Benha University
Benha Faculty of Engineering
Basic Engineering Sciences Department

جامعة بنها
كلية الهندسة ببنها
قسم العلوم الهندسية الأساسية

موضوعات الأبحاث لمقرر الميكـانيكـا (ب) للفرقة الإعدادية

اسم المقرر	الميكـانيكـا (ب)
كود المقرر	س 1022
الفرقة	الإعـداديـة

أعضاء لجنة الامتحان	1- د/ محمـد ضيـاء الديـن خضـر 2- د/ نصر الدين عبد الستار عبد الباري 3- د/ محمـد السيـد عبـد الواحـد

تعليمات عامة للطلاب:

1- يخصص لكل مجموعة فصول موضوع منفصل يكتب الطالب فيه البحث المطلوب ولا يسمح للطالب تقديم البحث في موضوع غير الموضوع المخصص لفصله طبقا لجدول توزيع الأبحاث المعلن، وإذا قدم الطالب بحثا في غير الموضوع المخصص لفصله سوف يتم رفض البحث ويعتبر الطالب راسباً في المادة.
2- إذا ثبت اقتباس أو نقل نسبة كبيرة من البحث نصا من طالب آخر أو من كتاب أو من أحد المقالات أو من موقع على شبكة المعلومات يتم رفض البحث ويعتبر الطالب راسباً في المادة. وعلى الطالب عند استعانته بمصادر ينقل منها بعض النصوص أن يذكر المصدر تفصيلا بين أقواس أو في التذييل.
3- يمكن للطالب الاستعانة بالكتاب المقرر كأحد المصادر ولكن لا يكون هو المصدر الوحيد ويطبق على الكتاب المقرر نفس الضوابط السابق ذكرها من حيث ألا تكون نسبة الاقتباس كبيرة ومن حيث ذكر المصدر عند الاقتباس.
4- غيـر مسمـوح بنقـل الأمثلـة المحلولـة فـي كتـاب المـادة لتنفيـذ البحـث المطلـوب.
5- الأبحاث المطلوبة عددها خمسة أبحاث موزعة على الفصول طبقـا للجدول التالي:

	أرقام الفصول																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
بحث رقم 1	☑					☑					☑					☑					☑			
بحث رقم 2		☑					☑					☑					☑					☑		
بحث رقم 3			☑					☑					☑					☑					☑	
بحث رقم 4				☑					☑					☑					☑					☑
بحث رقم 5					☑					☑					☑					☑				

البحث الأول

رقم البحث	1
أرقام الفصول	21 & 16 &11 & 6 & 1
تفاصيل البحث المطلوب	1) For a particle moving along a straight line. Determine: a) (v - t) and (a - t) relations for a given x(t) b) (v - t) and (x - t) relations for a given a(t) c) (v - x) and (x – t) relations for a given a(x) d) (v - x), (v – t) and (x - t) relations for a given a(v). 2) Give a solved numerical example for each of the four previous cases. 3) Give two examples for a body in general plane motion. Explain how to find the absolute velocity and absolute acceleration of a point of the body. 4) For a Slider-Crank mechanism with known dimensions, explain how to find the velocity and the acceleration of the piston at a given instant if the angular velocity and angular acceleration of the crank are known at that instant.

