1. (a) Define simple harmonic motion and write down its differential equation. 
(b) What is a compound pendulum? Deduce an expression for the time period of a bar pendulum and hence show that there are two positions on each side of the center of gravity of the bar pendulum for which time periods are equal. 
(c) A scale of a spring balance reading 0 - 5 kg is 10 cm. A body suspended from the balance oscillates with a frequency \( \frac{7}{\pi} \) Hertz. Calculate the mass of the body attached to the spring.

2. (a) What are Lissajous figures? Give the analytical treatment of the formation of these figures when the period of two simple harmonic vibrations are in the ratio of \( 1 : 1 \). Under what conditions the Lissajous figures are straight line and circle?
(b) What is meant by resonance? Obtain the condition of resonance from the differential equation of a forced oscillator.

3. (a) What are the characteristics of a mechanical wave? Give two examples of a mechanical wave.
(b) Obtain expressions for energy density and intensity of a plane progressive wave.
(c) The displacement equation of a plane progressive wave is given by \( \psi = 10 \sin 2\pi(360t - 0.01x) \) in centimeter. Calculate the (i) Wave length (ii) Wave velocity (iii) Direction of propagation.

4. (a) (i) What do you mean by monochromatic aberration? (ii) Write down the names of different types of monochromatic aberration.
(b) Using the third order theory, show that the image distance produced by a paraxial ray passing through a convex spherical refrating surface is larger than that produced by a marginal ray.
(c) Of two plano-convex lenses \( L_1 \) and \( L_2 \), the former one has the focal length 1.2 times greater than the latter one. If the focal length of \( L_1 \) is 12 cm, then how far \( L_2 \) has to be placed on an optical bench from \( L_1 \) to have minimum spherical aberration.
5. (a) Show cardinal points diagrammatically for a thick lens.
(b) Derive the following formula for a thick lens:
\[
\frac{n^2}{f'} = \frac{n_1^2}{f_1} + \frac{n_2^2}{f_2} - \frac{n_2 d}{f_1 f_2} = \frac{n}{f}
\]
and also derive the formula for the first focal length (Where the symbols have their usual meaning).
(c) A glass lens of thickness 4.5 cm and refractive index 1.7 has radii of \(r_1 = 3.0\) cm and \(r_2 = 3.5\) cm. If a liquid of index 1.32 is in contact with \(r_1\) and a very dense transparent oil of index 2.2 is in contact with \(r_2\), find the primary and secondary focal lengths of the lens.

6. (a) Write what you mean by achromatism of lenses and how an achromatic doublet can be produced.
(b) Deduce the conditions to produce (i) dispersion without deviation and (ii) mean deviation without dispersion of light in a combination of two prisms.
(c) A 51° prism is made of glass for which the constants in the two-term Chauchy’s equation are \(A = 1.5397\) and \(B = 4.6528 \times 10^4\) Å². Find the angular dispersion in radius per angstrom when the prism is set for minimum deviation for a wavelength of 5000 Å.

7. (a) What is the physical significance of wave function?
(b) Describe the quantum-mechanical behavior of a particle trapped in an infinite square well potential and solve the Schrödinger equation for the particle to find its energy eigenvalue, \(E_n\).
(c) For an eigen function, \(\psi_n = \sqrt{2} \frac{\sin \frac{n\pi x}{L}}{L} \) of a particle inside an infinite square well, compute \(\langle x \rangle\) and \(\langle x^2 \rangle\), and hence find the quantum uncertainly in position, \(\Delta x\), for the particle in the ground state.

8. (a) What are bosons and fermions?
(b) Considering an isolated system of identical and indistinguishable fermions, deduce the Fermi-Dirac distribution law.
(c) Copper contains free electrons at absolute zero. Find the Fermi energy, Fermi velocity and mean internal energy of the free electrons. Given that the molar mass of copper, \(M = 63.55 \times 10^{-3}\) kg/mol, its density, \(\rho = 8.93 \times 10^3\) kg/m³, Avogadro’s number, \(N_A = 6.023 \times 10^{23}\) /mol, Planck’s constant, \(h = 6.626 \times 10^{-34}\) J.s and mass of electron, \(m = 9.11 \times 10^{-31}\) kg.
SECTION – A
There are FOUR questions in this Section. Answer any THREE.

