BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

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SECOND SEMESTER 2019-20
COURSE HANDOUT

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Date: 07.01.2020

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In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course No	**: EEE G547**
Course Title	**: DEVICE DRIVERS**
Instructor-in-Charge	**: DEVESH SAMAIYA**
Instructor(s)	**:**

Tutorial/Practical Instructors:

1. Course Description:

This course provides a hands on experience on linux device driver development. Facilitate beginner level understanding of kernel structure of unix like systems, its design and internals.

2. Scope and Objective of the Course:
- Basic understanding of linux kernel.
- Handle hardware level details while writing a linux device driver.
- Write kernel modules.
- Basics of UNIX system programming.
- Design basics of UNIX like operating systems

3. Text Books:
 "**Linux Device Drivers**" By Jonathan Corbet, Alessandro Rubini, and Greg Kroah-Hartman, O'Reilly Media

4. Reference Books:
- [R1]. **Understanding The Linux Kernel** By Daniel P. Bovet, Marco Cesati, O'REILLY Media
- [R2]. **The design of UNIX operating system** By Maurice J. Bach, Pearson
- [R3]. **The Linux Kernel Module Programming Guide** By Peter Jay Salzman, Michael Burian ,Ori Pomerantz
- [R4]. **Exploring Beagle Bone – Tools and Techniques for Building with Embedded Linux** By Derek Molloy, WILEY Publications
- [R5]. **Linux kernel development by** Robert Love, Pearson, ISBN 978-81-317-5818-2.
- [R6]. **Unix network programming** by W. Richard Stevens, Prentice Hall, ISBN 9332549745

5. Course Plan:

Lec. No.	Topic	Learning Objectives	Readings
1	Introduction & Overview	Course overview, Intro. to device drivers, Intro. to linux kernel, Linux history	TB - Ch. 1
2	Introduction to Git, Classes of device drivers	How to use Git? Basics of Char, Block, Network devices	TB- Ch1 Class notes
3	Introduction to Make command	How to make and use makefiles?	Class notes
4	Kernel Modules	Write first kernel module	TB- Ch2
5	Kernel specific C language extensions	printk() etc.	Class notes
6	Char drivers	Intro to char drivers, major, minor numbers	Class notes TB- Ch3, Ch6
7	Char device file creation and operations **Assignment - 1**	Kernel modules for Char devices	Class notes TB- Ch3, Ch6
8-9	Kernel data structures	Linked lists, Queues, Binary Trees in kernel	R5- Ch6
10	Programming Exercise	case study of a simple device driver	Class notes
11	I/O mapped operations	Accessing I/O mapped hardware	Class notes TB- Ch9
12	Process management in UNIX	Process structure, Process control, Process scheduling	R5 - Ch3, Ch4 R2 - Ch6, Ch7, Ch8
13-14	Synchronization, locking and concurrency management	Synchronization and concurrency management methods in Kernel	R5 - Ch9, Ch10
15	Internal file representation	inode, inode assignments, allocation of disk blocks	R2- Ch4
16	System calls for the file system	open, read, write, pipes, close, creation	R2- Ch5

17-18	Memory management in kernel	Swapping, Demand Paging, kmalloc(), kfree() etc.	R5- Ch12 R2 - Ch9 TB - Ch8, Ch15
19-20	Block devices & drivers **Assignment 2**	Anatomy of block device, Buffers, bio structure	TB- Ch16 R5- Ch14
21	PCI and Network Interface Card drivers,	Packet handling, Socket programming basics	TB- Ch17 R6
22	Platform Drivers	Driver registration and discovery through platform driver approach	Class notes
23	Timers & Time management in Kernel	Notion of time in kernel, Tick rate, Jiffies etc.	R5 - Ch11 TB - Ch7
24	Programming exercise	case study	Class notes
25	Interrupts & Bottom Halves	Kernel API for interrupts and deferred work	Class notes
26-29	USB Host Drivers	USB protocol, USB in linux kernel, libusb	TB-Ch13 Class notes
30-31	Linux GPIO Subsystem **Assignment 3**	GPIO handling in a device driver	Class notes
32	Industrial IO Subsystem in Kernel	Handling data acquisition in linux device drivers	Class notes
33	Linux LED Subsystem	Handling LEDs as event indicators	Class notes
34	I2C and SMBus Subsystem	Handling I2C devices in drivers	Class notes

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	30%	<TEST_1>	Close Book
Comprehensive Examination	3 h	35%	13/5 AN	Close + Open Book
Assignments	Continuous	20%		Take home
Project		25%		Take home

7. Make-up Policy:

Makeup shall be allowed for genuine cases with prior intimation and approval from the instructor in charge.

Instructor-in-charge
Course No. EEE G547