

A blue-tinted photograph of a modern building with 'UNSW' written on its facade. The building has a glass and metal structure with a prominent tree-like sculpture in the foreground. The text 'UNSW' is visible on the upper part of the building's facade.

GNSS Curriculum Development

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Back in 2004 (WG on the implementation of recommendations of the Action Team)...

"... support should be provided for capacity-building through GNSS education and training...."

Via?

**U.N. Regional Centres for Space
Science and Technology Education**



THE UNIVERSITY OF
NEW SOUTH WALES
SYDNEY · 2052 · AUSTRALIA



Why?

- ...capacity-building for whom?...engineers, educators, administrators, policy-makers...
- ...education or training?...yes, we need to be pedantic...
- ...lack of structured and generic GNSS learning materials?...free of HW, national or educational institution bias...
- ***There are models...***



What is available?

- **University courses**...typically semester length, parts of UG & PG programmes...
- **Short courses**...commercial, HW vendors, industry, institutions (e.g.ION, U.N.), adhoc...
- **Books**...
- **Online materials**... self-pace courses & tutorials, SW tools, etc...
- *In the future podcasts?*...



UNOOSA courses

- Satellite Communications
- Satellite Meteorology & Global Climate
- Remote Sensing & GIS
- Space & Atmospheric Science
- ***35 weeks (Lec/Tut 40/60) (200x6hr) (2 modules + fieldwork) + one year project in participant's home country***



Bangalore, India, 18 June - 18 July 2008

- "International Training Course on Satellite Navigation & LBS"
- Space Applications Centre, ISRO, Ahmedabad
- 18 participants from 10 countries
- 120 hours...approx 50% lectures
- *Module 1...Basics of Satellite Navigation*
- *Module 2...Applications of Satellite Navigation with Special Emphasis on Location Based Services*



Why standardise courses?

- Standard set of teaching materials
- Ability to interchange teachers
- Easier to update
- Easier to develop "add-ons" (advanced or app-specific courses)
- Accreditation (award "advanced standing" for university programmes)



ICG GNSS curriculum: issues

- Varying backgrounds of students... depth?
- Variety of end-users... breadth?
- Training or education?
- Delivery mode?
- "Hands-on" exercises?
- Custom designs... no reuse?
- *Universities typically offer 40-60hr (F2F) semester courses*



GNSS curriculum: *how much can you squeeze into 120hrs?*

Module 1: 3d (18hrs)

- Coordinates & reference systems
- Satellite orbit principles
- Introduction to GPS & GNSS
- Measurements & modelling
- Positioning principles
- Information sources



GNSS curriculum: *how much can you squeeze into 120hrs?*

Module 2: 3d (18hrs)

- Introduction to GPS receivers
- Receivers & applications
- Other GNSS
- RNSS & SBAS
- Single point positioning
- GPS performance



GNSS curriculum: *how much can you squeeze into 120hrs?*

Module 3: 3d (18hrs)

- Advanced tracking principles
- Errors & biases
- Optimal estimation principles
- DGPS/DGNSS
- CPH-based positioning
- Standards & interoperability



GNSS curriculum: *how much can you squeeze into 120hrs?*

Module 4: 3d (18hrs)

- Geodesy & scientific applications
- Surveying & mapping
- Industrial applications
- Air & marine navigation
- LBS & infomobility applications
- *The Future*



GNSS curriculum: *how much can you squeeze into 120hrs?*

Labs/Fieldwork: 3hr each (18hrs)

- Internet tools... satviz, geoid, SDR rx, DGPS, IGS...
- Matlab/Excel... SPP, coord conversion/transformation, bias algorithms...
- Receiver interfacing... NMEA, RTCM/RTCA, NTRIP, RINEX, I/O OEMs...
- Commercial SW... CPH & PR data processing, web...
- App-specific... survey & GIS, car nav, LBS, etc...
- Outdoor pracs... handheld nav, accuracy tests, CPH, RTK/DGPS, kinematic tests, LBS...



GNSS curriculum: *how much can you squeeze into 120hrs?*

Extras (12hrs)

- Seminars
- Introduction/feedback/graduation
- Demonstrations
- Field visits
- Extra tutorials
- ...



Where to from here?

- 2009, two more GNSS courses (Morocco & Mexico)... local university teachers, a variation on Bangalore course?...
- Engage WG-C members in discussion on GNSS curriculum design...
- Strawman proposal...
- Evaluation of options & experiences...
- ***Outcome***