1. (a) Discuss the formation of polymer and polymerization reactions. (8)
   (b) What are the differences between thermoplastic and thermosetting plastics? (5)
   (c) Describe the preparation of the following plastics with reactions (any two). Mention their uses. (10+4)
   (i) Polyvinyl chloride (ii) Epoxy resin (iii) Polyethylene
   (d) Discuss physical properties and health hazards of plastics. (8)

2. (a) Give the classification of synthetic fibres. (6)
   (b) Describe the manufacturing process of viscose rayon or terylene with flow sheet reactions. (5+5+4)
   (c) Write short notes on the following (any three):
       (i) Dynel, (ii) Polycarbonate, (iii) Methods of spinning, (iv) Polyurethane. (15)

3. (a) What are the sources of Natural Rubber? (6)
   (b) Write the structure and name of monomers, polymers and co-polymers of Rubber. (10)
   (c) Give the chemical composition of natural Rubber Latex. (7)
   (d) Describe the properties and importance of Rubber. (12)

4. (a) What are the glass formers? Discuss the importance of formation of batch materials for the manufacturing of good quality glass. Describe the different physical and chemical methods for the separation of impurities from the raw materials. (15)
   (b) Why annealing is required for almost all glass wares and how annealing is usually carried out in glass industry? (8)
   (c) Write notes on the following:
       (i) Glass sand, (ii) Cullet, (iii) Refining agents, (iv) Fluxes. (12)

Contd ………. P/2
CHEM 141(ME)

SECTION - B

There are FOUR questions in this Section. Answer any THREE.

5. (a) Discuss the effects of rock and minerals as the source of impurities of under-ground water.
   (6)
(b) Distinguish between (i) alkaline hardness, (ii) non-alkaline hardness and alkinity of under-ground water.
   (10)
(c) Describe the processes by which one can determine the hardness and Cl₂ content in water.
   (12)
(d) What do you understand by wet steam? How one can prevent or minimize the formation of wet steam?
   (7)

6. (a) Classify under-water corrosion. Describe them with chemical reactions involved there in.
   (6)
(b) With suitable explanation discuss the effect of pH on the rate of under-water corrosion.
   (10)
(c) Write the names of different forms of corrosion that we commonly come across. Discuss them in brief.
   (10)
(d) Write a note on prevention of corrosion.
   (9)

7. (a) What are the characteristic properties of refractory Materials which differentiate it from other engineering materials? What type of physical and chemical changes occur during firing of refractory materials?
   (10)
(b) Describe the special characteristic properties of clay which render it essential raw material for the manufacture of ceramic articles. Explain the three different lines of manufacturing process of ceramic products.
   (10)
(c) Describe the industrial manufacturing process of ceramic wares. Mention the chemical compositions, weathering action and industrial uses of feldspar.
   (15)

8. (a) Define lubricant and lubrication. Point out the detrimental effects of friction.
   (8)
(b) Classify lubricants into different classes. Describe them in brief.
   (10)
(c) What are the different allotropic forms of carbon? Mention the uses of amorphous form of carbon in our daily life. How lampblack is obtained from carbonaceous material?
   (11)
(d) Show the effect of temperature and pressure on the thermodynamic stability of diamond.
   (6)
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-2  B. Sc. Engineering Examinations 2012-2013
Sub : **HUM 101 (English)**
Full Marks : 210   Time : 3 Hours
The figures in the margin indicate full marks.
USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION - A**
There are **FOUR** questions in this Section. Answer Q. No. 1 and any other **TWO** from the rest.

1. (a) Explain with reference to the context any two of the following:
   (i) "It will do you good to sit down for a while and chat with me."
   (ii) "But the more I read the more complicated the subject seemed to me and the more conscious I grew of my ignorance."
   (iii) "We want to be rescued; and of course we shall be rescued."

(b) Answer any one of the following:
   (i) What evidence do **YOU** find that Jack is likely to be Ralph's opponent?
   (ii) Why did the writer in "Shooting an Elephant" shoot the elephant?

