



UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

SCHOOL OF ENGINEERING

EXAMINATIONS: NOVEMBER 2018

COURSE AND CODE: PROJECTS AND THE ENVIRONMENT

ENCH4PE

DURATION: 2 HOURS

TOTAL MARKS: 80

INTERNAL EXAMINER(S): DR HW BERNHARDT

INTERNAL MODERATOR(S): MR EM OBWAKA

EXTERNAL MODERATOR: PROF P MUSONGE

INSTRUCTIONS:

1. **ALL** questions should be attempted.
2. Any programmable or non-programmable calculator may be used provided it has been cleared of any information that would subvert the purpose of the examination.
3. Calculations must be shown in sufficient detail to illustrate your understanding of the procedure.
4. **Appropriate formulae are provided on page 3.**
5. This examination question paper, together with all associated diagrams **MUST BE HANDED IN TOGETHER WITH YOUR SCRIPT.**

Student Number:

QUESTION 1

During the Projects and Environment (ENCH4PE) course a major focus has been the impact that plastic waste has on our environment. In particular, microplastics affect our environment in ways that are not yet fully understood. Describe the effect of microplastics on our environment using the following sub-headings:

- a) What are microplastics (3)
- b) What are the sources of microplastics (4)
- c) What are some of the known effects of microplastics on fishes or other organisms (marine and fresh water) (4)
- d) What measures are needed to reduce the impact that microplastics will have on our environment (4)
- e) What further research is needed to better understand the impact of microplastics on our environment? (5)

Write your answers in point form. Avoid vague statements.

TOTAL /20/

QUESTION 2

- a) Due to inflation, the value of the income for a company generally becomes less over the years. This needs to be taken into account in determining the long-term economic sustainability of a business. By using a discount rate of 6.3 %, calculate the Net Present Value (NPV) of the 5 year cash flows shown in the table below. Please show your working details clearly.

Year	Net Income (R'000)
2013	385.4
2014	672.3
2015	715.8
2016	426.5
2017	555.3

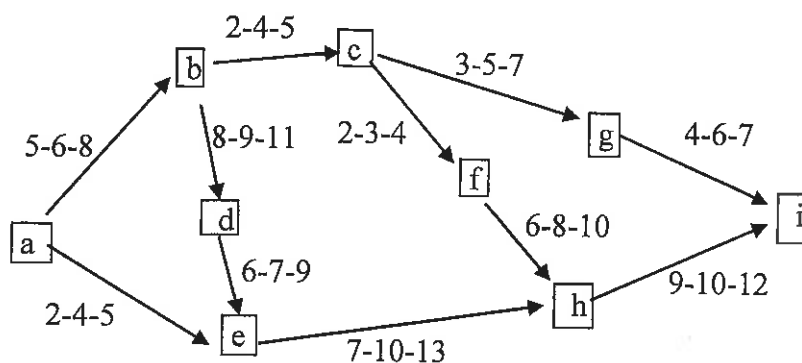
(8)

- b) It is always difficult for a company to raise the capital for major expansions. One way of doing this is to put aside a definite amount every month, and invest that at the best interest rate available to the company until it is needed for the expansion. How much money would have to be set aside every month for a capital expansion planned 5 years and 7 months into the future if the best interest rate the company could earn with a commercial bank is 9.4% p.a., assuming the interest earned is compounded monthly. The estimated amount required at the end of the 5 years and 7 months is R 4 896 770.

(8)

- c) The following network represents the length (in weeks) of the major activities of a construction project. On each activity are three time estimates, the first representing the most optimistic time (o), the second the most likely time (m) and the third the pessimistic time (p). Determine: (i) the expected length of each path, (ii) the expected overall length of the project and (iii) the probability (using normal distribution tables) of finishing the project in 30 weeks. **Present your working in a neat table.** Do not use more than 3 decimal figures.

(20)



TOTAL /36/

QUESTON 3

- a) List 8 factors that affect the efficiency of ethanol fermentation (8)
- b) A distillery that produces low grade industrial alcohol has the following production data:
- Product: 95% (V/V) ethanol, 15 000 litres/batch, Relative density = 0.811.
 - Fermentable sugar concentration ($C_6H_{12}O_6$) in the mash = 11.5 g/100 ml
 - Conversion rate of fermentable sugar to final product = 87%.

What volume of mash is required for one batch of product?

[Given: C = 12, O = 16, H = 1]

(16)

TOTAL /24/**FORMULAE**

$$FV = PV(1+i)^n, \quad FV = A \left[\frac{(1+i)^n - 1}{i} \right], \quad NPV = \sum_{t=0}^n \frac{C_t}{(1+k)^t}$$

$$t_c = \frac{o + 4m + p}{6}, \quad \sigma^2 = \left[\frac{(p-o)}{6} \right]^2 \text{ or } \frac{(p-o)^2}{36}, \quad \sigma_{path} = \sqrt{\sum (\text{variances of activities on path})}$$

$$t = V / Q;$$

volumetric organic loading = (mass COD load /day) / total volume of the system

F / M = (Mass COD added to system each day) / (total mass MLSS in system)

NORMAL DISTRIBUTION TABLESProbability Content from $-\infty$ to Z

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990