples, Small samples; chi-square test, Analysis of variance.

MG1103: Managerial Economics 3 credits (2-0-2)

Nature & scope of managerial economics; nature of marginal analysis; alternative objectives of business firm; cardinal utility theory; indifference curve technique and the theory of consumer choice; consumer surplus; price, income and substitution effects; demand elasticity; demand estimation and forecasting; relationship between price elasticity and marginal revenue. Law of variable proportions; laws of return; optimal input combination; output-cost relation; engineering cost curves; technological change and production decisions; revenue curves of a firm; duopoly analysis using reaction curves; price-output decisions under alternative market structures; shut-down points; Baumol's sales maximization model, advertising and price-output decisions. Collusive behaviour of firms; cartel behaviour; game theory and strategic behaviour; product differentiation and price discrimination; price-output decision in multi-plant and multi-product firms; managerial theories of the firm; general pricing strategies; special pricing techniques – limit pricing, peak load pricing and transfer pricing; dumping analysis; pricing of public utilities. Risk analysis; investment and capital replacement decisions; locational choice of a firm; measures of national income; business cycles; operative aspects of macroeconomic policies; inflation analysis; tariff analysis.

MG1104: Businesses and Legal Environment 3 credits (2-0-2)

Micro-economic issues and principles involving households and firms, mainly in the areas of Demand and Supply; Production and Cost of Firms; Price/Output Decisions by firms under varying market conditions; and factor pricing. National Accounts, National Income Determination and Multiplier Analysis; Business Cycles; Inflation; Monetary and Fiscal Policies; Supply side economics and rational expectations. General principles of laws relating to contracts and the legal aspects in business and management. Law of Contract, Law of Agency, Negotiable Instruments Act, Sale of Goods Act; Law of Partnership, Companies Act, FEMA, Intellectual Property Rights, Right to Information Act, Information Technology Act, Environment Protection Act.

MG1105: Financial Reporting & Management Control

3 credits (2-0-2)

Financial Accounting-concept. Importance and scope, accounting principles, journal ledger, trial balance, depreciation (straight line and diminishing balance methodology). Preparation of final accounts with adjustments. Analysis and interpretation of financial statements- meaning, importance and techniques, ratio analysis, Fund flow analysis, cash flow analysis. Cost accounting - meaning, importance, methods, techniques; classification of costs and cost sheet; inventory valuation; an elementary knowledge of activity based costing. Management accounting- concept, need, importance and scope; Budgetary control- meaning, need, objectives, essentials of budgeting, different types of budgets; standard costing and variance analysis: Marginal costing and its application in managerial decision making.

MG1106: Organizational Behavior

3 credits (2-0-2)

Foundation and background of OB, contemporary challenges-workforce diversity, cross – cultural dynamics, changing nature of managerial work, ethical issues at work, emotional intelligence in contemporary business. Perception, Personality, Learning, Motivation – Concepts and applications, individual decision making. Understanding and managing group processes-interpersonal & group dynamics, Group cohesiveness, Group decision making Emotional Intelligence-concept and applications, Understanding work teams, power & politics, Empowerment, Conflict & Negotiation. Organizational processes and structure; Organizational structure & design, Work & job

design; organizational learning; organizational culture; Organization change and development.

MG1107: Internet Technologies for Business

3 credits (2-0-2)

Computer organization: Introduction, components, classification, capabilities characteristics & limitations. Operating systems: storage devices; application of computer in Business, Computer Languages. Internet: Internetworking, Concepts, Internet Protocol Addresses, WWW Pages & Browsing, Security, Internet Applications, Analog & Digital Signals, Bandwidth, Network Topology, Packet Transmission, Long Distance communication, Network Applications. Introduction to database: Concept, characteristics, objectives, Advantage & limitations, entity, attribute, schema, subschema.

MG1108: Business Communication

3 credits (2-0-2)

Purpose and process of communication; myths and realities of communication; paths of communication; oral communication; noise, barriers to communication; listening process, types of listening, deterrents to listening process, essentials of good listening; telephonic communication. Presentation skills; prerequisites of effective presentation, format of presentation; Assertiveness – indicators of assertive behaviour, strategies of assertive behaviour; Communication skills for group discussion and interviews. Non verbal communication; gestures, handshakes, gazes, smiles, hand movements, styles of working, voice modulations, body sport for interviews; business etiquettes; business dining, business manners of people of different cultures, managing customer care. Written communication; mechanics of writing, report writing, circulars, notices, memos, agenda and minutes; business correspondence-business letter format, style of letter arrangement, types of letters, telex managers, facsimiles, electronic mail; diary writing; development resume.

MG1109: Seminar I (Audit)

1 credits (0-0-2)

Students will be required to make presentation on topics of contemporary interest.

MG1201: Human Resource Management

3 credits (2-0-2)

Diagnosis and Prediction of Individual Behaviour; Group and Inter-group Behaviour, Culture and Tradition; Values and Social System; Influence of

Technology; Power and Politics, Leadership and Inter-Personal Skills. Organisational Structure, Configuration and Design; Staff-Line Role; Control Mechanisms; Power and Politics; Responsiveness; Culture; Organisational Evolution; Comparative Organisational Designs; and Organisational Change and Development. Human Resource Planning; Job Analysis and Design; Recruitment and Selection; Organizational Socialization; Performance Management; Grievance Handling; Participative Management; Trade Union Policy; Unionism; Factionalism and White Collar Unionism; Labour Laws; Industrial Conflict, Conflict Resolution and Collective Bargaining; Productivity Bargaining.

MG1202: Operations Management

3 credits (2-0-2)

Operations Management and Productivity of Organisations; Operating Decision Analysis; Long Range Planning and Design for Operations; Job Design; Method Study and Work Measurement; Facilities Location and Layout. Product and Process Design; Capacity Planning; Aggregate Planning; Production Scheduling and Control; Maintenance Management; Quality Management; Japanese Approach to Operations Management (JIT/TQC); Project Management; Energy Management; Integration of Operations with Organisational Strategy. Material Flow Systems; Materials Storage, Handling and Accounting; Materials Planning - Independent Demand Systems; Materials Planning - Dependent Demand Systems (Material Requirements Planning); Inventory Control Systems.

MG1203: Marketing Management

3 credits (2-0-2)

Analyzing the marketing environment and consumer behavior; Identifying market segments and selecting target markets; Differentiating and positioning the market offer; Developing , testing, and launching new products and services; Managing product life cycles and strategies; Managing product lines, brands and packaging; Designing pricing strategies and programs. Distribution and selection of channels, modern retailing, integrated marketing communication, advertising and sales promotion. Market Research, demand estimation, rural marketing, international marketing and marketing implementation.

MG1204: Decision Modeling

3 credits (2-0-2)

Operations Research: Evolution, methodology and role in decision making; Linear programming: Meaning, assumptions, advantages, scope and limitations: Formulation of Problem of problem and its solution by graphical and simple methods; special cases in simplex method; infeasibility, degeneracy, unboundedness and multiple optimal solutions; duality. Transportation problems including transshipment problems; Special cases in transportation problems; unbalanced problems, degeneracy; maximization objective and multiple optimal solutions; assignment problems including traveling salesman's problem. Special cases in assignment problems; unbalanced problems, maximization objective and multiple optimal solutions. PERT/CPM: Difference between PERT and CPM, network construction, calculating EST, EFT, LST, LFT and floats, probability considerations in PERT, time cost trade off. Decision theory: decision making under uncertainty and risk, Bayesian analysis, decision trees. Game theory, pure and mixed strategy games; principle of dominance; two person zero sum game; Queuing theory: concept, assumptions and applications; analysis of queue system, Poisson distributed arrivals and exponentially distributed service time model (MMI and MMK); simulation; meaning, process, advantages, limitations and applications.

MG1205: Financial Management

3 credits (2-0-2)

Financial management-scope finance functions and its organization, objectives of financial management; time value of money; sources of long term finance. Funds Flow Analysis; Basic Concepts of Working Capital Management; Forecasting Working Capital Needs; Cash Management. Financing, investment and distribution decisions, Capital Budgeting Decisions; Leverage, Capital Structure and Planning; Dividend Decisions; Leasing; Mergers and Takeovers, determinants of dividend models-Walter, Gordon & M.M. models.

MG1206: Management Information Systems

3 credits (2-0-2)

Role of information systems in managerial decision making; information systems design methodologies; hardware and software tools and technologies; design and implementation of effective organisational information systems; critical role of user managers in design of effective information systems.