(c) Answer any three of the following:
   (i) Why did the writer want to have a book of philosophy?
   (ii) What did the astrologer look like?
   (iii) Why was the astrologer unable to carry on the work of his forefathers in his village?
   (iv) What is Maugham's assessment of Bertrand Russell?
   (v) Why did the writer say the young Buddhist Priest were the worst?

2. (a) Recast and correct any ten of the following sentences:
   (i) The courthouse annals is not the place to look for the date of marriage.
   (ii) I shall accompany the winners, whomever they may be.
   (iii) The committee are empowered to make a recommendation.
   (iv) Laura is an alumnus of the Oxford.
   (v) He sat his plane down in the farmer's pasture.
   (vi) We suspicioned that something was amiss.
   (vii) Johnson and me are the first in line.
   (viii) The boat slipped out of the harbor, I suddenly realized I was on my way to Myanmar.
   (ix) I have no appetite at all to study.
   (x) I enjoyed during the holidays.
   (xi) The old president has been defeated and new officers elected.
   (xii) Prior to the rainy season, they repaired the road.
(b) Give meanings of and make sentences with any ten of the following words:

Alluring, Bicker, Credulous, Eulogy, Gauche, Hilarious, Intrepid, Moron,
Obsequious, Perforated, Quell, Tyro.

3. Amplify the idea in any one of the following:

(i) Victory has many fathers but defeat is parentless.
(ii) If winter comes, can spring be far behind?

4. Write a précis of the following:

Is it possible to persuade mankind to live without war? War is an ancient institution which has existed for at least six thousand years. It was always wicked and usually foolish, but in the past the human race managed to live with it. Modern ingenuity has changed this. Either man will abolish war, or war will abolish man. For the present, it is nuclear weapons that cause the gravest danger, but bacteriological or chemical weapons may, before long, offer an even greater threat. If we succeeded in abolishing nuclear weapons, our work will not be done. It will never be done until we have succeeded in abolishing war. To do this, we need to persuade mankind to look upon international questions in a new way, not as contests of force, in which the victory goes to the side which is most skillful in massacre, but by arbitration in accordance with agreed principles of law. It is not easy to change age-old mental habits, but this is what must be attempted. There are those who say that the adoption of this or that ideology would prevent war. This is a profound error. All ideologies are based upon dogmatic assertions which are, at best, doubtful, and at worst, totally false. Their adherents believe in them so fanatically that they are willing to go to war in support of them. The movement of world opinion during the past years has been very largely such as we can welcome. It has become a commonplace that nuclear war must be avoided. Of course very difficult problems remain in the international sphere, but the spirit in which they are being approached is a better one than it was some years ago. It has begun to be thought, even by the powerful men who decide whether we shall live or die, that negotiations should reach agreements even if both sides do not find these agreements wholly satisfactory. It has begun to be understood that the important conflict nowadays is not between East and West, but between Man and the H-bomb.
5. Read the following passage carefully and answer the questions that follow:

People are always talking about the problem of youth. If there is one - which I take leave to doubt - then it is older people who create it, not the young themselves. Let us get down to fundamentals and agree that the young are after all human beings - people just like their elders. There is only one difference between an old man and a young one: the young man has a glorious future before him and the old one has a splendid future behind him: and may be that is where the rub is.

When I was a teenager, I felt that I was just young and uncertain - that I was a new boy in a huge school, and I would have been very pleased to be regarded as something so interesting as a problem. For one thing, the young are busily engaged in seeking.

I find young people exciting. They have an air of freedom and they have not a dreary commitment to mean ambitions or love of comfort. They are not anxious social climbers, and they have no devotion to material things. All this seems to me to link them with life, and the origins of things. It's as if they were in some sense cosmic beings in violent and lovely contrast with as suburban creatures. All that is in my mind when I meet a young person. He may be conceited, ill-mannered, presumptuous or fatuous but I do not turn for protection to dreary cliches about respect for elders - as if mere age were a reason for respect. I accept that we are equals, and I will argue with him, as an equal, if I think he is wrong.

Questions:

(i) How does an old man, according to the writer, differ from a young one?
(ii) Why was the writer pleased to be treated as a problem when he was young?
(iii) What, according to the passage, are the characteristic features of young age?
(iv) Why does the writer think that mere age should not be the reason for respect for elders?
(v) What is your own idea about an old man and a young one?
(vi) Write down the meanings of the following words as used in the passage:

Dreary, cosmic, suburban, presumptuous, fatuous.

