T73S06 (Creep Rupture & R5V6) Course Syllabus

Last update: 11/7/10

23	What is creep? Deformation versus Failure; Mechanisms of creep; Mechanism maps; Failure versus crack initiation; Primary, secondary and tertiary creep versus the behaviour of real 300 series austenitics: examples of real creep strain v time data; Mechanisms of primary/secondary transition; Temperature dependence (Arrhenius); Mechanisms of tertiary creep; Example of isochronous data; R5 definitions of insignificant creep: is it really always insignificant? 'Cold' creep.
24	Formulation of the structural analysis problem in creep (in brief); Examples of structural response in creep; Distinct creep responses to primary and secondary loads; Relaxation versus redistribution; Time variation of stress distribution across a notched bar; Concept of skeletal point/stress; Neuber relation; Creep hardening laws: relevance to changes in conditions; Reminder of the scope of the various Volumes of R5
25	Definition of reference stress; Warning re use of term 'reference stress' in other parts of R5; R5 definition of rupture reference stress and why it is motivated physically; Creep ductile v creep brittle materials and R5 definitions; Commonly required reference stress solutions (uncracked): potentially all those covered in IMAN#4, including pipe butt weld P+M; pipe branch P+M; trunnion; etc.; Inverse code and γ factor; Axial versus hoop dominance; Sources
26	Example rupture data (316); Effect of triaxiality on creep rupture, limitations of R5; Variable conditions: Robinson's Rule; MECT definitions based on rupture or deformation; CMV weldment zones and how they differ as regards creep rates and creep strength; Mixed HAZ and the α parameter (and might it be misleading, e.g. drain pots?); k redistribution factors
27	Limitations of assessing primary stress creep rupture alone; When can influence of secondary stresses on rupture be ignored?; Provisions within R5V7; Provisions within R5V2/3 in brief: (a)cyclically enhanced creep, concept of 'core stress'; (b)checks of significance of cyclic effects or creep-fatigue; (c)damage due to relaxation of secondary stresses; The Bree diagram and code approaches; reheat cracking in ferritics, austenitics.
28	Fatigue endurance data (S-N curves); Correction for size effects; Transition joints: R5V6 A, B & C terms; Miner's Law; $\Delta\alpha\Delta T$ effect and distinction between contributions to B & C; Methodology for strain range and endurance data for term B; creep data to be used for term C; Is the $\Delta\alpha\Delta T$ damage real? Salutary lesson re $\Delta\alpha$ (HPB/HNB UTJs); R5V6: is it failure or initiation?
29	Inspection requirements following from creep rupture assessments: TGN(CTS) requirements and assessment assumptions (data bounds): TGN043,044,046; Additional requirements for HI, IOGF, IOF items; Relaxed rules for "frequent" items; Procedure if lower bound life expires (CMV); Performance of structural assessment cf metallurgical examination; Type IV damage, cavity counting v life fraction.