INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITD&M) KANCHEEPURAM

INTRODUCTION OF NEW COURSE

Course Title	Network System Design	Course No *(will be assigned)*				
Specialization	Computer Engineering	Structure (LTPC)	3	0	0	3
Offered for	PG	Status	Core ☐		Elective ■	
Faculty	Dr. Noor Mahammad Sk	Type	New ■		Modification ☐	
Pre-requisite	COT	To take effect from	Aug 2013			
Submission date	July 2013	Date of approval by AAC				
Objectives	The focus of this course is the design of computer network systems, including hardware, software, network interface card, packet processing, protocol processing on software/hardware, packet classification and forwarding by hardware/software and hybrid, switching fabrics for switches and routers, network processor design and its scalability.					
Contents of the course *(With approximate break up of hours)*	**Introduction and overview**: Network systems and Internet, Applications vs Infrastructure, review of protocols and packet formats (4 hrs). **Network Interface Card**: functionality, optimizations for high speed, onboard address recognition, packet buffering, DMA, operation and data chaining (4hrs). **Packet Processing**: Algorithms - Bridge, lookup and hashing, IP- Fragmentation, Reassembly and forwarding algorithms, TCP – connection recognition and Splicing algorithms; Data structures, functions –error detection and correction, packet classification, queueing and packet discard, scheduling and timing (6 hrs). **Protocol Software on a conventional Processor**: Fast packet processing, software interrupts and priorities, software for layered protocols (3hrs). **Hardware Architecture for Protocol Processing**: Network system architecture, data rate, packet rate and software router feasibility, overcoming single CPU bottleneck, fine and course-grain parallelism, special purpose/AISC coprocessors, NICs with onboard processing and Data pipeline (6 hrs). **Classification and Forwarding**: Classification - Packet, software implementation and optimization, hardware implementation and optimization, hybrid hardware/software classification. Forwarding – flow forwarding connection and connectionless network; Second generation network systems, embedded processors in second generation systems, classification and forwarding chips (4hrs). **Switching Fabrics**: Concepts, synchronous and asynchronous fabrics, taxonomy, crossbar architectures, queueing, sharing data paths, shared bus, medium, memory architectures, multistage fabrics, Banyan architectures – scalability, commercial technologies (6hrs). **Network Processors(NP) Design**: 3G network systems, scalability with parallelism and pipelining, costs and benefits of NP, functionality, Ingress and Egress processing, parallel and distributed architecture, The architectural role of NPs, NP design and software emulation(4hrs). **Network Processor Architectures and Scalability**: Characteristics, Architecture, Packet flow and clock rates, software architecture, Assigning functionality to the processor hierarchy and scaling, scaling – faster processors, increasing the number of processors and their types, memory hierarchy, size and bandwidth, adding caches, CAM, limitation on scale, software scalability(4hrs). Case study of commercial network processors (1hr).						
Textbook	1. Douglas E Comer, Network System Design using Network Processors: Intel 2XXX Version, Prentice Hall Publisher, First Edition, 2005.					
References	2. Ran Giladi, Network Processors: Architecture, Programming, and Implementation (System on Silicon), Morgan Kaufmann Publishers, First Edition, 2008. 3. Gregory J Pottie and William J Kaiser, Principles of Embedded Networked Systems Design, Cambridge University Press, First Edition, 2009.					