6. (a) What are the principles of writing a business letter?
(b) As an Assistant Engineer of a company you have recently bought some electrical appliances for your organization. But after the delivery the appliances are found to be sub-standard. Now write a letter of complaint for the replacement of those products.
(c) Write phonetic transcriptions of the following words. (Any five)

Teach, cloud, thing, blood, pleasure, among.
HUM 101(ME)

7. (a) What are the elements of structure of a formal report? (5)
    (b) Write a short essay on any one of the following topics: (15)
        (i) The Glamour of the Past
        (ii) Controlling Temper: A shower on Fire
        (iii) Online Education
    (c) Write a dialogue between two students of Mechanical department about arranging a
        Cleanliness Programme at BUET Campus. (10)

8. (a) Transform the following sentences as directed. (Any five) (10)
    (i) I am glad to hear that you have passed the exam. (Simple)
    (ii) Eat better and live better. (Simple)
    (iii) This rule, the source of all our troubles, is disliked by everyone. (Complex)
    (iv) She heard an explosion and phoned the police. (Complex)
    (v) Unless you do it I shall fine you. (Compound).
    (vi) Getting up, we walked away. (Compound)
    (b) What are the qualities of a sales letter? (5)
    (c) Write short notes on any three of the following: (15)
        (i) Diphthongs
        (ii) Terminator in a paragraph
        (iii) Annual Confidential Report
        (iv) Barriers to communication

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L-1/T-2/ME

Date : 11/06/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-2  B. Sc. Engineering Examinations 2012-2013
Sub : MATH 163 (Integral Calculus and Differential Equations)
Full Marks : 280  Time : 3 Hours
The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are FOUR questions in this Section. Answer any THREE questions.

1. Carry out the following :  
   \( \int \frac{dx}{\sqrt{\sin^3 x \cos x}} \)  
   \( \int \frac{x^2 - 1}{x^4 + x^2 + 1} \, dx \)  
   \( \int \frac{dy}{(y-a)\sqrt{(y-a)(b-y)}} \).

2. (a) Find a reduction formula for \( \int x^n \sin mx \, dx \) and hence evaluate \( \int x^2 \sin 3x \, dx \).
   (16)
   \[ \lim_{n \to \infty} \left[ \left( 2 + \frac{1}{n^2} \right)^{\frac{1}{2} \left( 2 + \frac{2^2}{n^2} \right)^{\frac{1}{2}}} \ldots \left( 2 + \frac{n^2}{n^2} \right)^{\frac{1}{2}} \right] \]
   (14)
   (b) Evaluate: \( \int \frac{\sqrt{x} \, dx}{(1 + x)^2} \).
   (16\%)
   (c) Evaluate: \( \int x^4 \, dx \) by taking seven equidistant ordinates. Compare it with exact value.

3. (a) Prove that
   \( \int_0^\infty x^2 e^{-4x} \, dx = \frac{3\sqrt{\pi}}{128} \)  
   \( \beta(p,q+1) = \beta(p+1,q) = \frac{\beta(p,q)}{p+q} \)  
   (8+8)
   (b) Find the area common to the two curves \( y^2 = ax \) and \( x^2 + y^2 = 4ax \).
   (16\%)
   (c) Apply Simpson's rule to calculate an approximate value of \( \int_3^1 \, dx \) by taking seven equidistant ordinates. Compare it with exact value.

4. (a) Find the whole length of the curve \( x(a^2 - x^2) = 8a^2 y^2 \).
   (18)
   (b) The loop of the curve \( 2a^3 = x(x - a)^2 \) revolves about the x-axis. Find the volume of the solid so generated.
   (12)
   (c) Find the surface of the solid generated by the revolution of the lemniscates \( r^2 = a^2 \cos 2\theta \) about the initial line.
   (16\%)

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MATH 163(ME)  
SECTION - B
There are FOUR questions in this Section. Answer any THREE.