MG1207: Database Management**3 credits (2-0-2)**

Database Management Concepts and Architecture; Data Organization and Data Models. SQL Query Language for Data Creation, Retrieval and Manipulation; Database Administration. Concepts of Distributed Databases for designing a database application in networking environment such as Internet, Object Oriented Databases, Visual Databases and Knowledge-based Databases.

MG1208: Foreign Language**2 credits (2-0-0)**

This course aims to develop working expertise covering oral and written communications aspects of a foreign language.

MG1209 : Seminar II (Audit)**1 credits (0-0-2)**

Students will be required to make presentation on topics of contemporary interest.

MG2101: Strategic Management**3 credits (2-0-2)**

Concept of Corporate Strategy; Role of General Manager in Strategy Formulation; Organisational Mission, Objectives and Strategies; Environmental Analysis; Internal Appraisal; Personal Values; Social Responsibility of Business; Strategic Options; and Strategic Choices. Resource Allocation; Organisation Structure, Systems, Skills, Functional Policies; and Leadership Styles.

MG2102: Project Management**3 credits (2-0-2)**

Project Management Concepts; Establishing the Project and Goals; Organising Human Resources and Contracting; Organising Systems and Procedures for Implementation; Project Direction, Coordination and Control; Project Management performance; Project Management Case Studies; Project Information Systems; Computer Based Project Management; Future of Project Management.

MG2103: Business Process Management**3 credits (2-0-2)**

Concepts, methods, and tools that help organizations define, implement, measure and improve their end-to-end processes. Organizational transformation concepts such as Business Process Reengineering, Enterprise Resource planning, Lean Six Sigma, Total Quality Management and supporting technologies such as workflow

management, process analytics, process mining, and service-oriented systems.

MG2104: Business Ethics**3 credits (2-0-2)**

Sources of Value Systems, Types, Values, Loyalty and Ethical Behaviour, Values across Cultures. Nature, Characteristics and Needs, Ethical Practices in Management. Indian Values and Ethics- Respect for Elders, Hierarchy and Status, Need for Security, Non- Violence, Cooperation, Rights and Duties, Ethics in Work life, Holistic relationship between Man and Nature, Attitudes and Beliefs. The Ethical Value System- Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes.

MG2105: Seminar III (Audit)**1 credits (0-0-2)**

Students will be required to make presentation on topics of contemporary interest.

MG2106: Colloquium based on Summer internship (Audit)**1 credits (0-0-2)**

It is generally based on summer internship, student will be required to prepare a report and make a presentation highlighting the work done during the summer internship. Students are required to acquire skills in planning, time management and communication.

MG2107: Comprehension (Audit)**1 credits (0-0-2)**

Comprehension will be a comprehensive viva which will test the knowledge and skills gained by students.

MG2199: Major Project Part -I**5 credits (0-0-10)**

Students will be required to formulate a problem in his/her area of interest. Literature review, identification of deliverables after formulating a detailed problem statement.

MG2201: Entrepreneurship and InnovationMgt.**3 credits (2-0-2)**

Entrepreneur, Creativity and Innovation, Business Planning Process, Institutions supporting entrepreneurs, Family Business, International Entrepreneurship Opportunities, Informal risk capital and venture capital, Managing growth.

MG2202: International Business**3 credits (2-0-2)****Pre-requisites:MG1104**

Recent global trends in international trade and finance; dimensions and modes of IB; structure of IB environment; risk in IB; motives for internalization of firms; organizational structure for IB; world trading system and impact of WTO; exchange rate systems; global financial system; barriers to IB; international business information and communication. Foreign market entry strategies; country evaluation and selection; factors affecting foreign investment decisions; impact of FDI on home and host countries; types and motives for foreign collaboration; control mechanisms in IB. International promotion mix and pricing decisions; counter trade practices; mechanism of international trade transactions.

MG2203: Business Analytics**3 credits (2-0-2)****Pre-requisites: MG1104, MG1207**

Business Intelligence, Data Mining and Business Analytics; Data Mining Process and Methodology, Methodology for Data Mining; Data Mining methods, tools and techniques such as regression, decision trees, neural networks, clustering, market basket analysis, association rules, fuzzy inference systems, genetic algorithms, and rough sets.

MG2204: E-Governance**3 credits (2-0-2)****Pre-requisites: MG1101**

Introduction to concepts in the management and implementation of information systems in the public sector. Management of strategy and projects, data security, quality assurance, policies, political challenges and ethical challenges. implementation of eGovernment information systems including aspects such as feasibility studies, system analysis, system design, and construction with case studies.

MG2205: Seminar IV (Audit)**1 credits (0-0-2)**

Students will be required to make presentation on topics of contemporary interest.

MG2299: Major Project Part-II**5 credits (0-0-10)**

The student will continue to work on the problem identified in Major Project Part – I as per the work plan. The work is continued until all stated

objectives and deliverables are met. Student will prepare a comprehensive report containing introduction to the problem, literature review, methodology, results and discussion and conclusion.

MG3301: Product and Brand Management**2 credits (2-0-0)****Pre-requisites: MG1203**

Concepts of the brands, branding and creating brand equity in the domestic and international markets. Developing a brand and understanding the issues involved in developing brands in different contexts. Role of brands in the marketing strategy and developing competitive advantage. Brand management decision making for establishing relationship with customers and gaining competitive advantage

MG3302: E-Marketing**2 credits (2-0-0)****Pre-requisites: MG1203**

Introduction to E-Marketing, E-Marketing Environment, E-Marketing Strategy, E-Marketing Management.

MG3303: Services Marketing**2 credits (2-0-0)****Pre-requisites: MG1203**

Introduction to services, Consumer behavior in services, Understanding customer expectation through market research, Customer defined service standards, Employee role in service designing, Managing demand and capacity, Role of marketing communication, Physical evidence in services.

MG3304: Advertising and Sales Promotion Management**2 credits (2-0-0)****Pre-requisites: MG1203**

Advertising and sales promotion; public relation; personal selling; evaluation and control of marketing effort; web marketing; green marketing; reasons for and benefits of going international; entry strategies in international marketing.

MG3305: Sales and Distribution**2 credits (2-0-0)****Pre-requisites: MG4401**

Sales Management Process, Role of Sales Manager, Concept of Personal Selling, Sales Management and Salesmanship, The Ones of Personal Selling, Process of Personal Selling, Qualities of a Successful Salesman. Goals in Sales Management, Sales Force

Management, Introduction to Distribution Management, Channel Management

MB3306: Strategic Marketing

2 credits (2-0-0)

Pre-requisites: MG1203

Marketing Strategy, Portfolio Analysis, Analysis of business enterprise, industrial analysis, market analysis, Analyzing competitive sustainable competitive advantage, generic strategies, Marketing mix strategies, Growth strategies, Implementing marketing strategy.

MG3307: Marketing Research

2 credits (2-0-0)

Pre-requisites: MG1102, MG4401

Introduction to Market Research techniques such as: Advertising Budget Decisions (Regression Analysis); Marketing Strategy Formulation (Discriminant Analysis); Questionnaire Development and Advertising Theme Decisions (Factor Analysis); Market Segmentation (Cluster Analysis); Brand and Product Line Decisions (Conjoint Analysis); Strategy Formulation (Multidimensional Scaling).

MG3308: Social Marketing

2 credits (2-0-0)

Pre-requisites:MG1203

Foundation of Social Marketing: Definition; Nature and Scope; Social Marketing Challenges; Conceptual Framework of Social Marketing; Need for Social Marketing. Social Marketing Strategies and Applications: Social Markets Segmentation; Product Strategies; Marketing Mix; Pricing Strategies; Promoter Strategies: Role of Govt. and NGO's in Social Marketing; Social Marketing; Applied in Family Planning; Medicare; Small Savings; AIDS Prevention.

MG3309: Customer Relationship Management

2 credits (2-0-0)

Pre-requisites: MG1203

Customer relationship management and its growing importance in the current business logic. Customer service, customer delight, relationship building, information technology and a memorable buying experience, doing business through IT and relationship building, and CRM strategies and approaches practiced by a range of corporations in India and overseas.

MG3310: International Marketing

2 credits (2-0-0)

Pre-requisites:MG203, MG2203

Framework of international marketing, Developing a global vision through marketing research, Global marketing management , Products and services for consumers, Licensing, Strategic Alliances, FDI, Pricing decisions, Recent trends in India's foreign trade, The future of global marketing: Six major changes in global marketing.

