



.UBA40[∞]
AÑOS DE
DEMOCRACIA

Resolución Consejo Directivo

Número:

Referencia: EX-2023-04455836- -UBA-DMESA#FCEN - POSTGRADO - SESIÓN
25/09/2023

VISTO:

La nota presentada por la Dirección del Departamento de Ciencias Geológicas, mediante la cual eleva la información del curso de posgrado Principios de Geotermia y Recursos Renovables Geológicos para el año 2023,

CONSIDERANDO:

lo actuado por la Comisión de Doctorado,

lo actuado por este Cuerpo en la sesión realizada en el día de la fecha 25 DE SEPTIEMBRE DE 2023

en uso de las atribuciones que le confiere el Artículo 113° del Estatuto Universitario,

**EL CONSEJO DIRECTIVO DE LA FACULTAD
DE CIENCIAS EXACTAS Y NATURALES**

R E S U E L V E:

ARTÍCULO 1°: Aprobar el nuevo curso de posgrado Principios de Geotermia y Recursos Renovables Geológicos de 64 horas de duración, que será dictado por el Dr. Héctor Adolfo Ostera

ARTÍCULO 2°: Aprobar el programa del curso de posgrado Principios de Geotermia y Recursos Renovables Geológicos que como anexo forma parte de la presente Resolución, para su dictado en el segundo cuatrimestre de 2023.

ARTÍCULO 3°: Aprobar un puntaje máximo de tres (3) puntos para la Carrera del Doctorado.

ARTÍCULO 4°: Establecer que el presente curso no será arancelado (CATEGORÍA 1).

ARTÍCULO 5°: Disponer que, de no mediar modificaciones en el programa, la carga horaria y el arancel, el presente Curso de Posgrado tendrá una vigencia de cinco (5) años a partir de la fecha de la presente Resolución.

ARTÍCULO 6°: Comuníquese a todos los Departamentos Docentes, a la Dirección de Estudiantes y Graduados, a la Dirección de Movimiento de Fondos, a la Dirección de Presupuesto y Contabilidad, a la Biblioteca de la FCEyN y a la Secretaría de Posgrado con copia del programa incluida. Cumplido, pase a GEOLOGIA#FCEN y resérvese.

ANEXO

PROGRAMA

Objetivo de la materia:

El objetivo de la materia es dar una visión introductoria de la Geotermia, sus aplicaciones y el empleo de recursos renovables geológicos en la transición energética. Al finalizar la misma, los estudiantes realizan un Informe de Prefactibilidad Geotérmica requerido por las autoridades para la puesta en marcha de un Proyecto Geotérmico. Este Informe implica el uso de todas las herramientas que son impartidas en el curso de una manera concreta y práctica.

Metodología de enseñanza

Para el logro de los objetivos, se desarrollarán clases teóricas, videos, prácticas de problemas y presentaciones a realizar sobre diferentes temas por parte de los participantes.

a) Clases teóricas

Exponen la información básica y avanzada de los diferentes tópicos, resumen el conocimiento hasta la fecha desde muchas fuentes, provee estructuras para ayudar a los estudiantes a aprender más efectivamente

b) Clases de problemas

Da a los estudiantes oportunidad de aplicar principios, formular problemas y aprender a evaluar la evidencia desde su punto de vista y desde el de otros.

La participación en las discusiones ayuda a los estudiantes a establecer relaciones entre conceptos, mediante la participación activa, el intercambiando opiniones y el establecimiento de relaciones entre los hechos y evidencias.

c) Casos tipo

Se utilizarán para representar un tipo particular de problema, con datos reales. Comprende la adquisición, procesamiento, uso de la información y aplicación de aspectos teóricos a la resolución de un problema.

Modalidad de la materia: Teórico - Prácticas. Las teóricas están vinculadas a las clases problemas subsiguientes y presentaciones. El hecho de desarrollar un trabajo final para la aprobación de los prácticos en equipo permite simular las condiciones reales de planificación y ejecución de un programa de prefactibilidad geotérmica.

Carga horaria: 64 horas

Duración: 8 semanas

Programa

1- Estructura de la Tierra. Flujo de calor y transferencia de calor. Conductividad de las rocas. Gradiente geotérmico.

2- Recursos geotérmicos. Actividad geotérmica. Sistemas hidrotermales: reservorio, área de recarga, fuente de calor, campos geotérmicos.

3- Tipos de sistemas geotérmicos: hidrotermales, de rocas secas, geo-presionados y magmáticos.

4- Fluidos hidrotermales: entalpía, calor específico y estado físico de los mismos (líquido/vapor, vapor seco, vapor supercalentado).

5- Sistemas hidrotermales dominados por agua y dominados por vapor. Interés económico de los diferentes tipos de sistemas hidrotermales. Ejemplos argentinos y mundiales.

6- Origen del vapor en los sistemas hidrotermales. Evidencias isotópicas ($d_{18}O$ y dD) y geoquímicas. Consecuencias para el balance hidráulico y térmico de los campos geotérmicos.

7- Química de los fluidos hidrotermales. Equilibrios mineral-agua. Gases no-condensables, gases reactivos e inertes. Toma de muestras de agua, vapor y de gases para estudios geoquímicos e isotópicos.

8- Localización geológica de los recursos geotérmicos.

9- Exploración de recursos geotérmicos. Estimaciones de temperatura, volumen y permeabilidad del reservorio en profundidad. Estrategias de exploración: inventario e investigación de manifestaciones superficiales, estudios geológicos e hidrogeológicos, estudios geoquímicos, investigaciones geofísicas (estudios de resistividad eléctrica, electromagnéticos, gravimétricos y determinaciones del flujo de calor) y pozos de

exploración.

10- Geotermómetros basados en la solubilidad, en equilibrios mineral-agua y en isótopos estables. Ventajas y desventajas de cada tipo. Determinación de la edad del agua mediante ^{14}C y Tritio.

11- Perforación de pozos, extracción y distribución de fluidos. Generación de electricidad a partir de fluidos geotérmicos.

12- Usos no eléctricos de la energía geotérmica.

13- Impacto ambiental de las explotaciones geotérmicas. Riesgos de contaminación del aire y de cuerpos de agua. Reinyección de los fluidos hidrotermales enfriados.

14- Modelado de contaminación.

15- Estudios de prefactibilidad geotérmica. Legislación argentina nacional y provincial. Recursos geotérmicos de la Argentina. Posibilidades de desarrollo para el futuro.

16- Hidrógeno geológico. Distribución y fuentes. Ciclo del hidrógeno. Hidrógeno profundo. Serpentinización. Reacciones minerales. Radiólisis del agua. Actividad Biológica. Volcanes y sistemas hidrotermales. Descomposición de materia orgánica. Hidrógeno en gas y petróleo. Hidrógeno atmosférico. Hidrógeno antropogénico. Reformado de gas natural, generación por electrólisis, energía solar, eólica y biomasa.

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