5. (a) Find the differential equation corresponding to the curves, \( y = c_1 e^{2x} + c_2 e^{-2x} \), where \( c_1 \) and \( c_2 \) are arbitrary constants. (15)

(b) Solve the differential equation \( 2x^2 \frac{dy}{dx} = 3xy + y^2 \) subject to the initial condition \( y(1) = -2 \). (16\%)

(c) Solve: \( e^y \sin 2x \ dx + (e^{2y} - y) \cos x \ dy = 0 \). (15)

6. (a) Solve: \( (2y^2 + 3x)dx + 2xydy = 0 \). (15)

(b) Solve: \( 2 \frac{dy}{dx} = \frac{y}{x} - \frac{x}{y} \). (16\%)

(c) A thermometer is removed from where the air temperature is 70°F to the outside where the temperature is 10°F. After \( \frac{1}{2} \) minute, the thermometer reads 50°F. What is the reading after 1 minute? How long will it take the thermometer to reach 15°F? (15)

7. (a) Verify that the given functions \( y_1 = e^x \cos 2x \) and \( y_2 = e^x \sin 2x \) form a fundamental set of solutions of the differential equation \( \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + 5y = 0 \) on \( -\infty < x < \infty \) and hence find the general solution. (13)

(b) Find a differential operator that annihilates the function \( f(x) = 5x^2 - 6x + 3x^2 e^{-2x} + 3e^{5x} \) and hence solve the differential equation \( y'' + 4y'' + 4y' = f(x) \) by undetermined coefficients. (18\%)

(c) Solve: \( x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} + 2y = x^4 e^x \). (15)

8. (a) Solve: \( xy'' + (x - 2)y' - 2y = x^3 \) by the method of factorization of operator. (15)

(b) Solve: \( y(1 - \ln y) \frac{d^2y}{dx^2} + (1 + \ln y) \left( \frac{dy}{dx} \right)^2 = 0 \). (16\%)

(c) Test the convergence or divergence of the series: \( \sum_{n=1}^{\infty} \frac{1}{\sqrt{n} + 1 + \sqrt{n}} \) (15)
SECTION - A

There are FOUR questions in this Section. Answer any THREE questions.

1. (a) A certain bearing is to carry a radial load of 4 kN and an axial thrust of 1.8 kN. The service life of the bearing should be at least 5 years, for 8 hr/day at 2500 rpm with 95% reliability. The outer ring of the bearing contact bearing is stationary. Find the following:

(i) Select an angular contact bearing for these applications.
(ii) What is the median life of the selected bearing?
(iii) What is the probability of survival of the selected bearing for the design life?

(b) A certain bearing is to carry a radial load of 45 kN at speed of 10 rpm for 20% of the time. This load changes to 35 kN at 50 rpm for 50% of the time and 20 kN at 100 rpm for 30% of the time. With a desired life of 3000 hours, find the cubic mean load and select a straight roller bearing appropriate for the specified load.

2. (a) A Journal bearing is 400 mm in diameter and 40 mm in length and has a journal speed of 1200 rpm. The radial clearance ratio is 1000. The bearing is lubricated with SAE 40 oil at an inlet temperature of 40°C. The applied radial load on the bearing is 3.0 kN. The bearing is medium construction (A = 12.5 dl) ring oiled, operating is still air. Determine the following:

(i) Minimum film thickness.
(ii) Friction loss on the bearing.
(iii) Heat dissipated to the surrounding.

(b) A pair of helical gears, subjected to heavy shock loading is to transmit 25 kW at 1200 rpm of the pinion, with velocity ratio of 4.0 and helix angle 45°, and minimum Dp of 120 mm. The gears are made of hardened steel with BHN 350 and teeth are carefully cut, with normal pressure angle of 20° FD. Select the appropriate gear sizes.

3. (a) A pair of 4 : 1 reduction gears is designed for a 20 kW motor whose full load speed is 1000 rpm with intermittent service. The gears are to be 20° FD with a phosphor bronze (SAE 65) pinion and a cast iron (class 35) gear. Make an estimate of the size of spur gear required. Considering average mounting conditions and light shock in driven machinery.

(b) A 40 kW motor running at 1750 rpm is to deliver power to a worm gear reducer with velocity ratio of 20. Worm is made of steel with minimum BHN 250, and the gear is made of phosphor bronze. Decide upon the appropriate gear set and compute the efficiency of the gear drive.