MG3311: Emerging Areas in Marketing

2 credits (2-0-0)

Pre-requisites: MG1203, MG3307

The course will aim at introducing student to some of the areas of current interest in Marketing. This will be of relevance to both practitioners and to academicians. The exact contents might vary based on the current trends in the industry.

MG4401: Supply Chain Management

2 credits (2-0-0)

Pre-requisites:MG1202

Supply Chain Management Concepts and Evolution Modeling and Application; Choice of Supply Chain Strategy & Structure; Sourcing Strategy & Vendor Management; Inventory Management in Supply Chains; Dynamics of Supply Chains; Supply Chain Integration and Transformation using Information Technology; Customer Value & Focus; Global Supply Chain Management; Innovations & Best Practices in Supply Chain Management

MG4402: Service Operations Management

2 credits (2-0-0)

Pre-requisites:MG1202

Global trends in Services Sector; Changing paradigms in Competitiveness of services; Services – Manufacturing Continuum. Recent trends in manufacturing, increased role of services in manufacturing. Developing an overall vision for the service system. Developing a service strategy. Service Positioning & Implications for Service Delivery Design. Service Enhancement using Internet. Performance issues in service systems. Capacity issues in service systems. Queueing Theory Applications in Service Systems. The services supply chain. Services Management in IT/ITES Sectors. Risk & Security issues in Financial Services Sector: Role of technology

MG4403: New Product Development

2 credits (2-0-0)

Product innovation for sustainable competitive advantage. Generation of product and service ideas. Research methodologies and customer based

decision making processes for increasing the success of the new product innovations.

MG4404: Business System Simulation

2 credits (2-0-0)

Pre-requisites: MG1204

System Models, System analysis, System Design, System Postulation, System simulation, Techniques of Simulation, Process of Simulation, Simulation vs Analytical methods. Monte Carlo Method, Numerical Computation techniques for Continuous and Discrete models, Distributed Lag models, Cob Web Models, Continuous system simulation, Continuous system simulation languages, CSMP III, Analog simulation, Hybrid simulation, digital-Analog Simulation, real time simulation, feedback system, interactive system, Exponential growth models, Exponential decay models, Modified Exponential growth models, System Dynamics diagrams, Multi segment models, Feedback in Socio- Economical Systems. Comparative features of Discrete Simulation languages.

MG4405: Retail Management

2 credits (2-0-0)

Pre-requisites:MG1202

Retail Management, Retail Market segmentation, Retailing Channels, Retail Pricing, Relationship Marketing in Retailing, Management of Relationship, Evaluation of Relationship Marketing, Relationship, Marketing Strategies, Retail Research and Retail Audits.

MG4406:Total Quality Management

2 credits (2-0-0)

Introduction to quality control- quality and cost consideration- statistics and its implication in quality control- sampling inspection in engineering manufacturing- statistical quality control by the use of control charts- methods of inspection and quality appraisal- reliability engineering- value engineering and value analysis. Theory of sampling inspection- standard tolerance- ABC analysis-defect diagnosis and prevention. Recent techniques of quality improvements - zero defect - quality motivation techniques- quality management system and total quality control. Section of ISO model and implementation of ISO 9000. Human resource development and quality circles - Environmental management system and total quality control

MG4407:Technology Management

2 credits (2-0-0)

Technology management definitions, concepts, main technologies and their characteristics, technology development and acquisition, forecasting, generation and development. Technology absorption and diffusion. Selection and implementation of new technologies and automation decisions. Strategic decision models. Managing new generation technologies, knowledge based techniques, competitive advantages through new technologies, product development, from scientific breakthrough to marketable product, mechanism for technology transfer and acquisitions.

MG4408: Advanced Operations Management

2 credits (2-0-0)

Pre-requisites: MG1202

Linking organizational objectives to production and operations objectives. Basic manufacturing processes used in engineering and non engineering industries. Need for product design and re design. Just in time production systems. Job design and work measurement. Aggregate planning – aggregate units of production. MRP and MRP II systems, embedding JIT into MRP, advanced MRP systems.

MG4409: Technology and Operations Strategy

2 credits (2-0-0)

Strategic role of Operations; to appreciate the linkages between different decision areas in Operations, and between Operations and other areas; to explore the process of formulating and implementing Operations policies consistent with objectives; and to understand the importance and methods of building capabilities in Operations. The broad contents of the course are: Concept of Operations Strategy; Capacity and Facilities Strategy; Product/ Process Development and Technology Strategies; Manufacturing Organisation & Workforce Issues; Service Operations Strategy; Building Operations Capabilities and Managing Improvement Strategies; and Competing through Operations.

MG4410: Emerging Areas in Technology and Operations Management

2 credits (2-0-0)

The course will aim at introducing student to some of the areas of current interest in Technology and Operations Management. This will be of relevance to both practitioners and to academicians. The exact contents might vary based on the current trends in the industry.

MG5501: Software Project Management**2 credits (2-0-0)****Pre-requisites: MG1207, MG2102**

Overview of Project Planning, Project Execution Approach, Software requirement study and Analysis, Objectives of activity planning, project scheduling, sequencing and scheduling activities, Network planning models, forward pass, backward pass identifying critical path, project crashing, Project progress review, Risk Management, Managing People and Organising Teams.

MG5502:IT and Strategy**2 credits (2-0-0)****Pre-requisites: MG2101**

Role of Information and communication technologies for achieving competitive advantage. Linkages of IT strategy and business strategy.

MG5503: Knowledge Management**2 credits (2-0-0)**

Definition, evolution, need, drivers, scope, approaches in organizations, strategies in organizations, components and functions, understanding knowledge; Learning organization: five components of learning organization, knowledge sources, and documentation. Knowledge creation process, knowledge management techniques, building the knowledge corporation. Knowledge management system life cycle, managing knowledge workers, knowledge audit, and knowledge management practices in organizations, Knowledge Engineering.

MG5504: Software Engineering**2 credits (2-0-0)****Pre-requisites: MG1207**

Introduction to software engineering, Software requirement study and Analysis, Software Requirement Specifications, Software Estimation, Objectives of activity planning, Software Design Concepts, Risk Management, Software Testing and Software Maintenance.

MG5505: Decision Support Systems**2 credits (2-0-0)****Pre-requisites: MG1207**

Decision Support System: Characteristics of DSS, Decision making process, Anatomy of DSS, knowledge based systems, Architecture of DSS,

Hardware, Software & User Interface for DSS, expert Systems for Decision Support, Group Decision support system, Enterprise Support System. Data Warehousing – Need for data warehousing, data warehouse components, Construction of data warehouse, data base for data warehouse,database warehouse architecture, maintenance issues in data warehouse, Data mining, tools for data mining, online analytical processing.

MG5506: Software Quality Management**2 credits (2-0-0)**

Software Quality, Product versus Process Quality management, techniques to help enhance software quality, Software Validation and Verification, Qualityplans, Brief description of SEI-CMM.

MG5507: Telecommunication Systems Management**2 credits (2-0-0)**

Introduction to telecom technologies. Concepts of accounting, finance, operations, human resource management, organization, marketing and computing science in design of telecommunication systems. Market and regulatory issues.

MG5508: Strategic Planning of Information Systems**2 credits (2-0-0)**

Impact of information systems (IS) and information technology (IT) on business performance. Role of IT/IS in crafting strategic options of organisations. Tools, techniques and management frameworks to both align strategies for IS and IT with business strategy.

MG5509: Emerging Areas in IT and Systems 2 credits (2-0-0)

The course will aim at introducing student to some of the areas of current interest in IT and Systems. This will be of relevance to both practitioners and to academicians. The exact contents might vary based on the current trends in the industry.

MG6601: Security Analysis and Portfolio Management**2 credits (2-0-0)****Pre-requisites: MG1205**

Investments, Portfolio Theory, Equilibrium in Capital Market, Bond Analysis, Equity Valuation Model, Security Analysis, Derivatives

MG6602: Financial Risk Management**2 credits (2-0-0)**

Pre-requisites:MG1205

Risk Management, Employee Benefit Plan and Design and Financing, Business Insurance and Estate Planning, Risk & Crisis Management, Markets for Pure Risk , Risk Management and Treatment, Financial Strategies and Analysis, Financial Derivatives, International Markets, Investment Management, Risk Analysis and Environmental Management

MG6603: Corporate Tax Planning**2 credits (2-0-0)****Pre-requisites: MG1205**

Introduction to Direct Taxes, Income Tax, Wealth Tax, Important Provision of Income Tax Act, Basic Concepts of Assessment Years, Previous Years, Person, Income, Gross Total Income, Capital and Revenue Receipts and Expenditure, Residential Status and Incidence of Tax, Tax Free Income. Meaning, Taxability of Allowances and Perquisites, Permissible Education, Treatment of PF, Gratuity, Tax Planning. Income from Business and Profession: Basis of Charge, Scheme of Provisions, Deductions Expressly Allowed, Expenses Allowed Under Restriction, Depreciation, Tax Planning. Income from House Property: Tax Planning, Income from Capital Gains and other Sources, Deduction: Deduction Allowed From Total Income, Rebates and Relief.TDS, Tax Planning in Relation to NRIs.

