1.3.2 Number of value-added courses for imparting transferable and life skills offered during last five

1.3.3 Average Percentage of students enrolled in the courses under 1.3.2 above (10)

Year -1						
Name of the value added courses (with 30 or more contact hours)offered	Course Code (if any)	Year of offeri	No. of times offered during the same year	Duration of course	Number of students enrolled in the year	Number of Students completing the course in the year
Theory of Pressure Vessel Design	MG-01	2014	1	35 hrs	49	17
Year 2						
Name of the value added courses (with 30 or more contact hours)offered	Course Code (if any)	Year of offering	No. of times offered during the same year	Duration of course	Number of students enrolled in the year	Number of Students completing the course in the year
Essence of Materials Science	MG-02	2015	1	60 hrs	66	22
Year 3						
Name of the value added courses (with 30 or more contact hours)offered	Course Code (if any)	Year of offering	No. of times offered during the same year	Duration of course	Number of students enrolled in the year	Number of Students completing the course in the year
Year 4						
Name of the value added courses (with 30 or more contact hours)offered	Course Code (if any)	Year of offering	No. of times offered during the same year	Duration of course	Number of students enrolled in the year	Number of Students completing the course in the year

13.08.2020

एस. के. सिंह Singh

वैज्ञानिक अधिकारी (एच) एवं वार्डन Scientific Officer (H) and W

मानव संसाधन विकास प्रभाग Human Resource Development D

भाभा परमाणु अनुसंधान केंद्र Bhabha Atomic Research Cen

भारत सरकार Government of India

प्रशिक्षण विद्यालय भवन, अणुशक्तिनगर मुंबई-400 094

Training School Complex, Anushak

Linear Control Systems Theory	EG-13	2017	1	48 hrs	16	6
Natural Circulation Based Passive Safety Systems for	MG-03	2017	1	48 hrs	12	6
Nuclear Fuels and Fuel Cycle	MG-04	2017	1	48 hrs	65	36
Year 5						
Name of the value added courses (with 30 or more contact hours)offered	**Course Code (if any)**	**Year of offering**	**No. of times offered during the same year**	**Duration of course**	**Number of students enrolled in the year**	**Number of Students completing the course in the year**
State - space approach to reactor control	EG-01	2018	1	48 hrs	13	6
Natural Circulation based passive safety system for advanced reactor	M-G03	2018	1	48 hrs	9	5
Advanced computational physics	PY705	2018	1	35 hrs	20	20

Singh 13.08.2020

एस. के. सिंह S. K. Singh
वैज्ञानिक अधिकारी (एच) एवं वार्डन Scientific Officer (H) and Warden
मानव संसाधन विकास प्रभाग Human Resource Development Division
भाभा परमाणु अनुसंधान केंद्र Bhabha Atomic Research Centre
भारत सरकार Government of India
प्रशिक्षण विद्यालय भवन, अणुशक्तिनगर, मुंबई-400 094
Training School Complex, Anushaktinagar, Mumbai-400 094

QUEST- Continuing Education Programme of HBNI: *Special Set of Courses by Homi Bhabha Chair Professors/Raja Ramanna Fellows*

HRD Division invites applications from employees of DAE units located in Mumbai/Navi Mumbai, and from HBNI students for advanced course *'Theory of Pressure Vessel Design'*

- The course is planned to commence from last week of February/first week of March, 2014. It comprises about 32 lectures of 1.5 hours (1 hour and 30 minutes) duration each. It is expected to be completed by end of June, 2014. The proposed timings of the lectures are 1000 – 1130 hrs (Tuesdays and Fridays).

- A total of 100 marks are assigned for the course with a breakup of 40 marks (maximum) for periodic tests and assignments, and 60 Marks (minimum) for an examination (written) to be conducted at the end. Board of Studies of HBNI has assigned **4 credits** for the course.

- The advanced courses, like the one mentioned above, are offered to the DAE staff subject to approval from competent authority (Head of Division or equivalent within BARC & other DAE units in Mumbai/Navi Mumbai). Students pursuing M.Tech/ M.Sc. (Engg)/Ph.D. programmes of HBNI may forward their applications (nomination) through their respective guides.