Contd .......... P/2
4. The brake shown in Figure 4 is 300 mm in diameter and is actuated by a mechanism that exerts the same force F on each shoe. The shoes are identical and have a face width of 32 mm. The lining is molded asbestos having a coefficient of friction 0.32 and a pressure limitation of 1000 kPa. Estimate the following:

(a) Maximum allowable actuating force F.
(b) Identify the location of the maximum pressure.
(c) Braking capacity.

The following relations are given:

Moment of normal forces: 
\[ M_f = \frac{P_a br}{\sin \theta_a} \left[ a (- r \cos \theta)^6 - a \left( \frac{1}{2} \sin^2 \theta \right)^6 \right] \]

Moment of friction forces: 
\[ M_N = \frac{P_a bra \left( \theta - \frac{1}{2} \sin 2\theta \right)^6}{\sin \theta_a} \]

Torque applied to drum: 
\[ T = \frac{P_a br^2 (\cos \theta_1 - \cos \theta_2)}{\sin \theta_a} \]

SECTION - B

There are FOUR questions in this Section. Answer any THREE.

Symbols have their usual meaning.

5. A BS-5216 Grade 4 compression spring is to be used for the front side of an automobile. The spring has an index of 6, a free length of 105 mm, 21 active coils, and squared and ground ends. The spring is to be assembled with a preload of 45 N and will operate to a maximum load of 225 N during use.

(a) Decide upon the outside and wire diameter of the spring for a design factor of 1.5 based on Goodman Criteria.

(b) What would be the design factor for the spring obtained in (a) guarding against a fatigue failure based on a life of 50,000 cycles and 99% reliability?
6. An 8 mm thick leather belt connects two flat pulleys to transmit a power of 3 kW. The pulley diameters are 300 mm and 450 mm and the corresponding angles of lap are 160° and 210°. The smaller pulley runs at 200 rpm. The coefficient of friction between the belt and pulley is 0.25. The safe working stress in the belt material is 1.6 MPa. (Mass of belt per unit length = 2 kg/m)

(a) Design the belt cross-section for 2% slip at the pulley and 20% overhead capacity.

(b) It is proposed to increase the power transmission capacity of the drive by increasing the coefficient of friction by 10%. Verify the effectiveness of the proposal.

7. (a) List the relative advantages of using wire ropes over other flexible power transmission elements.

(b) A skip for a mine shaft weighs 900 kg and is to lift a maximum load of 1350 kg from a depth of 300 m. The maximum speed of 6 m/sec is attained in 5 sec.

(i) Design a 6 x 19 Improved Plow Steel rope based on static design consideration.

(ii) What is the elongation of the rope found if 1350 kg load is added while the hoist hangs freely at the bottom?

(iii) How is the wear life of a rope is assured? Is the extent of wear associated with the above rope within the acceptable limit?

8. A circular shaft (machine finished) transmits 188.5 kW at 180 rpm by a pulley. A maximum bending moment of 2500 N-m (completely reversed) is applied to the shaft. The shaft material is B830 M31, hardened and tempered. For suddenly applied load with minor shock, determine the shaft diameter using

(a) Static load approach

(b) ASME design code

(c) Soderberg approach

(d) Goodman approach

Consider fatigue stress concentration factor of 2.0 for profile keyway. Choose factor of safety of 3.0 for (a) and (b), and 1.3 for (c) and (d).
SECTION - A

1. (a) What do you mean by price discrimination? Explain first degree, second degree and third degree price discrimination with examples. (10)

(b) What are the equilibrium conditions for a firm in a perfectly competitive market and a monopoly market? Show graphically the 'super normal profit', 'abnormal loss', 'normal profit' for a firm in perfect competition and 'super normal profit' for a monopoly market. (3+7=10)

(c) Suppose an arbitrary cost function of a firm:

\[ TC = 10 Q^3 - 180 Q^2 + 7500 Q \]

With the help of the above cost equation, derive the marginal cost and average cost curves from the total cost curve and then show the relationship between total cost, marginal cost and average cost curves. (15)

2. (a) Consider the production equation of a firm is \( TP = -30 L^3 + 2700 L^2 \)