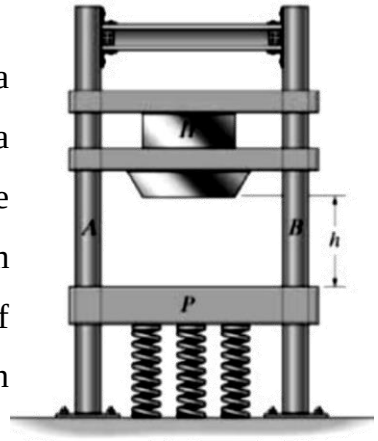
البحث الثاني

رقم البحث	2
أرقام الفصول	22&17&12&7&2
تفاصيل البحث المطلوب	1) Derive the basic equations that govern the motion of a projectile in two dimensions, when the air resistance is neglected. 2) Give suitable numerical solved example, for the following cases. a) A projectile is projected in a horizontal direction from a given altitude to hit a target on the ground. b) How to determine the firing angle of a projectile fired with a known initial velocity to hit a target with known location. c) The range of a projectile projected on an inclined plane. 3) For a rigid body, which rotates about a fixed axis, Derive the expression of the angular velocity and the angular acceleration. 4) Derive the expressions of the velocity and acceleration of a point of the rigid body which rotates about a fixed axis. 5) Give a numerical solved example for a rigid body which rotates about a fixed axis in space (3D) with known angular velocity and angular acceleration at a given instant and find the velocity and acceleration of a point of this body at that instant.

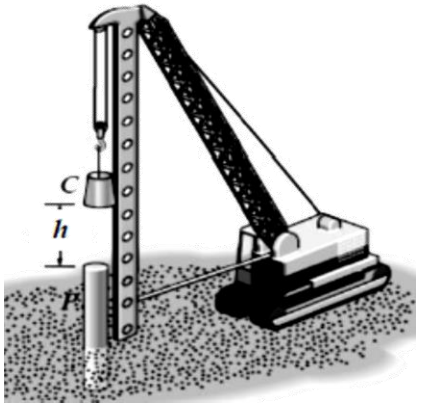
Benha University
Benha Faculty of Engineering
Basic Engineering Sciences Department

جامعة بنها
كلية الهندسة ببنها
قسم العلوم الهندسية الأساسية

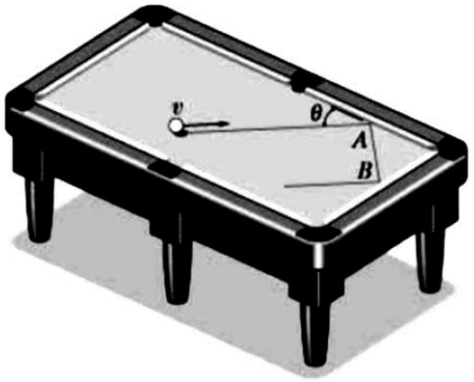
البحث الثالث (على صفحتين)

رقم البحث	3
أرقام الفصول	23 & 18 & 13 & 8& 3
تفاصيل البحث المطلوب	1) Derive the basic equations for the velocity and acceleration of a particle that moves along a curved path using a) Rectangular components b) Tangential and normal components c) Radial and transverse components. 2) Give a solved numerical example for each type of the previous components. 3) Deduce the coefficient of restitution between two deformable bodies collide with each other during very short period of time. 4) Give practical examples that can be simulated using the principle of linear impulse and momentum. 5) Using your conclusions, solve **one model** only from the following: a) The drop hammer **H** has a weight $\mathbf{W_H}$ and falls from rest ***h*** onto a forged anvil plate **P** that has a weight $\mathbf{W}_P$. The plate is mounted on a set of springs that have a combined stiffness $\mathbf{k_T}$. Determine (**a**) the velocity of **P** and **H** just after collision and (**b**) the maximum compression in the springs caused by the impact. The coefficient of restitution between the hammer and the plate is ***e***. Neglect friction along the vertical guideposts A and B. 

b) During the construction of one of a high rise building and in the stage of foundation construction, the pile ***P*** has a mass of ***M*** kg and is being driven into loose sand using the ***m***-kg hammer C which is dropped a distance of ***h*** m from the top of the pile. Determine the initial speed of the pile just after it is struck by the hammer and the distance the pile is driven into the sand after one blow. The coefficient of restitution between the hammer and the pile is ***e***. Neglect the impulses due to the weights of the pile and hammer and the impulse due to the sand during the impact.



c) The billiard ball of mass **M** is moving with a speed **v** when it strikes the side of the pool table at A. If the coefficient of restitution between the ball and the side of the table is **e**, determine the velocity of the ball just after striking the table twice, i.e., at A, then at B. Neglect the size of the ball. Also prove that the velocity after rebounding from B is parallel to the initial velocity **v.**