- The nominations received will be scrutinized by the course coordinator and the final list of accepted candidates will be put up on BTS with information to the concerned Division. Details of the topics to be covered under the course are also put up on **BTS>HRD>CEP>QUEST.**

- It is mandatory that the interested employees/HBNI students enrolled for the Courses have a minimum of 80% attendance in the classes to be eligible to appear in the final written examination. Kindly note that certificates will be issued only to those who appear in the written examination and score an aggregate of 50% or more in home/classroom assignments & written examinations taken together.

As has been the practice, eligible staff members and HBNI-PhD students may be encouraged to take up the course. Kindly forward the nominations with applications from your Division to **Shri S.K. Singh, QUEST Coordinator, HRDD latest by February 10, 2014 (Monday)** to ensure programme implementation as envisaged above.

Detailed course content and Application-cum-Nomination Form are available on BTS>HRD>CEP>QUEST for kind information and necessary action at your end.

Theory of Pressure Vessel Design (35 Lectures, 4 Credits)

Faculty for the Course: Shri H.S. Kushwaha, Raja Ramanna Fellow
ex- Director, Health, Safety & Environment Group, BARC

Chapter 1

1.0 Pressure Vessel Design Philosophy
1.1 Pressure Vessel Materials
1.2 Factor of Safety
1.3 LRFD and ASD Methods
1.4 Design by Rules
1.5 Design by Analysis
1.6 Design of thin and thick Cylindrical Shell
1.7 Design of Hemispherical, Ellipsoidal,Torispherical, Conical heads and Flat cover.
1.8 Discontinuity Analysis of Cylindrical shell and Covers.
1.9 Thermal stresses in Cylidrical Shell

Chapter 2

2.0 Structural Design Criteria
2.1 Mode of Failure
2.2 Theory of Failure
2.3 Service Limits
2.4 Elastic Stress Analysis Methods
2.5 Limit Load Analysis Methods
2.6 Elastic-Plastic Analysis Methods
2.7 Protection against Collapse from Buckling
2.8 Weibull's Statistical theory of Brittle Fracture
2. 9 Design Rules for Graphite Reactor Components (Brittle Materials).
2.10 Structural Design Rules for Fusion Reactor Components.

Chapter 3

3.0 Stress Category
3.1 Stress Intensity
3.2 Categorization of Stresses
3.3 Stress Limits
3.4 FEM Analysis of Pressure Vessel Components.
3.4 Linearization of Finite Element Stresses
3.5 Protection Against Local Failure

Chapter 4

4.0 Fatigue assessment of Pressure Vessel
4.1 Stress Concentration about a Circular hole
4.2 Cylindrical and Spherical Shell with Nozzles under internal Pressure and External Forces / Moments.
4.3 Exemption from Fatigue Analysis

4.4 Protection against Failure from Cyclic loading.
4.5 Neuber Rule
4.6 Rain flow Cycle Counting Method.
4.7 Cumulative Damage Rules.
4.8 Fatigue Assessment Procedures
4.9 Simplified Elastic Plastic Analysis
4.10 Determination of Ke - Factors
4.11 Ratcheting / Shakedown Phenomena
4.12 Fatigue Ratcheting Assessment Method
4.13 Residual Stress.

Chapter 5

5.0 Design of Vessel Supports
5.1 Types of Vessel Supports.
5.2 Design of Cylindrical Vessel under Saddle Support.
5.3 Design of Cylindrical Vessel with skirt Support.
5.4 Design of Spherical Vessel with Lugs Support.
5.5 Wind and Earthquake Design Considerations

Chapter 6

6.0 Design of Vessel under Creep Loading
6.1 High Temperature Material Damage problems.
6.2 Creep and Creep Test.
6.3 Stress Rupture Test
6.4 Creep Extrapolation Methods.
6.5 Fatigue & Creep Interactions
6.6 Irradiation Assisted Creep Damage
6.7 Thermo Mechanical Fatigue (TMF)

Chapter 7

7.0 Design of Pressure Vessel against Fast Fracture
7.1 Toughness of Materials and its Requirement in the Design
7.2 Radiation Embrittlement of Pressure Vessel Steels.
7.3 Fracture Analysis Diagram
7.4 Fracture Toughness and Strength Parameters.
7.5 Application of Fracture Mechanics in ASME Flaw Evaluation
7.6 R-6 Flaw Assessment Methods and Engineering Critical Assessment Procedures.