Sketch a graph showing the relationship between the total product, average product and marginal product curves of the firm. (15)

(b) What is 'returns to scale'? Explain different types of 'returns to scale' with examples. (2+5=7)

(c) Define 'opportunity cost' with an example. What will be the impact of the changes in technology and resources on the Production Possibility Frontier (PPF)? Compare the PPF of a rich country and that of a poor country. (3+5+5=13)

3. (a) What is inflation? Explain the causes of 'demand pull' and 'cost push' inflation. (15)

(b) Graphically show the effects of demand pull and cost inflation on an economy. What is stagflation? (20)

4. (a) What do you mean by Gross Domestic Product (GDP) and Gross National Product (GNP)? What is the difference between GDP and GNP? (10)

(b) What are the different methods to calculate GDP? What items are not calculated in GDP measurement? (25)
HUM 103(ME)

SECTION – B

There are FOUR questions in this Section. Answer any THREE.

5. (a) Define supply function. (5)
   (b) Explain the main determinants of supply. (10)
   (c) What are the exceptions to the law of demand? (10)
   (d) What are the differences between change in demand and change in quantity demanded? (10)

6. (a) What are the determinants of price elasticity of demand? (10)
   (b) How would you measure price elasticity of demand at any point on a straight line demand curve? (15)
   (c) From the following table calculate elasticity of demand if you move from point A to C and explain what you understand from the result. (10)

<table>
<thead>
<tr>
<th>Point</th>
<th>Y</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7000</td>
<td>800</td>
</tr>
<tr>
<td>B</td>
<td>8000</td>
<td>700</td>
</tr>
<tr>
<td>C</td>
<td>9000</td>
<td>600</td>
</tr>
</tbody>
</table>

7. (a) What are the advantages and disadvantages of division of labour? (20)
   (b) From the following demand and supply function calculate equilibrium price and quantity and show the result in a graph. (15)

   \[ P = 0.20Q + 10 \]
   \[ P = -0.40Q + 70 \]

   (i) What will happen to this equilibrium price and quantity if government imposes a sales tax of Tk. 2 per unit? (15)
   (ii) Describe the change in equilibrium.

8. (a) Explain consumer's equilibrium with the help of budget line and indifference curve. (15)
   (b) What are the properties of an indifference curve? Explain them. (10)
   (c) Define budget line and budget set. (10)
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2  B. Sc. Engineering Examinations 2012-2013

Sub: ME 171 (Computer Programming Language)

Full Marks : 210  Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are FOUR questions in this Section. Answer any THREE questions.

1. (a) List the minimum hardware components/modules needed to build-up a computer. Which other components/modules would you suggest to build-up a workable computer? (6)
   (b) What is 'Hardware Abstraction Layer (HAL)'? Is HAL good or bad? - Discuss. (6)
   (c) Why is the concept of 'Computing Platform' necessary? - Explain with examples. (6)
   (d) List the different components/modules needed to constitute a complete programming environment. Also show all the sequential steps to develop a program using these modules. What is an IDE? (12)
   (e) How would you convince someone to learn 'C as a programming language'? (5)

2. (a) What is an identifier? Write down the rules for naming identifiers in C language. (8)
   (b) Define a prototype of a function named "func0" that will return an integer value and receive an integer and a floating point type value. (3)
   (c) Write a function "swap0" with two float arguments, so that when this function is called by another function, it will swap the values of the two variables of the calling function. (8)
   (d) Write a program to generate 10 random numbers between 10 and 100 and sort them in descending order. (16)

3. (a) Make a comparison among arrays, structures and unions. (9)
   (b) The following program has several errors. Identify each of them. (12)

```
#include <stdio.h>
void main (void)
{
    #define N 4
    int a [N] = {0, 4, 6, 3, 9};
    int b [N-5];
    int c [3, 1];
    a = b[2. 0] + c [0] [1];
    printf (a);
}
```

Contd .......... P/2
Correct the following code and mention the output from the corrected code:

```c
#include <stdio.h>
void main (void)
{
    struct MyGPA
    {
        int id;
        float gpa;
        char name [30];
    };
    struct MyGPA L1t2, *p;
    p = & L1t2;
    p.id = 100;
    p.gpa = 3.5;
    printf ("%d	%f", p.id, p.gpa);
}
```

What are the similarities and dissimilarities of a C structure and C++ class? Briefly explain with examples.