MG6604: International Finance**2 credits (2-0-0)****Pre-requisites:MG1205**

International boundaries are blurring therefore MNCs can raise funds from international financial management. The purpose of this paper is to equip the students with financial and investment decision of MNCs. An overview of multinational financial management; international monetary and financial systems, IBRD and development banks; fiancé in a multination firms; international flow of funds. International working capital management; international cash management; international receivable management, managing short term assets and liabilities; international capital money markets; euro dollar and currency market; financial market instruments - GDRs, ADRs, Euro issues, CP and ECB. Multinational capital budgeting, cost of capital and capital structure decisions; dividend policy of multinational firm. Developments in foreign exchange markets; exchange rate

determination; measuring and managing various risks and exposure; country risk analysis; taxation in multinational firms.

MG6605:Personal Wealth Management**2 credits (2-0-0)****Pre-requisites:MG1205**

Wealth Management as an all inclusive set of strategies that aims to grow, manage, protect and distribute assets in a much planned systematic and integrated manner. Liquidity management, Wealth formation and Wealth optimization

MG6606: Project Appraisal and Finance**2 credits (2-0-0)****Pre-requisites: MG1205**

Planning & Analysis Overview, Generation and screening of project ideas, Financial Analysis, Types and measure of risk, Social Cost Benefit Analysis(SCBA), Multiple projects and constraints, Project financing in India, Project management concepts.

MG6607: Corporate Restructuring**2 credits (2-0-0)**

Mergers and Acquisition, Corporate restructuring, Merger Process, Valuation, Accounting for amalgamation, Takeovers, Legal and regulatory frame work of Mergers and Acquisition, Indian Income Tax act 1961, SEBI take over code, Provisions of Competition Act.

MG6608: Management of Financial Services**2 credits (2-0-0)****Pre-requisites: MG1205**

Financial Service: salient features, scope and problems; mutual funds; venture capital financing; regulatory and theoretical framework of leasing; issue management activities/ procedures of merchant banking. Credit rating; factoring and forfeiting; housing finance; merger/amalgamation and acquisition/takeover; debt securitization. Development Banks- operational policies and practices of IDBI, ICICI, IFCI, SIDBI; EXIM BANK; UTI; LIC; segments/instruments for money market. Mechanism of security trading, NSE, OTCEI, scripless trading, depository system and custodial service; SEBI-its objectives, functions and powers.

MG6609: Economic and Financial Modeling**2 credits (2-0-0)****Pre-requisites: MG1205**

Information gathering, Analysis of company/ industry performance on various financial

parameters. Development and analysis of financial model. Valuation of companies.

MG6610: Emerging Areas in Finance

2 credits (2-0-0)

The course will aim at introducing student to some of the areas of current interest in Finance. This will be of relevance to both practitioners and to academicians. The exact contents might vary based on the current trends in the industry

MG7701: Change Management

2 credits (2-0-0)

Pre-requisites: MG1201 OverLaps: MG9909

Organizational change, Human process interventions, Techno structural interventions, Contemporary issues and applications.

MG7702: Organization Theory

2 credits (2-0-0)

Pre-requisites: MG1201

Organizational theory principles, Organizational Design, Integrating Mechanism, Locus of Decision Making, Forms of Organization Design, Design by Division, Leadership, Motivation, Communication in Organization.

MG7703: Corporate Social Responsibility

4 credits (3-1-0)

Pre-requisites: MG1201

Introduction, Shareholders and Stakeholders, Corporate restructuring and Responsibilities, Corporate Governance Risks, Corporate Social Responsibility, Compliance checklist for Corporate Social responsibility, Emerging Areas and Trends in Corporate Social.

MG7704: Leadership and Talent Management(Old Code : MGL-674)

2 credits (2-0-0)

Pre-requisites: MG1201

Leadership and talent development, Leadership values and behaviors, Leadership assessment and development framework, Talent dimension, Organizational needs, Approach to establish talent requirement, Organizational life stage, High performance team behaviors.

MG7705: Competency Management

2 credits (2-0-0)

Pre-requisites: MG1201

Role of skill, attitude, knowledge and other attribute that is observable and identifies successful performance. Translation of competencies into strategic vision and achievement of organizational goals. Development of HRM system for competency development, Measurement of

observable behaviors. Employee communication for competency development.

MG7706: Training and Development

2 credits (2-0-0)

Pre-requisites: MG1201

Training concept and rationale; training process of stakeholders in training programme; Organization and Management of training function; Training needs assessment-organization analysis, operational analysis, person analysis; competency mapping. Process of learning in training programme- attributed and factors influencing; learning process; learning styles; training climate and pedagogy; developing training modules; Training aids. Training methods and techniques such as role playing, business games, in basket exercises, laboratory training; incidents and cases; seminars, syndicates and group discussion; lecture, programmed instructions; inspirational techniques- brainstorming, mind mapping, creative problem solving. Evaluation of training-need for evaluation, principles of evaluation, criteria and approaches; return on investment in training, process of calculating RoI in training; emerging trends in training and development; new perspectives on training-cross culture training, e-learning, knowledge management.

MG7707: Management of Employee Relation

2 credits (2-0-0)

Pre-requisites: MG1201

Traditional industrial relations, Conflict resolutions to employee relations Management, collaborative partnership between employers and employees. Shift from industrial relations to employees' relations, the implementation of employee relations management, Negotiations skills and soft skills.

MG7708: Organizational Development

2 credits (2-0-0)

Pre-requisites: MG1201

Definition, Foundations of organizational development, Process of organizational development, Organizational development Intervention, Client And Consultant Relationship.

MG7709: Emerging Areas in Human Resource Management 2 credits (2-0-0)

The course will aim at introducing student to some of the areas of current interest in Human Resource Management . This will be of relevance to both practitioners and to academicians. The exact contents might vary based on the current trends in the industry

MG8801: Infrastructure Management**2 credits (2-0-0)****Pre-requisites: MG1104**

Introduction to infrastructure management, Overview of infrastructure needs - National & Global, Indian economy, Infrastructure policies, Program and project development, Growing energy needs, Infrastructure economics, Marketing and infrastructure services, Strategy and competition for infrastructure, Integrated infrastructure management system, Information system for infrastructure management, Infrastructure project management, Financing infrastructure developments, Advanced project management, Project evaluation, Legal aspects of infrastructure management, Regulatory issues in infrastructure management, Environmental policies, Urban governance, Other issues in infrastructure management, Rural infrastructure management, Technology change management in infrastructure sectors

MG8802: Public Private Partnerships**2 credits (2-0-0)****Overlaps: MG9903**

Definitions, PPP and infrastructure, International experiences of PPP, International perspective, Role of international multilateral agencies, PPP in soft infrastructure, PPP and project management, National policy on PPP.

MG8803: Public Policy and Processes**2 credits (2-0-0)****Pre-requisites: MG1101**

What is public Policy, Policy is what it does, Why policy?, 'Public policies and private strategies', Relationship between market and government failures, Policy context- Ideas, Actors and Institutions, The policy context', Stages of policy, Process vs outcome analysis 'Policy content and context in implementation', Top-down vs bottom-up modes of analysis. Top-down and bottom-up approaches to implementation. Research, Actor-oriented policy understanding, Street-level bureaucracy, 'Putting it all together: Models of the policy process', Technician/Bureaucrat- politician incentives vs interests analysis in policy. Rational choice, Landing on your feet', Public choice, Comparative policy analysis, The eightfold path, Policy learning, policy transfer, policy change, policy reform.

MG8804: Management of Rural and Social Sector
2 credits (2-0-0)

Indian rural and social sector, rural and social sector economic development programs of Asia, economic development through the rural and social sector.