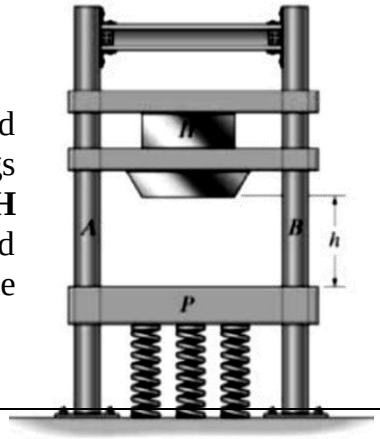
البحث الرابع

رقم البحث	4
أرقام الفصول	24&19&14&9& 4
تفاصيل البحث المطلوب	1) Write short notes about: a) Newton's second law. b) The equations of motion in different types of components. c) The types of Forces acting on a body in any mechanical system. d) The system of units used with the law. 2) Explain in detail the phenomenon of dry friction between two rubbing surfaces. 3) Give a solved numerical example for the motion of a block along a rough inclined plane. 4) Give a solved numerical example for a particle moving in a curved path. 5) Define the terms: a) Conservative forces (Give example). b) Potential energy (Give example). 6) Explain the principle of conservation of energy. 7) Give two numerical examples and solve each one by the principle of work and energy and then by the principle of conservation of energy.

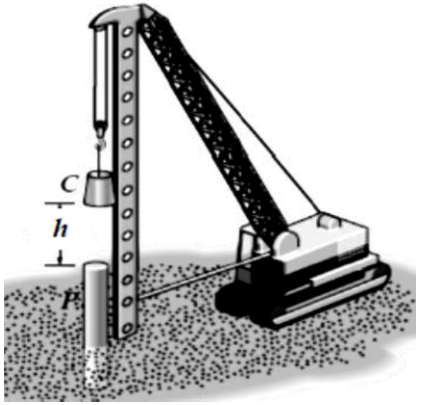
Benha University
Benha Faculty of Engineering
Basic Engineering Sciences Department

جامعة بنها
كلية الهندسة ببنها
قسم العلوم الهندسية الأساسية

البحث الخامس (على صفحتين)

رقم البحث	5
أرقام الفصول	20 & 15&10&5
تفاصيل البحث المطلوب	1) Define the work of a force acting on a body. 2) Derive the expression for: a) The work of a constant force in rectilinear motion. b) The work of the force of gravity. c) The work of the force exerted by a spring. 3) Explain how to derive the principle of work and energy from Newton's second law. 4) Give at least **three solved** numerical examples about the principle of work and energy containing the types of forces mentioned above. 5) Deduce the principle of conservation of momentum for a system of particles. 6) Suggest a model that can be simulated using both principles conservation of energy and conservation of momentum. 7) Using your conclusions, solve **one model** only from the following: a) The drop hammer **H** has a weight $\mathbf{W_H}$ and falls from rest ***h*** onto a forged anvil plate **P** that has a weight $\mathbf{W_P}$. The plate is mounted on a set of springs that have a combined stiffness $\mathbf{k_T}$. Determine (**a**) the velocity of **P** and **H** just after collision and (**b**) the maximum compression in the springs caused by the impact. The coefficient of restitution between the hammer and the plate is ***e***. Neglect friction along the vertical guideposts A and B. 

b) During the construction of one of a high rise building and in the stage of foundation construction, the pile ***P*** has a mass of ***M*** kg and is being driven into loose sand using the ***m***-kg hammer C which is dropped a distance of ***h*** m from the top of the pile. Determine the initial speed of the pile just after it is struck by the hammer and the distance the pile is driven into the sand after one blow. The coefficient of restitution between the hammer and the pile is ***e***. Neglect the impulses due to the weights of the pile and hammer and the impulse due to the sand during the impact.



c) The billiard ball of mass **M** is moving with a speed **v** when it strikes the side of the pool table at A. If the coefficient of restitution between the ball and the side of the table is **e**, determine the velocity of the ball just after striking the table twice, i.e., at A, then at B. Neglect the size of the ball. Also prove that the velocity after rebounding from B is parallel to the initial velocity **v.**