(a) Differentiate between 'Procedural (Structured)' and 'Object Oriented Programming (OOP)'.

(b) Rewrite the following codes written in C using C++ constructs for File I/O.

```c
#include <stdio.h>
int main(void)
{
    char name [30];
    FILE *infile, *outfile;
    infile = fopen ("input.txt", "r");
    outfile = fopen("output.txt", "w");
    fscanf (infile, "%s", name);
    fprintf (outfile, "%s", name);
    fclose (infile);
    fclose (outfile);
    return 0;
}
```

(c) What do you mean by 'instance(s)' and 'inheritance' in OOP?
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Condt ... Q. No. 4
(d) Define a class named "MyTriangle" with private float variables base and height, with a constructor to initialize the base and height with zeros and a destructor for the class. The class will contain a public function set() which will get the actual input values for the base and height and another public function area() which will calculate and return the area of the triangle. Then create an instance of the class in function main() and use the public methods of the class to calculate and print the area of that object.

SECTION – B
There are FOUR questions in this Section. Answer any THREE.

5. (a) With appropriate examples, list the different kinds of tokens used in C programming language.
(b) Convert the following hexadecimal numbers to binary, and show their bit representation on a single precision machine according to IEEE 754 standard.
   (i) 7AF
   (ii) –1EF8
(c) With the variables declared as the following,
   char a = 'a', b = 'b', c = 'A';
   /*a has decimal value 97 */
   int i = 1, j = 2, k = 3;
   double x = 8.05, y = 4.7;
Write down the resulting data types and values of the following expressions:
   (i) !x * !y
   (ii) i & & j & & k
   (iii) x || i & & j - 3
   (iv) i < j & & x < y
   (v) i < j || x < y
   (vi) 'A' <= c & & c <= 'z'
   (vii) c - 1 = = 'A' || c + 1 = = 'z'
   (viii) i = = j ? a - 1 : b + 1
   (ix) j % 3 = = 0 ? i + 4 : x
   (x) j % 3 ? i + 4 : x

6. (a) The greatest common divisor (GCD) of two positive integers p and q is q if (p % q) equals zero. Otherwise it is the GCD of (p % q) and q. Write a function that takes two integers as input, and calculate their GCD recursively.
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Contd ... Q. No. 6

(b) Show that return values of the following for 5 consecutive calls in a for loop. Is it a pseudorandom or a true random number generator? Explain.

```c
#define INIT 17
#define MULT 25173
#define INCR 13849
#define MOD 65536

static unsigned seed = INIT;
unsigned random (void)
{
    seed = (MULT * seed + INCR) % MOD;
    return seed;
}
```

(c) What are enumeration variables? Why are they used in C programming language?

```c
Int a = 1, b = 2, c = 3;
float d = 8.0;
a += ++c;
printf("%Sd%Sd
", a, b, c);
a += c = 7*d;
printf("%Sd%Sf
", a, d, c);
```

7. (a) With the variables declared as the following,
```
int i = 4, j = 6, *p = &i, *q = &j, *r;
double x;
```

Write down the values/output of the following expressions:

(i) `p = = &i`

(ii) `** &p`

(iii) `r = &x`

(iv) `4 **p / *q+4`

(v) `* (r = &j) * = *p`

(b) What do you understand by "Call-by-value" and "Call-by-reference"? Explain with examples.

(c) Write a function, unsigned lenstr (const char *s), to calculate string length without using the strlen ( ) function defined in <string.h>.

(d) What gets printed? Explain.
```
printf("%c\n%c\n%c\n", "ABC" [2], "*defg" +5,
       *("hijk") + 11, "*"Imno" -7,
       "stuv" [9],
```
8. (a) Give a brief description of the four C storage classes with their scope and storage
duration. 

(b) List the predefined symbolic constants in C, and describe their behavior.

(c) Write a program that defines and uses a macro MIN2 to determine the smaller of two
numbers. Then define another macro MIN4 which uses MIN2 and gives the smallest of
four numbers taken as input from the user.