MG8805: Sustainable Development**2 credits (2-0-0)**

Global economic environment and policy. Competition for resources, development challenges, comparative regulations framework, WTO, climate change, Global public goods, Global business strategy, Business and society, Sustainable business strategy and management

MG8806: Management of Non Formal Organization**2 credits (2-0-0)**

Contribution of non-formal sector in Indian economy. Nonformal vs formal sectors, issues in: finance, operation, marketing, human resource. Management of the NFO organization, setting up of the goals and objectives of NFO activities, thorough understanding of the organizational framework of NFOs, and distribution of portfolios among its members. NFO Management also involves devising of strategies and operational pathways, supervision and planning of financial and other policies and various other programmes of the organization. Role of government, role of financial agencies, Successful case studies in non formal sectors.

MG8807: Information Technology Enabled Services**2 credits (2-0-0)****Pre-requisites: MG1207**

This covers entire gamut of operations which exploit information and communication technology for improving efficiency of an organization. These services provide a wide range of applications in call Centre, medical transcription, medical billing and coding, back office operations; revenue claims processing, legal databases, content development, payrolls, logistics management, GIS (Geographical Information System), HR services, web services etc.

MG8808: Healthcare System Management**2 credits (2-0-0)**

Understanding the principles that govern how health systems function. Healthcare systems design, modes of operation, and implications. Analysis of healthcare systems.

MG8809: Emerging Areas in Management in Social Sector

2 credits (2-0-0)

The course will aim at introducing student to some of the areas of current interest in Management in **M.Tech[CSE] Programme (Two Years)**

MIT1101: Modeling & Simulation

4 credits (3-1-0)

Introduction and basic simulation procedures. Model classification : Monte Carlo simulation, discrete-event simulation, continuous system simulation, mixed continuous/discrete-event simulation. Quantitative modelling paradigms: queueing networks, stochastic process; algebras and stochastic Petri nets Input and output analysis: random numbers, generating and analysing random numbers, sample generation, trace- and execution-driven simulation, point and interval estimation. Variance reduction techniques, Process-oriented and parallel and component simulation and modelling.

MT1102: Advanced Database Management Systems

4 credits (3-1-0)

Formal semantics of relational databases and systems, Data Model, physical database tuning, advanced issues in query optimization and transaction processing. Advanced database facilities such as triggers and materialized views, query caching, and database mediation. Introduction to modern database systems: object-relational databases, deductive databases, spatial databases, temporal databases, multimedia databases, Real Time Databases and advanced relational databases. Current topics in data base research and development.

MT1103: Advanced Computer Architecture

3 credits (3-1-0)

Instruction set design (RISC and CISC), virtual memory system design, memory hierarchies, cache memories, pipelining, vector processing, I/O subsystems, co-processors, and multiprocessor architectures.

MT1104: Advanced Data Structures and Algorithms

4 credits (3-1-0)

Review of basic linear data structures and their realization in object oriented environments. Trees, Graphs, heaps. Graph algorithms: Matching and

Social Sector. This will be of relevance to both practitioners and to academicians. The exact contents might vary based on the current trends in the industry

Flows. Approximation algorithms: Use of Linear programming and primal dual, Local search heuristics. Parallel algorithms: Basic techniques for sorting, searching, merging, list ranking in PRAMs and Interconnection networks.

MT1105: Communication Skills

2 credits (3-1-0)

Importance of Effective Communication; Reading, writing and oral communication skills; Methods/Modes of communication, choice of media; Barriers to communication. Basics of Technical report Writing, Referencing methods, Visual communication and its impact, Hands-on-experiences and Case studies

MT1201: Advanced Operating Systems

4 credits (3-1-0)

Operating systems structuring, multithreading and synchronization, systems issues in parallel and distributed computing systems.

MT1202: Digital Signal Processing

4 credits (3-1-0)

Discrete-time signals and systems, Constant coefficient difference equation. Review of Z Transform: properties, R.O.C, stability and Causality criterion. Structures for digital filters. DTFT and DFT: properties, linear and circular convolution. FFT: Decimation in time & Decimation in frequency. Design of IIR Filters: Bilinear transformation, Impulse invariant transformation. Butterworth, Chebychev, Inverse Chebychev and Elliptical filters etc. Design of F.I.R filters by windowing: rectangular, Bartlett, Hann, Hamming, Kaiser window filters, Design method, Relationship of Kaiser to other windows. Application of MATLAB for design of digital filters. Advanced signal processing techniques: Multirate Signal processing – Down sampling/upsampling.

MT1203: Advanced Computer Networks

3 credits (2-0-2)

Internet overview, in-depth study of the application, transport, network and link layers and associated protocols, peer-to-peer networks

MT1204: Research Methodology

2 credits (3-1-0)

Research methodology: introduction and motivation, types of research, research approaches, Significance of research, research methods versus methodology, Defining the research problem, selecting the problem, techniques involved in defining a problem, Measurement in research, measurement scales, sources of error in measurement; technique of developing measurement tools, scaling, Methods of data collection ,Case study method, meaning, advantages, limitations, Meaning of interpretation, significance of report writing, different steps in writing report

MT2197: Seminar**3 credits**

Students will be required to make presentation on topics of contemporary interest.

MT2199: Major Project Part I :**6 credits**

Formulation of the problem, Literature search, Design of experimental setup, Exploration of possible solution techniques and familiarization with relevant software/algorithms, specifications of deliverables.

MT2299: Major Project Part II :**12 credits (0-0-24)****Pre-requisites: MT2199**

The student are expected to work towards achieving the goals and milestones specified in Major Project Part I, At the end there would be delivery of tangible product/algorithm/solution technique/design methodology. A dissertation outlining the entire problem including literature review and various results obtained along with their solutions is expected to be produced by each student.

MT3301: Cellular and Mobile Communication Systems**4 credits (3-1-0)**

Evolution of wireless communication, Wireless generations and standards.Fundamentals of cellular systems, Operation of cellular system, Concept of frequency reuse, Channel assignment strategies, Hand off strategies, Co-channel and Adjacent channel interference, Trunking and grade of service. Cell splitting, Sectoring. Mobile Radio signal propagation, path loss and channel models: Large Scale Path Loss, Small Scale Path Loss - Rayleigh and Rician Fading. Modulation

techniques for mobile radio.Multiple access techniques (F/TDMA, CDMA, SDMA, MU-MIMO, OFDMA);Current and upcoming wireless systems: 3G, 4G, 802.11a/b/g, 802.16, WiMAX, 802.22

MT3302: Network Management and Security**4 credits (3-0-2)**

Basic notions of confidentiality, integrity, availability; cryptographic systems, coding and decoding of messages. Cryptographic protocols for privacy, integrity, Authentication, key exchange and access control. TCP/IP security; Firewalls, IPSec; Virtual Private Networks, Web-service security

MT3303: Mobile Computing**4 credits (3-0-2)**

Wireless communication principles such as wireless transmissions, smart antennas, frequency allocations, error detection and correction, location-based technologies, spread spectrum, and CDMA/TDMA. Wireless LANs with emphasis on 802.11, Bluetooth, wireless sensor networks, UWB (Ultra Wideband), cellular networks ranging from 1G to 5G, mobile ad hoc networks (MANETs), wireless local loops, satellites communications. Mobility Management: Cellular architecture, Co-channel interference, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, hierarchical scheme, predictive location management schemes. Wireless Internet, Mobile IP, wireless gateways, mobile application servers. Ad hoc Network Routing Protocols: Ad hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, location aided routing, zonal routing algorithm.The architectural, security, and management/support issues and their role in building, deploying and managing wireless systems in modern settings. wireless security wireless sensor applications, and mobile agent applications.

MT3304: Distributed Computing**3 credits (3-0-0)**

Models of distributed computing; Basic issues; Causality, Exclusion, Fairness, independence, Consistency; Specification of Distributed Systems; Transition systems, Petri nets, process algebra properties; Safety, Liveness, Stability.

MT3305: Grid and Peer-To-Peer Computing**3 credits (3-0-0)**

Computing grids and data grids; Data management in data grids; Resource management and scheduling in computing grids; secure data grid technologies ;P2p systems: pure p2p, super peers, hybrid P2p techniques: distributed hashing, routing, free rider problem ;P2p security ;Current p2p systems: Napster, Gnutella, KazaA, FreeNet, Pastry, Tapestry.

MT3306: Queuing Theory and Data Networks
4 credits (3-1-0)

Review of the lower four layers of the ISO-OSI Model. Queueing Theory: Introduction, Little's theorem, Applications of the Little's theorem. The M/M/1 queueing system, M/M/m and M/M/{infinity}, and M/M/m/m, and other Markov systems. The M/G/1 system. Networks of transmission lines. Time reversibility-Burke's theorem. Networks of queues-Jackson's theorem. Multi-access communication, Routing and flow control in data networks. Traffic modeling and the application

MT3307: Quantum Computing)
3 credits (2-0-2)

Introduction, and fundamental notions of computation theory and quantum physics; Review of the necessary tools from linear algebra; Concept of qubits and the framework of quantum mechanics, quantum model of computation; Super dense coding and quantum teleportation, quantum algorithms, algorithms with super polynomial speed-up; Algorithms based on amplitude amplification, quantum computational complexity theory and lower bounds and quantum error correction in detail.

MT3308: Special Topics in Networks
3 credits (3-0-0)

This will focus on special topics of contemporary relevance and interest to both o industry and research.

MT4401: Communication Systems
4 credits (3-1-0)

Review of Fourier methods of signal and system analysis ,Power and energy spectral densities, Correlation functions, Hilbert Transform, Band-pass signals and systems.Review of probability, Random variables and Random Process.Review of Continuous-wave (CW) modulation.Digital transmission of analog signals: Sampling theorem, Quantization, Pulse code modulation (PCM) system, Electrical waveform representation of binary sequences, Differential Pulse Code

Modulation (DPCM), Delta Modulation, Adaptive delta modulation, Noise Performance of a PCM System. Digital Modulation Techniques: ASK, PSK and, FSK.Characterization of Communication Signals and Systems: Representation of band-pass signals and systems, Signal space representation, Representation of digitally modulated signals, spectral characteristics of digitally modulated signals.Optimum Receivers for the AWGN Channels: Correlation demodulator, Matched filter demodulator, The optimum detector, The maximum-likelihood sequence detector. Performance of the optimum receiver for memoryless modulation.

MT4402: Cellular and Mobile Communication Systems
4 credits (3-1-0)

Evolution of wireless communication, Wireless generations and standards.Fundamentals of cellular systems, Operation of cellular system, Concept of frequency reuse, Channel assignment strategies, Hand off strategies, Co-channel and Adjacent channel interference, Trunking and grade of service. Cell splitting, Sectoring. Mobile Radio signal propagation,path loss and channel models: Large Scale Path Loss, Small Scale Path Loss - Rayleigh and Rician Fading. Modulation techniques for mobile radio.Multiple access techniques (F/TDMA, CDMA, SDMA, MU-MIMO, OFDMA);Current and upcoming wireless systems: 3G, 4G, 802.11a/b/g, 802.16, WiMAX, 802.22.

MT4403: Digital Signal Processing
4 credits (3-0-2)

Introduction; Discrete – time signals and systems: Implementation of Discrete – Time Systems.Correlation of Discrete Time Signals; Z-Transform and Its Application to the Analysis of LTI Systems;Frequency Analysis of Signals and Systems; Frequency Analysis of Continuous Time Signals, The FourierSeries for Continuous Time Periodic Signals, Power Density Spectrum of Periodic Signals, The Fouriertransform for Continuous – Time Periodic Signals, Energy Density Spectrum of Aperiodic.

MT4404: Advanced Communication Engineering
4 credits (3-1-0)

Signal design for band-limited channels: Characterization of band-limited channels, Nyquist criterion, Partial response signals, Data detection for controlled ISI, Probability of error in detection of PAM.Communication Through Band-Limited

Linear Filter Channels: Optimum receiver for channels with ISI and AWGN, Linear equalization, Decision-feedback equalization, reduced complexity ML detectors, Turbo equalization. Digital Communication Through Fading Multipath Channels: Characterization of Fading Multipath Channels, Effects of signal characteristics on the choice of a channel model, Diversity techniques, A tapped delay line channel model, Rake receiver demodulator. Spread Spectrum Signals for Digital Communications: Direct sequence spread spectrum signals (DSSS), Frequency hopped spread spectrum signals (FHSS), PN sequences. Multiuser Communications: Introduction to multiple access techniques, Capacity of multiple access methods, CDMA, ALOHA systems and protocols, Carrier sense systems and protocols.

MT4405: Optical communication
4 credits (3-1-0)

Introduction to optical communications, Optical signaling schemes viz., IM, PL, PCM, PCM/PL, digital PPM, PRM, PFM etc., video signal, electro-optic modulators. Various receiver configurations, performance evaluation of various optical receivers and their comparative study, noise sources in optical communication, , signal-to-noise ratio (SNR) calculations, Optimization of SNR, Applications of optical amplifier in the system. Optical preamplifier design. Optical line coding schemes: NRZ, RZ, Block codes, Error correction. Optical fiber link design power budget, time budget and maximum link length calculation, hybrid fiber coaxial/microwave links, fiber-in the loop (FITL) - FTTH/FFTB, FTTC. WDM Systems.

MT4406: Adaptive Signal Processing
4 credits (3-1-0)

Introduction to Adaptive Filters: Adaptive filters, filter structures, cost functions, applications etc. Stationary Processes and Models: Mean Ergodic theorem, correlation matrix and its properties, stochastic models, the eigenanalysis. Wiener Filters: Principle of orthogonality, minimum mean-squared error (MMSE), Wiener-Hopf equations, MMSE cost function, linearly constrained minimum variance filter. Linear Prediction: Forward and backward linear prediction, Levinson algorithm, lattice filters and their properties, joint process estimation. Stochastic Methods: Steepest-descent algorithm, its stability and transient behavior, Least Mean Square (LMS) algorithm, properties of LMS, Recursive LMS (RLMS) algorithm. Least Square

Methods: Least squares and orthogonality, Recursive least squares (RLS) algorithms, properties of RLS.

MT4407: Detection and Estimation Theory
4 credits (3-1-0)

Detection Theory: Binary decisions - Single observation: Maximum likelihood decision criterion; Neymann-Pearson criterion; Probability of error criterion; Bayes risk criterion; Minimax criterion; Robust detection; Receiver operating characteristics. Binary decisions - Multiple observations Vector observations; the general Gaussian problem; Waveform observation in additive Gaussian noise; Integrating optimum receiver; Matched filter receiver. Estimation Theory Maximum likelihood estimation; Bayes cost method - Bayes estimation criterion- Meansquare error criterion; Uniform cost function; absolute value cost function; Linear minimum, variance - Least squares method; Estimation in the presence of Gaussian noise. Linear observation; Non-linear estimation.; Properties of estimators Bias, Efficiency, Cramer-Rao bound, Assymptotic properties; Sensitivity and error analysis.; State Estimation: Prediction; Kalman filter. Sufficient statistics and Statistical Estimation of Parameters: Concept of sufficient statistics; Exponential families of distributions; Exponential families and Maximum likelihood estimation; Uniformly minimum variance unbiased estimation.

MT4408: Signal Theory
4 credits (3-1-0)

Representation of deterministic signals: Orthogonal representation of signals. Dimensionality of signal spaces. Construction of orthogonal basis functions. Time-bandwidth relationship: RMS duration and bandwidth, uncertainty relations. Random variables: Distribution and density functions, Some special random variables, Conditional distributions and total probability. Functions of one random variable: Mean, variance, Moments, Characteristic functions. Functions of two random variables: Moments and joint distributions, Conditional distributions, Conditional expected values, Mean square estimation. Random Processes: Definition and classification, stochastic integrals, Fourier transforms of random processes, stationary and non-stationary processes, correlation functions. Ergodicity, power spectral density, transformations of random processes by linear systems. Representation of random processes (via sampling, K-L expansion and narrow band representations),

special random processes (white Gaussian noise, Wiener-Levy processes, shot-noise processes, Markov processes). Introduction to wavelet transform.

MT4409: Special Topics in Communications
3 credits (3-0-0)

This will focus on special topics of contemporary relevance and interest to both industry and research.

MT4410: Mobile Computing
4 credits (3-0-2)

Wireless communication principles such as wireless transmissions, smart antennas, frequency allocations, error detection and correction, location-based technologies, spread spectrum, and CDMA/TDMA. wireless LANs with emphasis on 802.11, Bluetooth, wireless sensor networks, UWB (Ultra Wideband), cellular networks ranging from 1G to 5G, mobile ad hoc networks (MANETs), wireless local loops, satellites communications. Mobility Management: Cellular architecture, Co-channel interference, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, hierarchical scheme, predictive location management schemes. Wireless Internet, Mobile IP, wireless gateways, mobile application servers. Ad hoc Network Routing Protocols: Ad hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, location aided routing, zonal routing algorithm. The architectural, security, and management/support issues and their role in building, deploying and managing wireless systems in modern settings. wireless security wireless sensor applications, and mobile agent applications.

MT5501: Information Privacy and Computer Security
3 credits (3-0-0)

Introduction to security and privacy issues associated with information systems. Control of access through technical and physical means. Confidentiality, integrity, Identification and authentication. Management of encryption systems, key protection and distribution. Privacy legislation and technical means of providing privacy. Operating System security, Database security.

MT5502: Modern Cryptography
4 credits (3-0-2)

Secret Key Cryptography, Public Key Cryptography, Hash functions and MACs, Public key Infrastructure, Digital signatures

MT5503: Network Management and Security
4 credits (3-0-2)

Basic notions of confidentiality, integrity, availability; cryptographic systems, coding and decoding of messages. Cryptographic protocols for privacy, integrity, Authentication, key exchange and access control. TCP/IP security; Firewalls, IPsec; Virtual Private Networks, Web-service security

MT5504: Lightweight Security
3 credits (3-0-0)

Introduction to lightweight Security, Issues of Sensor network, RFID system, smart card system. Remedies against their vulnerabilities.

MT5505: Verification of Security Protocols
3 credits (3-0-0)

Black Box modeling, Secrecy, Authenticity and non repudiation (usage of nonce), BAN-logic, model checking, spi-calculus.

MT5506: Access Control System and Methodology
3 credits (3-0-0)

Access control Techniques, Access Control Administration, Identification and Authentication Techniques, Access Control Methodologies and Implementation. Relational Database Access controls using SQL, Monitoring and Penetration Testing

MT5507: Telecommunications, Network and Internet Security
3 credits (3-0-0)

Communications and Network Security, Internet/ Intranet/ Extranet security, IPsec Virtual Private Networks, Firewalls, E-mail Security, Secure Voice Communications Network Attacks and countermeasures.

MT5508: Digital Rights Management
3 credits (3-0-0)

Content protection technologies, right expression languages, DRM Architecture, Case study (Analysis of commercial DRM technology)

MT5509: Special Topics in Information Security
3 credits (3-0-0)

This will focus on special topics of contemporary relevance and interest to both industry and research.

MT5510: Cyber Laws and information Crime**3 credits (3-0-0)**

Basic Concepts of Cyber law: Understanding the Technology of Internet: How the Internet functions; Understanding TCP/IP, HTTP, Web hosting etc; Scope of Cyber Law: Nature of Cyber Space; Cyber Property; Cyber Personality; Cyber Transactions; Cyber Jurisprudence: Concepts of Historical, Analytical and Ethical Jurisprudence; Relationship between Meta Society Laws and Cyber Law; Abuse through Blogs, Economic Offences through Internet and Penal mechanisms. Introduction to Cyber Crimes, Origin and development of Cyber Law and Internet, Cyber vandalism, Classification of Cyber Crimes, Computer as an Instrument of Crime, Internet Crimes, Password Fraud, Web Based Crimes, Computer Containment, Computer Virus, Hacking, Internet Frauds, Cyber Pornography, Child Pornography, Protection of Copyrights and Intellectual Property Rights, Invasion of Privacy, Constitutional Basis of Privacy, Security, Search and Seizure, E-mail: Unsolicited E-mail, Defamation, Harassment and E-mail abuse, Present Legal Protection, Human Rights Violation and Internet, The Information Technology Act: Concept of Cyber Crime and ICT Act -2006; Jurisdiction and Cyber Crime, Forgery, Defamation, Cyber Terrorism, Regulation of Cyber Constitution, Powers & Jurisdiction of Cyber Appellate Tribunals, Case studies.

MT6601: Computer Vision**4 credits (3-0-2)**

Overview of Applications; Camera; Physics of Image Formation, Projective Model of Camera, Camera Calibration; Multiple-view Geometry and Reconstruction; Edge/feature extraction, correspondence and tracking, 3D structure/motion estimation. Object recognition, Scene and activity interpretation. Shape from X (defocus, shading, texture); Motion Analysis and Tracking; Object Recognition and Image Understanding.

MT6602: Computer Graphics and Multimedia Systems**3 credits (3-0-0)**

Computer graphics introduction, interactive graphics, raster graphics, display techniques, geometrical transformation, 2D transformation, Affine and projective transformation, homogeneous co-ordinate system, control points, 3D transformation, geometrical modeling, parametric cubic curves, curve entities, synthetic curve, B-Spline, Bezier curve, solid modeling,

lighting / illumination and shading effect, radiance, bidirectional reflectance distribution function BRDF, radiosity, radiance equation, ray tracing, recursive ray tracing, rendering, clipping, Parallel and perspective projection, Euler's rule, 3D view, introduction to multimedia, representation of graphics and image data, visual modeling, image representation and processing, BIT image, file format, Color model, Color look up table, median – cut-algorithm, multimedia authoring, image compression, Hoffman coding, FM, digital audio signal, MIDI, wave table

MT6603: Information Retrieval**4 credits (3-0-2)**

Introduction – What is IR; Applications and Significance; retrieval evaluation; Query Modelling and Query Languages; Indexing and Searching Text; Multimedia IR: Models, indexing, searching; User Interfaces and Visualization: Distributed IR; Web Search Engines; Digital Libraries.

MT6604: Pattern Recognition**4 credits (3-0-2)**

Application to pattern recognition, statistical decision theory, image processing and analysis, pattern recognition scheme, feature extraction, shape and texture based classification, concept of probabilities, random variables, joint distribution, supervised and unsupervised learning, RISK estimation, Statistical decision making, Baye's decision, priori probability, posteriori probability, multiple feature, decision boundary, estimation of error rate, non parametric decision making, nearest neighbor classification, adaptive discriminant function, PARZON window estimator, clustering, unsupervised classification, Fuzzy classification, Fuzzy clustering, artificial neural network, nets with hidden layers, back propagation algorithm, Hopfield network

MT6605: Advanced Computer Graphics**4 credits (3-0-2)**

Rendering: Ray tracing, Radiosity methods, Global illumination models, Shadow generation, Mapping, Anti-aliasing, Volume rendering, Geometrical Modelling: Parametric Surfaces, Implicit Surfaces, Meshes, Animation: Spline driven, quaternions, articulated structures (forward and inverse kinematics), deformation - purely geometric, physically-based. Other advanced topics selected from research papers.

MT6606: Natural Language Processing**3 credits (3-0-0)**

Introduction to NLP; History and state-of-the-art; Lexical semantics and word-sense disambiguation; Part-of-speech tagging; Morphology; Context-sensitive spelling correction; Noisy channel model; Language modeling; Parsing; Discourse processing; Dialogue systems; Generation; Inference and world knowledge; Semantic analysis; Information extraction Machine Translation;

MT6607: Artificial Intelligence

4 credits (3-0-2)

Problem solving, search techniques, control strategies, game playing (minimax), reasoning, knowledge representation through predicate logic rule based systems, semantics nets, frames, conceptual dependency formalism. Planning, Handling uncertainty: Bayesian Networks, Dempster-Shafer theory, certainty factors, Fuzzy logic Learning through Neural nets-Back propagation, radial basis functions, Neural computation models - Hopfield Nets, Boltzman machines, PROLOG programming Expert Systems.

MT6608: Digital Image Processing

4 credits (3-0-2)

Introduction, Digital image processing, image representation, image sampling and quantization, image histogram, image enhancement, mask processing, spatial domain operation, average filter, median filter, high pass filter, histogram modification, histogram equalization, segmentation, edge detection, gradient operator, first order, 2nd order, LOG operator, Canny edge detection, boundary extraction, boundary representation, chain code, frequency domain analysis, filtering and restoration, DFT, Inverse filter, Wiener filter, other Fourier domain filter, image perception, color representation, image compression, file formats, coding.

MT6609: Special Topics in Visual Information Processing

3 credits (3-0-0)

This will focus on special topics of contemporary relevance and interest to both industry and research.

MT7701: MOS VLSI Circuit Design

4 credits (3-0-2)

MOS transistor structure, CMOS process flow, Design rules and layout, CMOS inverters: static characteristics and dynamic characteristics, Combinational and sequential MOS logic circuits, Low power CMOS logic circuits, Semiconductor memories, and VLSI design methodology.

MT7702: CAD for VLSI

4 credits (3-0-2)

Introduction to VLSI design flow, Overview of simulation with simulation models, categories of simulations, simulation for design verification, advantages, disadvantages and speed of simulation, and types of simulation; Basic features of VHDL, Verifying behavior prior to system construction simulation and logic verification, Behavioral synthesis, RTL design, Logic synthesis, Optimization and high level synthesis, Introduction to Finite state machines (FSM), FSM synthesis, and technology mapping, VLSI physical design with layout algorithms, circuit partitioning, placement and routing algorithms, Introduction to reconfigurable computing and Field Programmable Gate Arrays (FPGAs), and Technology and challenges facing the industry today and in the next ten years.

MT7703: Mixed Analog-Digital Design

4 credits (3-0-2)

Introduction to Mixed Analog Digital Design with concepts of digital IC design, concepts of analog IC design, analog signal processing and examples of mixed digital analog systems, VLSI Technology and Layout, MOSFET modeling for ICs with MOS as an amplifier and as a switch, biasing of MOS amplifiers, small signal operation and models, SPICE simulation of MOS circuits; Analog CMOS sub circuits with current sources, current mirrors, current source amplifiers, source follower, cascade and differential amplifiers, CMOS OPAMPs, Comparators, Switched capacitor circuits, and Digital to analog and Analog to digital converters with basic circuits using binary weighted resistors, R-2R ladders, dual slope A/D converter, parallel or flash converter and charge redistribution converter.

MT7704: VLSI Testing and Testability

4 credits (3-0-2)

Introduction, VLSI test process and equipment, Test economics, Yield analysis and product quality, Faults and Fault Modeling, Logic Simulation, Fault Simulation, Testability measures, Combinational Logic Test Pattern Generation basics, Combinational ATPG and logic redundancy, Combinational ATPG algorithms, Major and advanced combinational ATPG algorithms, Sequential Logic Test Pattern Generation, Function Testing, Delay tests, IDDQ current testing, Memory

Testing, Pattern sensitive, Electrical theory test, Memory NPSF and parametric test, Ad Hoc Design for Testability, Structured Design for Testability, Built-In Self-Test, BIST Pattern Generation, and Response Analysis.

MT7705: VLSI System Design

3 credits (3-0-2)

Introduction to VLSI Systems: VLSI overview, VLSI designs flow, design hierarchy, VLSI design styles. Semiconductor technology trends and impact on VLSI architecture and design; Methodologies for VLSI structured design: Design analysis and simulation, Design Verification, Implementation approaches, Design synthesis, Validation and testing of integrated circuits. VLSI system design and optimizations for performance and power Design for test Case Studies: Application of CAD tools to design VLSI system based on above concepts Students will use VLSI CAD tools for layout and simulation. Laboratory experiments will focus on layout analysis, computer-aided layout, and logic and timing simulation. Students will be exposed to the state-of-the art CAD tools and CMOS circuit and system design methods.

MT7706: Embedded System Design

3 credits (3-0-0)

Introduction to an Embedded systems design, Real Time Operating Systems and its overview, Implementing Embedded Systems: Hardware/Software Co-design, Validation, Program Analysis and Design, Microcontroller, Embedded System Development, and Networks for Embedded Systems, and System Design Techniques

MT7707: Low Power Circuits and Systems

3 credits (2-0-2)

Sources of power dissipation in CMOS circuits, Static power estimation techniques (including probabilistic simulation, probabilistic modeling of dependencies, macro-modeling) , Dynamic power estimation techniques (including sampling techniques and sequence compaction), Power optimization at circuit level (including transistor resizing) Power optimization at logic level (including multilevel and two level optimization) Power optimization at RT- and behavioral-level (including module assignment, register sharing for low power and high speed, multiple voltage assignment) Voltage scaling approaches and Minimizing switching capacitance, Special techniques and Advanced techniques.

MT7708: Digital Signal Processing

4 credits (3-0-2)

Discrete-time signals and systems, Constant coefficient difference equation. Review of Z Transform: properties, R.O.C, stability and Causality criterion. Structures for digital filters. DTFT and DFT: properties, linear and circular convolution. FFT: Decimation in time & Decimation in frequency. Design of IIR Filters: Bilinear transformation, Impulse invariant transformation. Butterworth, Chebychev, Inverse Chebychev and Elliptical filters etc. Design of F.I.R filters by windowing: rectangular, Bartlett, Hann, Hamming, Kaiser window filters, Design method, Relationship of Kaiser to other windows. Application of MATLAB for design of digital filters. Advanced signal processing techniques: Multirate Signal processing – Down sampling/upsampling.

MT7709: Special Topics in VLSI

3 credits (3-0-0)

This will focus on special topics of contemporary relevance and interest to both industry and research.

MT9901: Soft Computing

4 credits (3-0-2)

Introduction, Soft Computing concept explanation. Importance of tolerance of imprecision and uncertainty. Biological and artificial neuron, neural networks. Adaline, Perceptron. Madaline and BP (Back Propagation) neural networks. Adaptive feedforward multilayer networks. RBF and RCE neural networks. Topologic organized neural networks, competitive learning, Kohonen maps. CPN , LVQ, ART, Neocognitron neural networks ,Neural networks as associative memories (Hopfield, BAM, SDM). Solving optimization problems using neural networks. Stochastic neural networks, Boltzmann machine. Fuzzy sets, fuzzy logic and fuzzy inference. Genetic algorithms. Probabilistic reasoning. Hybrid approaches (neural networks, fuzzy logic, genetic algorithms sets).

MT9902: Data Mining and Data Warehousing

3 credits (3-0-0)

Basic data warehouse architecture, data consolidation, warehouse internals: Storage and indexing, materialized views and aggregate pre-computation, online analytical processing (OLAP) systems, data mining: Main operations: Clustering, Classification, regression, neural networks, feature selection, deviation detection, Item set

Associations, discoveries along time, similarity of complex objects, system Integration issues in decision support tools, survey of existing mining and OLAP products, success and failure of data mining.

MT9903: Software Engineering

4 credits (3-0-2)

Introduction to software engineering, Software requirement study and Analysis, Software Requirement Specifications, Software Estimation, Objectives of activity planning, Software Design Concepts, Risk Management, Software Testing and Software Maintenance.

MT9904: Information Theory and Coding

3 credits (3-0-0)

Entropy, mutual information, channel capacity, information rate, Shannon's noiseless coding theorem and Shannon's fundamental coding theorem; modelling of information sources--zero-memory and Markov models; modelling of information channels--BSC and BEC channels, additivity of information and cascaded channels; construction of compact source codes--Kraft inequality, compact codes, Huffman and Shannon Fano compression codes; and analysis and design of error-control channel codes--Hamming distance, binary linear codes and the parity-check matrix, Hamming codes, checksum codes, cyclic codes and the generator polynomial and CRC codes, convolutional codes, Viterbi and other decoding algorithms.

MT9905: Advanced Graph Theory

3 credits (3-0-0)

Introduction to graphs, Max-flow Min-cut theorem, Algorithms for computing maximum s-t flows in graphs. Algorithms for computing the minimum cut in a graph, Edge and vertex connectivity of graphs and Menger's theorem. Maximum matching, Hall's theorem, algorithms for computing maximum matching in weighted and unweighted graphs. Arborescences and algorithm for computing minimum arborescence, Edmonds theorem for disjoint arborescences. Planar graphs and algorithms for checking for planarity. Edge and vertex colouring of graphs. Independent sets and perfect graphs, External graph theory.

MT9906: Multiobjective Optimization Methods

4 credits (3-1-0)

Simple Genetic Algorithms: Introduction, Mathematical Foundations, Computer

Implementation; Multiobjective Optimization: Multiobjective Optimization Problem, Principals of Multiobjective Optimization, Difference with Single-Objective Optimization, Dominance and Pareto-optimality; Classical Methods: Weighted Sum Method, Epsilon-Constrained Method, Weighted Metric Methods, Benson's Method, Value Function Method, Goal Programming Methods, Interactive Methods; Evolutionary Algorithms: Difficulties with Classical Optimization Method, Genetic Algorithms, Evolution Strategies; Non-Elitist Multiobjective Evolutionary Algorithms: Vector Evaluated Genetic Algorithm, Vector-Optimized Evolution Strategy, Weight-Based Genetic Algorithm, Random Weighted GA, Multiobjective Genetic Algorithm, Non-Dominated Sorting Genetic Algorithm, Niche-Pareto Genetic Algorithm; Elitist Multiobjective Evolutionary Algorithms: Rudolph's Elitist Multiobjective Evolutionary Algorithm, Elitist Non-Dominated Sorting Genetic Algorithm, Distance-Based Pareto Genetic Algorithm, Strength Pareto Evolutionary Algorithm, Thermodynamical Genetic Algorithm, Pareto-Archived Evolution Strategy, Multiobjective Messy Genetic Algorithm; Constrained Multiobjective Evolutionary Algorithms: Ignoring Infeasible Solutions, Penalty Function Approach, Constrained Tournament Method, RTS Method.